Emerging Researchers National (ERN) Conference in Science, Technology, Engineering and Mathematics

PROGRAM BOOK

FEBRUARY 19–21, 2015 | WASHINGTON HILTON | WASHINGTON, DC

NSF AAAS

Emerging Researchers National (ERN) Conference in STEM

Co-hosted by the
American Association for the Advancement of Science (AAAS)
Education and Human Resources Program (EHR)

National Science Foundation (NSF)
Division of Human Resources Development (HRD)
Directorate of Education and Human Resources Program

NSF Directorate for Engineering (ENG)
Office of Emerging Frontiers in Research and Innovation (EFRI)

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

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Contents

Overview of the Conference 6

About the National Science Foundation (NSF) 7

About the Emerging Frontiers in Research and Innovation (EFRI-REM) Scholars 8

About the American Association for the Advancement of Science (AAAS) 9

Welcome Letters 10-11

Joan Ferrini-Mundy and Jermelina Tupas, NSF
Shirley M. Malcom and Yolanda S. George, AAAS

Conference Staff 12

Conference Agenda 13-18

Biographies 19-24

Judges 25-27

Hotel Floor Plans 28

Exhibitor Information 29-44

Abstracts A1-A340

Washington DC Subway System Map A341

Abstract Index by Name A343-A356

Overview of the Conference

Emerging Researchers National (ERN) Conference in STEM

The 2015 Emerging Researchers National (ERN) Conference in Science, Technology, Engineering and Mathematics (STEM) is hosted by the American Association for the Advancement of Science (AAAS), Education and Human Resources Programs (EHR) and the National Science Foundation (NSF) Division of Human Resource Development (HRD), within the Directorate for Education and Human Resources (EHR). The conference is aimed at college and university undergraduate and graduate students who participate in programs funded by the NSF HRD Unit, including underrepresented minorities and persons with disabilities.

In particular, the conference seeks to highlight the research of undergraduate and graduate students who participate in the NSF Research Experiences for Undergraduates (REUs) Program and the following NSF HRD-funded programs:

- Alliance for Graduate Education and the Professoriate (AGEP);
- Centers of Research Excellence in Science and Technology (CREST);
- Emerging Frontiers in Research and Innovation (EFRI-REM) Scholars;
- EntryPoint;
- Historically Black Colleges and Universities Undergraduate Program (HBCU-UP);
- Louis Stokes Alliances for Minority Participation (LSAMP) and LSAMP Bridges to the Doctorate;
- Research in Disabilities Education (RDE); and
- Tribal Colleges and Universities Program (TCUP).

The objectives of the conference are to help undergraduate and graduate students to enhance their science communication skills and to better understand how to prepare for science careers in a global workforce. Towards this end, the general format for the 2-1/2 day conference includes:

- Student poster and oral presentations.

Other conference activities include workshops focused on:

- Strategies for applying for and succeeding in graduate programs and finding funding for graduate school;
- Career preparation for the STEM workforce, including employment searches and retention; and
- Understanding STEM careers in a global context and identifying international research and education opportunities for undergraduate and graduate students and faculty.

Exhibitors include representatives from academic, government, business, and the non-profit sector with information about graduate school admissions, fellowships, summer research opportunities, professional development activities, and employment opportunities.

For more information, visit the Web site at *http://www.emerging-researchers.org/*.

The National Science Foundation (NSF) Division of Human Resource Development (HRD)

The Division of Human Resource Development (HRD) serves as a focal point for NSF's agency-wide commitment to enhancing the quality and excellence of STEM education and research through broadening participation by historically underrepresented groups - minorities, women, and persons with disabilities. Priority is placed on investments that promise innovation and transformative strategies and that focus on creating and testing models that ensure the full participation of and provide opportunities for the educators, researchers, and institutions dedicated to serving these populations. Programs within HRD have a strong focus on partnerships and collaborations in order to maximize the preparation of a well-trained scientific and instructional workforce for the new millennium.

HRD Vision:

HRD envisions a well-prepared and competitive U.S. workforce of scientists, technologists, engineers, mathematicians, and educators that reflects the diversity of the U.S. population.

HRD Mission:

HRD's mission is to grow the innovative and competitive U.S. science, technology, engineering and mathematics (STEM) workforce that is vital for sustaining and advancing the Nation's prosperity by supporting the broader participation and success of individuals currently underrepresented in STEM and the institutions that serve them.

Strategic Goal 1:

The creation of new knowledge, innovations, and models for broadening participation in the STEM enterprise.

Strategic Goal 2:

The translation of knowledge, innovations, and models for broadening participation in STEM for use by stakeholders.[1]

Strategic Goal 3:

Expand Opportunities: The expansion of stakeholder capacity to support and engage diverse populations in high quality STEM education and research programs.

HRD Theory of Change:

HRD's fundamental mission of broadening participation in STEM is embedded in the greater EHR and NSF goals. A basic premise of all HRD programs is that increasing the successful participation of individuals from historically underrepresented groups in STEM will result in a diverse, highly capable STEM workforce that can lead innovation and sustain U.S. competitiveness in the science and engineering enterprise.

Therefore, HRD has an overall goal to increase the successful participation of underrepresented minorities, women and girls, and persons with disabilities in STEM. This is done through the implementation and testing of evidence-based practices, critical review of program results to assess impact, data-driven continuous improvement, and broad dissemination of program findings for wide adoption or scale-up of effective strategies.

[1]Stakeholders include a wide range of organizations and individuals such as but not limited to: NSF and other Federal agencies, federally funded STEM labs and centers, institutions of higher education including minority-serving institutions, State and local governments, education researchers and practitioners, policy makers, STEM employers, professional STEM societies, STEM organizations, and private funders.

About

The National Science Foundation (NSF) Directorate for Engineering (ENG) Office of Emerging Frontiers in Research and Innovation (EFRI)

The Office of Emerging Frontiers in Research and Innovation (EFRI) has been established as a result of strategic planning and reorganization of NSF Engineering Directorate (ENG). Motivated by the vision of ENG to be the global leader in advancing the frontiers of fundamental engineering research, EFRI serves a critical role in helping ENG focus on important emerging areas in a timely manner. Each year, EFRI will recommend, prioritize, and fund interdisciplinary initiatives at the emerging frontier of engineering research and education. These investments represent transformative opportunities, potentially leading to: new research areas for NSF, ENG, and other agencies; new industries or capabilities that result in a leadership position for the country; and/or significant progress on a recognized national need or grand challenge.

The EFRI process of selecting, announcing, and funding new frontier areas will function throughout the year, ensuring continual input and feedback from the engineering community on promising future research opportunities. This input comes from such diverse sources as workshops, advisory committees, technical meetings, professional societies, proposals and awards, and NSF committees of visitors. From this comprehensive input, ENG identifies, evaluates, and prioritizes those frontier topics that best match the EFRI criteria (transformative, addressing a national need or grand challenge, multi- or inter-disciplinary, an area where the community is poised to respond, and clearly demonstrating ENG's leadership role).

The American Association for the Advancement of Science (AAAS)

The American Association for the Advancement of Science is an international non-profit organization dedicated to advancing science around the world by serving as an educator, leader, spokesperson and professional association. In addition to organizing membership activities, AAAS publishes the journal *Science,* http://www.sciencemag.org/, as well as many scientific newsletters, books and reports, and spearheads programs that raise the bar of understanding for science worldwide.

AAAS was founded in 1848, and includes some 261 affiliated societies and academies of science, serving 10 million individuals. *Science* has the largest paid circulation of any peer-reviewed general science journal in the world, with an estimated total readership of one million. The non-profit AAAS is open to all and fulfills its mission to "advance science and serve society" through initiatives in science policy; international programs; science education; and more. For the latest research news, log onto EurekAlert!, http://www.eurekalert.org/, the premier science-news website, a service of AAAS.

Membership and Programs

Open to all, AAAS membership includes a subscription to *Science.*

Four primary program areas fulfill the AAAS mission:

- Science and Policy
- International Activities
- Education and Human Resources
- Project 2061

AAAS Mission

AAAS seeks to "advance science, engineering, and innovation throughout the world for the benefit of all people." To fulfill this mission, the AAAS Board has set these broad goals:

- Enhance communication among scientists, engineers, and the public;
- Promote and defend the integrity of science and its use;
- Strengthen support for the science and technology enterprise;
- Provide a voice for science on societal issues;
- Promote the responsible use of science in public policy;
- Strengthen and diversify the science and technology workforce;
- Foster education in science and technology for everyone;
- Increase public engagement with science and technology; and
- Advance international cooperation in science.

Visit the AAAS website at http://www.aaas.org/.

Welcome

Joan Ferriri-Mundy

Jermalina Tupas

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

OFFICE OF THE
ASSISTANT DIRECTOR
FOR EDUCATION AND
HUMAN RESOURCES

Dear Conference Participants:

On behalf of the National Science Foundation (NSF), we welcome you to the 2015 *Emerging Researchers National Conference in Science, Technology, Engineering and Mathematics (STEM)*. This research conference for undergraduate and graduate students, sponsored by the Division of Human Resource Development in the Directorate for Education and Human Resources, builds on and continues NSF's commitment to increase participation in STEM fields for underrepresented minorities, women, and individuals with disabilities as a means to foster the research and education capacity of the nation.

Student scholarship encompasses the creation of scientific knowledge, collaboration with other students, researchers, and faculty, and dissemination of research at conferences and in journals. We applaud your enthusiasm for research experiences as part of your ongoing studies.

This conference is designed to provide you with information and resources to become successful with the next steps in your career. We hope that you find the research presentations, plenary session, panels, workshops, and exhibits informative. We trust that you will take advantage of all of the opportunities this conference has to offer.

Sincerely,

Joan Ferrini-Mundy
Assistant Director
Directorate for Education and Human Resources

Jermelina Tupas
Division Director (Acting)
Human Resource Development

Telephone (703) 292-8600 FAX (703) 292-9179

Shirley M. Malcom

Yolanda S. George

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

Dear ERN Conference Participants:

Welcome to the 2015 *Emerging Researchers National (ERN) Conference in Science, Technology, Engineering and Mathematics (STEM)*. The American Association for the Advancement of Science (AAAS), publisher of the *Science family of journals*, is pleased to join the National Science Foundation (NSF) in co-sponsoring the fifth ERN conference. We applaud the NSF's continuing commitment to building a well-prepared and competitive U.S. STEM workforce, including broadening participation by underrepresented minorities, persons with disabilities, and females, as well as the institutions which serve them.

This year, we have over 740 undergraduate and graduate students presenting in oral or poster sessions, an increase of about 230 more student presentations than in 2014. Student researchers are from the NSF Human Resources Development (HRD) Programs; Research Experience for Undergraduates (REU); the Directorate for Engineering (ENG), Office of Emerging Frontiers in Research and Innovation (EFRI) Research Experience and Mentoring (REM) Program; and other federal programs, including the National Institutes of Health, NASA, and USDA. And the conference includes over 1,000 attendees from over 240 colleges and universities.

The Association of American Medical Colleges (AAMC) is back again with workshops on MD/PhD programs and the Institute for Broadening Participation (IBP) and the NSF Division of Graduate Education are once again presenting tips on undergraduate and graduate education funding. This year a speaker from the Office of the Associate Director for Data Science (ADDS), National Institutes of Health, joins presenters from Intel and the Southeastern Universities Research Consortium (SURA) in the computer career workshops. For last minute confidence building, we also have workshops on *Tips in Making Powerful Oral and Poster Presentations*.

We appreciate the continued support and efforts of the exhibitors at this Conference, many of whom are or have been grantees of the NSF Alliances for Graduate Education and the Professoriate (AGEP) or the Integrative Graduate Education Research Traineeship (IGERT) Programs. The exhibitors provide a wealth of information about graduate school admissions, fellowships, summer research opportunities, professional development activities, and employment opportunities. From our evaluations, we know that many attendees have benefited from services and programs provided by the ERN exhibitors.

This conference provides one of the few national venues for STEM undergraduate and graduate students to network, build their scientific communications skills, and showcase their research skills. *Helping scientists and engineers forge successful career paths is one way that AAAS "advances science and serves society."* Besides STEM conferences, AAAS also offers tools and tips, internships, fellowships, job market information, and a supportive online community via http://www.aaas.org/careers.

We are most appreciative for the continued support by the PhD alumni of the David and Lucile Packard HBCU Graduate Scholars Program, the AAAS Science and Technology Policy Fellows, the alumni of the SACNAS Summer Leadership Institute, and other STEM professionals who serve as role models and mentors and help with the judging of student oral and poster presentations. For the first time we also have alumni from the L'Oréal USA for Women in Science (FWIS) post-doctoral fellowship program serving as presentation judges.

It is our hope that you all benefit from the new people, knowledge, resources and networking opportunities that you discover at this Conference and via our Web site.

Sincerely, Shirley M Malcom Yolanda S. George

Shirley M. Malcom, Director, AAAS Education and Human Resources (EHR) Programs &
Yolanda S. George, Deputy Director and Program Director, AAAS EHR

Conference Staff

NSF and AAAS Staff

NSF Division of Human Resources Development (HRD) Senior Managers

Jermelina Tupas, *Division Director, Acting*
Jessie Dearo, *Deputy Division Director, Acting*

HRD Program Directors and Staff

Lura (Jody) Chase, *TCUP*
Shanelle Clay, *Science Assistant*
Earnestine Psalmonds Easter, *HBCU-UP*
A. James Hicks, *LSAMP*
Tasha Inniss, *LSAMP*
Martha L. James, *EASE and LSAMP*
Andrea Johnson, *HBCU-UP and CREST*
Mark H. Leddy, *ECR and AGEP*
Nafeesa Owens, *EASE*
Claudia Rankins, *HBCU-UP and CREST*
Victor Santiago, *HBCU-UP and CREST*
Marilyn J. Suiter, *EASE*
Alonso Thelem, *Science Assistant*

NSF Office of Emerging Frontiers in Research and Innovation (EFRI)

Sohi Rastegar, *Director of EFRI*
Garie Fordyce, *Program Manager, EFRI*
Adaora Nwokoye, *Fellow, American Association for the* Advancement of Science, *NSF EFRI*

AAAS Education and Human Resources (EHR)

Shirley M. Malcom, *Director*
Yolanda S. George, *Deputy Director*

AAAS Conference Staff

Donna Behar
Tarrick Clayton
Nicole Davies
Abeni Edwards
Binmiao (Joy) Guo
Cathy Ledec
Laureen Summers
Janaya Thompson

ERN Advisory Board

Daniel Akins, *City College of New York*
Kenneth Boutte, *Xavier University of Louisiana*
Anissa Buckner, *University of Arkansas, Pine Bluff*
Carol Davis, *North Dakota State University*
Lisa B. Elliot, *National Technical Institute for the Deaf at Rochester Institute of Technology*
Juan Gilbert, *Clemson University*
Kelly M. Mack, *Association of American Colleges and Universities*
Camille A. McKayle, *University of the Virgin Islands*
Larry Mattix, *Norfolk State University*
Lucas Miller, *Haskell Indian Nations University*
Delia Rosales-Valles, *New Mexico State University*
Carmen K. Sidbury, *Spelman College*

Chief Poster and Oral Presentation Judges

Jonathan Lambright, *Savannah State*
Arlene Maclin, *AAAS Consultant*

Thursday, February 19, 2015

11:00am - 3:00pm **Pre-Conference Packard Scholar Meeting *(Invitation Only)***
Fairchild East

3:00pm - 9:00pm **Conference Registration Opens**
Terrace Foyer

1:00pm - 7:00pm **Exhibitor Setup**
Columbia

3:00pm **ADA Resource Room Opens**
Oak Lawn

4:00pm - 5:00pm **Exhibitor Orientation**
Columbia

EFRI-REM Meeting *(Invitation Only)*
International Ballroom East

Garie Fordyce, *Program Manager, EFRI*
***Sohi Rastegar**, Director of EFRI*

5:00pm - 6:00pm **Judge's Orientation**
International Ballroom West

6:00pm - 8:00pm **Opening Plenary Session 1 and Dinner**
International Ballroom Center

Moderator and Welcome:
Shirley M. Malcom, *Director, EHR, AAAS*

Welcome Remarks:
Rush D. Holt, *AAAS Chief Executive Officer, Executive Publisher, Science*

Jermelina Tupas, *Acting Division Director, HRD, NSF*

Speaker:
Ainissa G. Ramirez, *Science Evangelist and co-author 'Newton's Football: The Science Behind America's Game'*

Closing Remarks:
Yolanda S. George, *Deputy Director, EHR, AAAS*

"How to Get the Most Out of the Conference"

8:00pm - 10:00pm **Exhibit Hall Opens**
Columbia

Friday, February 20, 2015

7:00am - 7:00pm **Registration**
Terrace Foyer

7:00am - 7:45am **Oral Presentations Session 1 (Set-up)**
(See handout for presentation room assignments.)

Poster Presentations Session 1 (Set-up)
Columbia

7:00am - 6:30pm **Judge's Room Opens**
International Ballroom West

7:45am - 9:45am **Networking Breakfast and Plenary Session 2**
International Ballroom Center

Moderator and Welcome:
Yolanda S. George, *Deputy Director, EHR, AAAS*

Welcome:
Jessie DeAro, *Acting Deputy Division Director, HRD, NSF*

Speaker:
Maggie Werner-Washburne, *Regents' Professor of Biology, University of New Mexico and Past President, SACNAS*

9:45am - 10:00am **Break**

10:00am - 4:00pm **EFRI-REM Networking Session *(Invitation Only)***
International Ballroom East

10:00am - 12:15pm **Poster Presentations Session 1**
Columbia

Oral Presentations Session 1

These include:
Biological Sciences (Undergraduate)
Jay

Chemistry and Chemical Sciences (Undergraduate)
Kalorama

Computer Sciences and Information Management (Graduate)
Morgan

Ecology, Environmental, and Earth Sciences (Graduate)
Northwest

Nanoscience/Physics (Undergraduate)
Piscataway

Technology and Engineering (Undergraduate)
Gunston East

Technology and Engineering (Graduate)
Gunston West

10:00am - 12:15pm **Concurrent Workshops Session 1**

A. NSF Graduate Research Fellowship Program
Lincoln East

Pushpalatha Murthy and Earnestine Psalmonds Easter, *Program Directors, EHR, NSF*

B. Tips in Making Powerful Oral and Poster Presentations
Lincoln West

Irene Hulede, *Manager, Student Programs, American Society for Microbiology (ASM)*

Olivia Harriott, *Associate Professor and Chair, Department of Biology, Fairfield University*

C. Biomedical Education and Careers for Scientists (PhD) and Physician-Scientists (MD-PhD)
Jefferson East

Victoria Freedman, *Associate Dean for Graduate Programs, Graduate Division of Biomedical Sciences, Albert Einstein College of Medicine of Yeshiva University*

Michael Donnenberg, *Director, MD-PhD/MSTP Program, Professor of Medicine, Microbiology and Immunology and Associate Chair,* University of Maryland School of Medicine, University of Maryland School of Medicine

D. Roadmap to Becoming a Doctor
Monroe

Rebecca Rice, *Director, Service Outreach, AAMC*

12:15pm - 1:30pm **Plenary Session 3 and Lunch**
International Ballroom Center

Moderator:
Sohi Rastegar, *Senior Advisor and Director, Office of Emerging Frontiers and Multidisciplinary Activities (EFMA), Directorate for Engineering, NSF*

Speaker:
Vinton G. Cerf, *Vice President and Chief Internet Evangelist, Google, and One of the "Fathers of the Internet"*

1:30pm - 4:00pm **Exhibit Hall Opens**
Columbia

1:45pm - 4:00pm **Oral Presentations Session 2 (Set-up)**
(See handout for presentation room assignments.)

Poster Presentations Session 2 (Set-up)
Columbia

4:00pm - 6:30pm **Poster Presentations Session 2**
Columbia

Oral Presentations Session 2

These include:
Biological Sciences (Undergraduate)
Jay

Chemistry and Chemical Sciences (Graduate)
Kalorama

Ecology, Environmental, and Earth Sciences (Graduate)
Northwest

Nanoscience/Physics (Undergraduate)
Piscataway

Technology and Engineering (Undergraduate)
Gunston East

Technology and Engineering (Graduate)
Gunston West

4:00pm - 6:30pm **Concurrent Workshops Session 2**

A. NSF Graduate Research Fellowship Program
Lincoln East

Pushpalatha Murthy and Earnestine Psalmonds Easter, *Program Directors, EHR, NSF*

B. Scientific Computation and Visualization: Solutions for World Changing Science
Lincoln West

Michael Smith, *Director of Intel® Academic Program, Intel*

Linda Akli, *IT Application and Outreach Specialist, SURA*

Philip E. Bourne, *Associate Director of Data Science, National Institutes of Health*

C. Funding Your STEM Education for Undergraduates and Graduates
Jefferson East

Lois Ricciardi, *MS PHD's Project Manager, Institute for Broadening Participation, Inc. (IBP)*

Yolanda Trevino, *Assistant Dean, Indiana University Graduate*

Bernard L. Batson, *Director, Diversity and Outreach Programs, College of Engineering, University of South Florida*

Sara Xayarath Hernandez, *Director, Diversity Programs in Engineering, Cornell University*

D. Tips in Making Powerful Oral and Poster Presentations
Monroe

Irene Hulede, *Manager, Student Programs, American Society for Microbiology (ASM)*

Olivia Harriott, *Associate Professor and Chair, Department of Biology, Fairfield University*

E. EFRI-REM Networking Session 1
(Invitation Only)
Mentors (Teachers, PIs, Postdocs, Graduate Students)
Cabinet

Christine Grant, *Professor and Associate Dean, College of Engineering, NC State University*

Andrew Greenberg, *Director REU, Chemistry of Materials for Renewable Energy, University of Wisconsin-Madison*

F. EFRI-REM Networking Session 2
(Invitation Only)
For Research Participants
International Ballroom East

SWOT/Session

Facilitators:
Sohi Rastegar, *Director, EFRI*

TJ Donahue, *Teacher, Cherry Creek High School*

Panel:
Rose Wesson, *Program Director, Chemical, Bioengineering, Environmental, and Transport Systems, NSF*

Bevlee Watford, *Program Director, Engineering and Education Centers, NSF*

Donna Riley, *Program Director, Engineering and Education Centers, NSF*

Jack Bobo, *Senior Advisor for Biotechnology, U.S. Department of State*

Adaora Nkwokoye, *Fellow, American Association for the Advancement of Science*

6:30pm **Dinner On Your Own**

6:30pm - 8:30pm **Invitation-Only Meetings and Networking Sessions**

Graduate Student Career Networking Session
International Ballroom Center

EFRI-REM Meeting
International Ballroom East

Lesia L. Crumpton-Young, *Engineer, Academician, Author, Entrepreneur, Executive Coach*

Science, Technology, and Disability Networking Session
Jefferson West

Saturday, February 21, 2015

Breakfast on Your Own

7:00am - 2:00pm **Registration**
Terrace Foyer

7:30am - 5:30pm **Judge's Room Opens**
International Ballroom West

7:30am - 8:00am **Oral Presentations Sessions 3 and 4 (Set-up)**
(See handout for presentation room assignments.)

Poster Presentations Sessions 3 and 4 (Set-up)
Columbia

8:00am - 12:30pm **EFRI-REM Networking Session *(Invitation Only)***
International Ballroom East

8:00am - 10:30am **Poster Presentations Session 3**
Columbia

Oral Presentations Session 3

These include:
Biological Sciences (Undergraduate)
Jay

Biological Sciences (Graduate)
Kalorama

Chemistry and Chemical Sciences (Graduate)
Morgan

Computer Sciences and Information Management (Undergraduate)
Northwest

Ecology, Environmental, and Earth Sciences (Undergraduate)
Piscataway

Mathematics and Statistics (Undergraduate and Graduate)
Embassy

Nanoscience/Physics (Graduate)
Gunston East

STEM Education/Social, Behavioral, and Economic Sciences (Undergraduate)
Gunston West

Technology and Engineering (Undergraduate)
Monroe

8:00am - 10:30am **Concurrent Workshops Session 3**

A. Tips in Making Powerful Oral and Poster Presentations
Lincoln East

Irene Hulede, *Manager, Student Programs, American Society for Microbiology (ASM)*

Olivia Harriott, *Associate Professor and Chair, Department of Biology, Fairfield University*

9:00am - 12:30pm **Exhibit Hall Opens**
Columbia

11:00am - 1:00pm **Poster Presentations Session 4**
Columbia

11:00am - 12:30pm **Oral Presentations Session 4**

These include:
Biological Sciences (Undergraduate)
Jay

Biological Sciences (Graduate)
Kalorama

Chemistry and Chemical Sciences (Graduate)
Morgan

Ecology, Environmental, and Earth Sciences (Undergraduate)
Northwest

Mathematics and Statistics (Undergraduate and Graduate)
Piscataway

Nanoscience/Physics (Graduate)
Embassy

Plant Research (Undergraduate)
Gunston East

STEM Education/Social, Behavioral, and Economic Sciences (Graduate)
Gunston West

Technology and Engineering (Undergraduate)
Monroe

11:00am - 12:30pm **Concurrent Workshops Session 4**

A. Scientific Computation and Visualization: Solutions for World Changing Science
Lincoln East

Michael Smith, *Director of Intel® Academic Program, Intel*

Linda Akli, *IT Application and Outreach Specialist, SURA*

Philip E. Bourne, *Associate Director of Data Science, National Institutes of Health*

B. Funding Your STEM Education for Undergraduates and Graduates
Lincoln West

Lois Ricciardi, *MS PHD's Project Manager, Institute for Broadening Participation, Inc. (IBP)*

Yolanda Treviño, *Assistant Dean, Indiana University Graduate School*

Bernard L. Batson, *Director, Diversity and Outreach Programs, College of Engineering, University of South Florida*

Sara Xayarath Hernandez, *Director, Diversity Programs in Engineering, Cornell University*

C. Biomedical Scientist (PhD) and Physician-Scientist (MD-PhD) Programs: How to Prepare and Apply
Jefferson West

Jabbar Bennett, *Associate Dean, Graduate School; Associate Dean, Division of Biology and Medicine; Director, Office of Diversity and Multicultural Affairs, The Warren Alpert Medical School of Brown University*

Lawrence Brass, *Associate Dean and Director, Combined Degree and Physician Scholar Programs and Professor of Medicine and Pharmacology, Perelman School of Medicine at the University of Pennsylvania*

12:30pm **Lunch On Your Own**

12:30pm **Exhibits Close**
Columbia

1:00pm - 3:30pm **Private Judge's Meeting and Lunch *(Determining Awardees)***
International Ballroom West

EFRI-REM Closing Meeting and Lunch *(Invitation Only)*
International Ballroom East

2:00pm - 6:00pm **Free Time for Tours or Special Meetings**

6:00pm - 9:00pm **Plenary Session 4 and Awards Banquet**
International Ballroom Center

Moderator:
***Shirley M. Malcom**, Director, EHR, AAAS*

Speaker:
Juan E. Gilbert, *The Andrew Banks Family Preeminence Endowed Chair and Associate Chair of the Research in the Computer and Information Science and Engineering Department, University of Florida*

Recognition of David and Lucile Packard HBCU Scholars:
James Stith, *Vice President Emeritus, American Institute of Physics (AIP)*

Recognition of the AAAS Policy Fellows, SACNAS Leadership Institute Alumni, and the L'Oreal USA for Women in Science (FWIS) Fellows

Presentation of EFRI-REM Poster Awards:
Sohi Rastegar*, Director of EFRI*

Presentation of Oral and Poster Awards:
Shirley M. Malcom, *Director, EHR, AAAS*
Claudia Rankins, *Program Director, HRD, NSF*

Presentation of Conference Incentives:
AAAS ERN Conference Staff

Closing Remarks:
Shirley M. Malcom*, Director, EHR, AAAS*

9:30pm - Midnight **Networking and Karaoke**
International Ballroom Center

Vinton G. Cerf, *Vice President and Chief Internet Evangelist, Google and One of the "Fathers of the Internet"*

Vinton G. Cerf has served as Vice President and Chief Internet Evangelist for Google since October 2005. In this role, he is responsible for identifying new enabling technologies to support the development of advanced, Internet-based products and services from Google. Cerf also served at MCI, the Corporation for National Research Initiatives, and the U.S. Department of Defense's Advanced Research Agency (DARPA). Widely known as one of the "Fathers of the Internet," Cerf is the co-inventor of the architecture and basic protocols of the Internet.

In December 1997, President Clinton presented the U.S. National Medal of Technology to Cerf and his colleague, Robert E. Kahn, for founding and developing the Internet. Kahn and Cerf were named the recipients of the ACM Alan M. Turing award in 2004 for their work on the Internet protocols. The Turing award is sometimes called the "Nobel Prize of Computer Science." In November 2005, President George Bush awarded Cerf and Kahn the Presidential Medal of Freedom, the highest civilian award given by the United States to its citizens. In April 2008, Cerf and Kahn received the prestigious Japan Prize (2013). Cerf, Kahn, and three others received the Queen Elizabeth Prize in Engineering. Cerf was made an officer of the French Legion d'Honneur in July 2013.

Cerf served as chairman of the board of Internet Corporation for Assigned Names and Numbers (CANN) from 2000-2007, founding president of the Internet Society from 1992-1995, and served a term as chairman of the Board in 1999. Cerf is honorary chairman of the IPv6 Forum, dedicated to raising awareness and speeding introduction of the new Internet protocol. He served as a member of the U.S. Presidential Information Technology Advisory Committee (PITAC) from 1997 to 2001 and serves on several national, state and industry boards and committees focused on cyber-security and other topics. He sits on the Board of Associates of Gallaudet University.

Cerf has received numerous other awards and commendations, nationally and internationally, in connection with his work on the Internet, including the Marconi Fellowship, the Charles Stark Draper award of the National Academy of Engineering, and the National Medal of Science from Tunisia, the Alexander Graham Bell Award presented by the Alexander Graham Bell Association for the Deaf, and the IEEE Alexander Graham Bell Medal. He is a Fellow of the IEEE, the ACM, and American Association for the Advancement of Science, the American Academy of Arts and Sciences, the International Engineering Consortium, the Computer History Museum, the Annenberg Center for Communications at USC, the Swedish Royal Academy of Engineering, the American Philosophical Society, the Hasso Platner Institute and is a member of the National Academy of Engineering. In 2011, he was made Distinguished Fellow of the British Computer Society.

In December, 1994, People magazine identified Cerf as one of that year's "25 Most Intriguing People." Cerf holds a Bachelor of Science degree in Mathematics from Stanford University and Master of Science and Ph.D. degrees in Computer Science from UCLA. He has received twenty honorary degrees.

Lesia L. Crumpton-Young, *Engineer, Academician, Author, Entrepreneur, Executive Coach*

Lesia L. Crumpton-Young is the recipient of the U.S. Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM) which she received from President Obama in 2010. She is a certified Life and Career Coach and serves as the Chief Research Officer at Tennessee State University and the Director of the Center for Advancing Faculty Excellence (CAFÉ).

She was the founder and former CEO of Powerful*Education* Technologies, and she founded and served as Executive Director of the Power Promise Organization. Other positions have included Program Director at NSF, Associate Provost at Texas A&M University, and Department Head and Professor of the Industrial Engineering and Management Systems Department at the University of Central Florida, and the Associate Dean of Engineering at Mississippi State University (MSU). During her tenure at MSU, she developed and directed the Ergonomics/ Human Factors Experimentation Laboratory.

Her research interests include human performance modeling and analysis, human reliability analysis, human fatigue assessment and modeling, use of virtual reality and computer simulation in ergonomics design and analysis, design of displays and controls, workplace design; carpal tunnel syndrome prevention and control; and workplace redesign for disabled persons. Her other research areas include STEM education, mentoring, curriculum reform, professional development, and STEM leadership development.

She has served as Principal Investigator on numerous research projects and published hundreds of scholarly publications. Her research has been supported by NSF, Office of Naval Research, NASA, and Department of Education and UPS, IBM, Caterpillar, Intel, Garan Manufacturing, Southwest Airlines, and Lockheed Martin. She received the NSF CAREER development award for her research on *Developing Engineering Criteria for the Inclusion of Persons with Disabilities* and an outstanding industrial paper award for her research on *An Investigation of Cumulative*

Trauma Disorders in the Construction Industry from the International Occupational Ergonomics and Safety Conference. She has also co-authored a workbook entitled "Advancing Your Faculty Career" and authored "You've Got The Power!"

Crumpton-Young awards include the Black Engineer of the Year Education Award (1997), Hearin-Hess Distinguished Professor of Engineering Award (1998), Janice A. Lumpkin Educator of the Year Golden Torch Award from the National Society of Black Engineers (1999), and the Outstanding Women of Color in Science and Technology Educator Award (2006). She is a fellow in the African Scientific Institute and holds the distinction of being one of the first African-American females to hold the rank of Full Professor in Engineering in the country. She has served on the National Science Foundation (NSF) Committee on Equal Opportunities in Science and Engineering (CEOSE), the NSF Engineering Advisory Committee as well as the Army Science Board for our country.

Crumpton-Young received her BS, MS, and PhD in Industrial Engineering from Texas A&M University; where she was the 1st African-American female to receive a PhD in engineering.

Joan Ferrini-Mundy, *Assistant Director, Directorate for Education and Human Resources, NSF*

Joan Ferrini-Mundy began her career as a high school mathematics teacher, and received her BS in Mathematics Education and an MS in Mathematics from the University of New Hampshire, where she completed her PhD in Mathematics Education in 1980. She taught mathematics and co-founded the SummerMath for Teachers program at Mount Holyoke College, and served on the mathematics faculty at the University of New Hampshire from 1983 through 1999. From 1999 through 2010 she was at Michigan State University, serving as Associate Dean for Science and Mathematics Education in the College of Natural Science. Joan was a faculty member in the MSU departments of mathematics and teacher education, and was named a University Distinguished Professor of Mathematics Education.

Ferrini-Mundy has had a number of public policy-related positions, including as Director of the Mathematical Sciences Education Board at the National Research Council (1995-1999), and in various positions at the National Science Foundation (program officer in Teacher Preparation and Enhancement, 1989 -91; and inaugural director, Division of Research on Learning in Formal and Informal Settings, 2007 – 2010). Currently Ferrini-Mundy is the NSF Assistant Director for Education and Human Resources, a position she has held since 2011, serving as a member of the U.S. Government Senior Executive Service.

Ferrini-Mundy was an ex officio member of the President's National Mathematics Advisory Panel, and co-chaired its Instructional Practices Task Group (2007-08). She was co-chair of the Federal Coordination in STEM Education Task Force which produced the 2013 *Federal Science, Technology, Engineering, and Mathematics (STEM) Education 5-Year Strategic Plan.* She has been a member of the Board of Directors of the National Council of Teachers of Mathematics, the Board of Governors of the Mathematical Association of America, and the American Mathematical Society's Committee for Research in Undergraduate Mathematics Education. She was president of the organization *Women and Mathematics Education*. Her research interests include calculus teaching and learning, mathematics teacher learning, and STEM education policy.

Yolanda S. George, *Deputy, Director, Education and Human Resources, AAAS*

Yolanda Scott George is Deputy Director and Program Director, Education and Human Resources Programs, American Association for the Advancement of Science (AAAS). She has served as Director of Development, Association of Science-Technology Centers (ASTC), Washington, DC; Director, Professional Development Program, University of California, Berkeley, CA; and as a research biologist at Lawrence Livermore Laboratory, Livermore, California involved in cancer research and cell cycle studies using flow cytometer and cell sorters.

George conducts evaluations, workshops and reviews for the National Institutes of Health and National Science Foundation, as well as for private foundation and public agencies, including the European Commission. She develops and coordinates conferences and workshops related to STEM undergraduate reform and recruitment and retention of minorities, women, and persons with disabilities in STEM. She works with UNIFEM, UNESCO, L'Oreal USA and Paris, and non-governmental organizations on gender, science, and technology initiatives related to college and university recruitment and retention and women leadership in STEM.

She currently serves as principal investigator (PI) or co-PI on several National Science Foundation (NSF) grants, including Vision and Change in Undergraduate Biology Education; National Science Education Digital Library (NSDL) Biological Sciences Pathways; Historically Black Colleges and Universities-Undergraduate Programs (HBCU-UP); Robert Noyce Teacher Scholarship Program; Transforming Undergraduate Education in STEM (TUES) and Virtual Faculty Workshop; and Women's International Research Collaborations at Minority Serving Institutions. In addition, George is the lead AAAS staff person for the L'Oréal USA Fellowships for Women in Science Program

(postdoctoral fellowships) and the David and Lucile Packard Foundation HBCU Graduate Scholars Program (graduate school fellowships).

George serves on a number of boards or committees, including: Maria Mitchell Women in Science Awards Committee; McNeil/ Lehrer Productions Online Science Reports Advisory Committee; Burroughs Wellcome Fund, Science Enrichment Program Grants, Advisory Board; The HistoryMakers, ScienceMakers, Advisory Board; and the National Advisory Board of The American Physical Society Physics Bridge Program. She has authored or co-authored over 50 papers, pamphlets, and hands-on science manuals. She received her BS and MS from Xavier University of Louisiana and Atlanta University in Georgia, respectively.

Juan E. Gilbert, *The Andrew Banks Family Preeminence Endowed Chair and Associate Chair of the Research in the Computer and Information Science and Engineering Department, University of Florida*

Juan E. Gilbert is the Andrew Banks Family Preeminence Endowed Chair and the Associate Chair of Research in the Computer and Information Science and Engineering Department at the University of Florida where he leads the Human-Experience Research Lab. He has also held faculty positions at Clemson University and Auburn University. He is President and Chief Technology Officer, Applications Quest™, LLC.

Gilbert's research integrates people, technology, information, policy, culture, and more to address societal issues. In general, Human-Centered Computing (HCC) research is highly interdisciplinary and applied. His areas of specialization include Natural Interactive Systems, Advanced Learning Technologies/Intelligent Tutoring Systems, Ethnocomputing/Culturally Aware Computing and Information Technology Workforce, Human-Computer Interaction, Databases and Data Mining.

His research projects include voting technology and accessibility (including access for the blind), college admissions software for achieving diversity, automotive user interfaces, internet use among the elderly, and investigating player behavior and experience in speech-enabled multimodal video games. In 2012, Gilbert and his team of students received the FCC Chairman's 2012 Award for Advancement in Accessibility for work that demonstrated how advanced technology addresses societal issues, meets the needs of people with disabilities, and promotes accessibility.

Gilbert has published more than 140 papers, given more than 200 talks, and raised more than $24 million dollars for research funding. He is a AAAS Fellow and a recipient of the Presidential Award for STEM Mentoring. He was named a national role model by Minority Access, Inc; a Master of Innovation by Black Enterprise magazine; Idea Maker: Ten Tech Innovators in 2013 by the Chronicle of Higher Education (2013); and the Pioneer of the Year by the National Society of Black Engineers. In 2013, the Black Graduate and Professional Association at Auburn University named their Distinguished Lecture Series in honor of Gilbert. He is the recipient of the 2014 AAAS Mentor Award. He received his BS in Systems Analysis, from Miami University and his MS and PhD in Computer Science at the University of Cincinnati.

Rush D. Holt, *AAAS Chief Executive Officer, Executive Publisher, Science*

Rush D. Holt is the AAAS Chief Executive Officer and Executive Publisher of the *Science* family of journals. Previously, Holt represented the 12th congressional district of New Jersey for eight terms in the United States House of Representatives.

Holt earned his BA degree in Physics from Carleton College in Minnesota, and completed his Master's and doctoral degrees in physics at New York University. He has held positions as a faculty member at Swarthmore College from 1980 -1988, where he taught courses in physics, public policy, and religion. During his faculty career, he was an AAAS Congressional Science Fellow (1982-83). As an arms control expert at the U.S. State Department, he monitored the nuclear programs of countries like Iraq, Iran, and North Korea. From 1989 until 1998, he served as Assistant Director of the Princeton Plasma Physics Laboratory, Princeton University's largest research facility and New Jersey's largest center for alternative energy research. As a result of his alternative energy research, Holt in 1981 was issued a patent on an improved solar-pond technology for harnessing energy from sunlight.

Holt's science- and education-related roles in Congress have included service on the Committee on Education and the Workforce; the Committee on Natural Resources; and the National Commission on Mathematics and Science Teaching for the 21st Century. He served as co-chair of the Research and Development Caucus, and sat on other caucuses related to children's environmental health, renewable energy, sustainable development, Alzheimer's and diabetes disease research, biomedical research more broadly, the Internet, community colleges, and more. He is a recipient of the Champion of Science Award from the nonprofit Science Coalition, a group of more than 50 leading public and private research universities. He is an AAAS Fellow and a Fellow of the American Physical Society.

Biographies

Shirley M. Malcom, *Director for Education and Human Resources (EHR) Programs at AAAS*

Shirley M. Malcom, Director for Education and Human Resources (EHR) Programs at AAAS, has served as a program officer in the NSF Science Education Directorate; an assistant professor of biology, University of North Carolina, Wilmington; and a high school science teacher. Malcom received her PhD in Ecology from the Pennsylvania State University; Master's in Zoology from the University of California, Los Angeles; and Bachelor's with distinction in Zoology from the University of Washington. In addition, she holds 16 honorary degrees.

Malcom serves on several boards, including the Heinz Endowments, Public Agenda, Digital Promise, and the National Mathematics and Science Initiative. She serves as a trustee of Caltech and as a Regent of Morgan State University. In 2003, Malcom received the Public Welfare Medal of the National Academy of Science, the highest award granted by the Academy. She was a member of the National Science Board, the policymaking body of NSF, from 1994 to 1998, and of the President's Committee of Advisors on Science and Technology from 1994 to 2001.

Earnestine Psalmonds Easter, *Program Director, Division of Graduate Education, NSF*

Earnestine Psalmonds Easter is a program director in the Division of Graduate Education. As senior program officer and visiting scholar in the Policy and Global Affairs Division, National Academies, she served as study director for the 2009 Academies report entitled *Partnerships for Emerging Research Institutions* and co-study director of *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads* (2010), a congressionally mandated study focused on the under-representation of minorities in science and engineering. She has represented the NSF on interagency science and engineering workforce initiatives including the Education and Workforce Development Subgroup of the National Science and Technology Council and consultation committee for the Department of Education Jacob K. Javits Fellowship Program.

Psalmonds Easter served on the board of directors for Oak Ridge Associated Universities and member of the North Carolina Board for Science and Technology, NASA Minority Business Resource Advisory Council, and executive committee of the Council on Research Policy and Graduate Education of the Association of Public and Land Grant Universities. She has held administrative positions at the Georgia Institute of Technology and Georgia State University, and she became the first vice chancellor for research at North Carolina A&T State University where she was also a professor of education. Psalmonds Easter served as principal investigator for projects funded by the National Science Foundation, National Institutes of Health, Department of Agriculture, Martin Marietta Energy Systems, Caterpillar Foundation, Environmental Protection Agency, and Department of Energy.

She has made numerous presentations, and is the co-author of copyrights to two software systems. She was honored by the Republic of Senegal through acceptance into the Order of the Lion. She received the Baccalaureate and Master's degree in Education from Tuskegee University and PhD in Higher Education Leadership with a concentration in Management Information Systems from Georgia State University.

Ainissa G. Ramirez, *Science Evangelist and co-author 'Newton's Football: The Science Behind America's Game'*

Ainissa G. Ramirez is a science evangelist who is passionate about getting the general public excited about science. She co-authored (with Allen St. John) *Newton's Football: The Science Behind America's Game* (Random House); and, authored *Save Our Science: How to Inspire a New Generation of Scientists* (TED Books).

Before taking on the call to improve the public's understanding of science, she was an Associate Professor of Mechanical Engineering & Materials Science at Yale University. *Technology Review*, the magazine of the Massachusetts Institute of Technology (MIT), named her as one of the world's 100 Top Young Innovators for her contributions to transforming technology. She has been profiled in *The New York Times, Fortune Magazine, CNN, NPR, ESPN, The Hartford Courant* and numerous scientific magazines *(Scientific American and Discover Magazine).*

Ramirez received her training in materials science and engineering from Brown University (ScB) and Stanford University (PhD). Prior to being on the faculty at Yale, she was a research scientist at Bell Laboratories, Lucent Technologies, in Murray Hill, New Jersey were she did award-winning research. She has authored more than 50 technical papers, holds six patents, and has presented her work worldwide.

She now focuses her energies on making science fun, and gave an impassioned called to action at TED on the importance of science, technology, engineering, and math (STEM) education, which generated widespread enthusiasm. At Yale, she was the director of the award-winning science lecture series for children

called *Science Saturdays* and hosted two popular-science video series called *Material Marvels and Science Xplained.*

As a graduate student she wrote as a science correspondent for *Time* magazine's Washington D.C. bureau, which ignited her passion for communicating science. Now, she speaks internationally on the importance of making science fun and has served as a science advisor to the American Film Institute, WGBH/ NOVA, and several science museums.

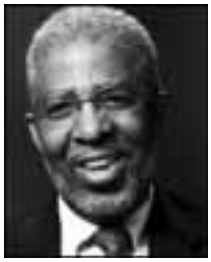
Claudia Rankins, *Program Director, HRD, NSF*

Claudia Rankins is a Program Officer in the Directorate for Education and Human Resources at the National Science Foundation, where she manages the Historically Black Colleges and Universities Undergraduate Program and the Centers for Research Excellence in Science and Technology. Prior to this post, Rankins served at Hampton University for 22 years in a number of capacities, including Chair of the Department of Physics, Assistant Dean for Research, and Dean of the School of Science. Rankins holds a PhD in Physics from Hampton University. She is the co-founder of the Society of STEM Women of Color, Inc.

Sohi Rastegar, *Senior Advisor and Director, Office of Emerging Frontiers and Multidisciplinary Activies (EFMA), NSF, Directorate for Engineering*

Sohi Rastegar is the Senior Advisor and the Director of Office of Emerging Frontiers in Research and Innovation (EFRI) at the US National Science Foundation (NSF), Directorate for Engineering. He joined NSF in November 2003 following fifteen years of academic and administrative service at Texas A&M University, Virginia Commonwealth University, and the Johns Hopkins University. He has been an Invited Professor at the Swiss Institute of Technology in Lausanne (EPFL), Switzerland. He earned his BS(Highest Honors) and MS in Aerospace Engineering, and his PhD in Biomedical Engineering at the University of Texas at Austin. Rastegar has over 150 scientific publications and presentations and has trained 8 PhD and 14 MS students. He is a co-founder of BioTex, Inc., a medical device company in Houston, Texas.

He is a Fellow of the American Institute for Medical and Biological Engineering (AIMBE), a Fellow of the American Society for Lasers in Medicine and Surgery (ASLMS), has served as the Chair of Bioengineering Division of ASME, Associate Editor of Annals of Biomedical Engineering, a member of the Editorial Boards of the Journals of Biomedical Optics and Journal of Diabetes Science and Technology. Rastegar is the recipient of numerous scientific and administrative awards and honors including the Select Young Faculty Award from the Texas Engineering Experiment Station, and the Director's Superior Accomplishment Award from the National Science Foundation.



James Stith, *Vice President Emeritus, American Institute of Physics*

James Stith is Vice President Emeritus for the American Institute of Physics (AIP). While an officer of the Institute, he had oversight responsibilities for AIP's Magazine Division, the Media and Government Relations Division, the Education Division, the Center for the History of Physics, the Statistical Research Division and the Careers Division. His Doctorate in Physics was earned from The Pennsylvania State University, and his Masters and Bachelors in Physics were received from Virginia State University. A physics education researcher, his primary interests are in program evaluation, and teacher preparation and enhancement.

Stith was formerly a Professor of Physics at The Ohio State University and Professor of Physics at the United States Military Academy. He has also been a Visiting Associate Professor at the United Air Force Academy, a Visiting Scientist at the Lawrence Livermore National Laboratory, a Visiting Scientist at the University of Washington, and an Associate Engineer at the Radio Cooperation of America.

He is a past president of the American Association of Physics Teachers, past president of the National Society of Black Physicists, a Fellow of the American Association for the Advancement of Science, a Fellow of the American Physical Society, a Chartered Fellow of the National Society of Black Physicists, and a member of the Ohio Academy of Science. He was named a Distinguished Alumni of Penn State, the Alumni Association's highest award, an Honorary Member of Sigma Pi Sigma (its highest award) the physics honor society, a National Academies Education Mentor in the Life Sciences and a Science-Maker (by HistoryMakers). Additionally, he serves on a number of national and international advisory boards and has been awarded a Doctor of Humane Letters by his alma mater, Virginia State University. He is married and has three adult daughters and two grandchildren.

Biographies

Jermelina Tupas, *Division Director (Acting), Division of Human Resource Development, Directorate for Education and Human Resources, NSF*

Jermelina Tupas is the Deputy Division Director of the Division of Human Resource Development (HRD), Directorate for Education and Human Resources (EHR) at the National Science Foundation, and currently serves as acting Division Director for HRD. She was acting Deputy Assistant Director for EHR from June-December 2014 before returning to her home division. Prior to coming to EHR at NSF, she held the position of Division Director for the Division of Community and Education at the National Institute of Food and Agriculture (NIFA) - U.S. Department of Agriculture from October 2009 to August 2012. Before working at NIFA she managed a portfolio of student training, fellowship and faculty research as a Program Director in the Division of Minority Opportunities in Research at the National Institute of General Medical Sciences, NIH from August 2006 to September 2009. She first joined NSF in 2004 as a Program Officer for more than two years, at the Division of Molecular and Cellular Biosciences, Biological Science Directorate at the National Science Foundation. Thus after stints at two other federal agencies (NIH and USDA), she has returned to NSF. Before moving to NSF, Tupas was a faculty member at the University of Hawaii at Manoa (UHM), where she taught graduate courses and carried out her research in hormone signaling and transcription regulation, while managing two undergraduate student research training and student development programs focused on increasing diversity in biomedical sciences. Jermelina Tupas holds a Bachelor's degree in Zoology and a Master's degree in Microbiology from the University of the Philippines, and a PhD in Molecular Biology from the Institute of Medical Sciences, University of Tokyo, Japan.

Maggie Werner-Washburne, *Regents' Professor of Biology at the University of New Mexico and Past President, SACNAS*

Maggie Werner-Washburne received a BA in English from Stanford. After graduation, she lived in Mexico, Central, and South America, Alaska, and Minnesota—a walkabout that led to her becoming a scientist. During this time, she became interested in ethnobotany (the traditional use of plants for food, clothing, and medicine). She spent time in Western Samoa and New Zealand and completed an MS in Botany at the University of Hawaii, and a PhD in Botany with a minor in Biochemistry at the University of Wisconsin-Madison. After a postdoc in Yeast Molecular Genetics, where she and collaborators discovered that HSP70 genes were chaperones, she and her family moved to Albuquerque, New Mexico, where she is now Regents' Professor of Biology at the University of New Mexico (UNM).

Werner-Washburne's research focuses on understanding how yeast cells survive starvation and most recently focuses on genomic analysis of the cell-fate decision that leads to the production of quiescent and non-quiescent cells in stationary-phase cultures and working on new technology to increase the utility of GFP-fusion libraries. Her work has provided insight into aging, the cell cycle, and other significant areas of cell biology. She also spent one year at NSF as a program officer for Microbial Genetics and wrote the first report on the Federal Investment in Microbial Genomics for the Office of Science and Technology Policy.

Werner-Washburne has been at UNM for more than 20 years, where she has mentored students from many backgrounds, her papers have been cited more than 4500 times. She is an AAAS Fellow, 2011 Harvard Foundation Distinguished Scientist, and has received numerous awards, including two Presidential awards, for Research and Excellence in Science, Engineering, and Math mentoring from both Presidents Bush. Her research has been funded by NIH, NSF, and DOE. Werner-Washburne also directs the NIH-funded UNM-Iniatives to Maximize Student Diversity (IMSD) program for student research and is a co-PI on the model organism database FlyBase (Harvard and other institutions) and VectorBase (Notre Dame and other institutions). The goal of the Model Organism Database program at UNM is to increase diversity in bioinformatics by developing a genome annotation center at UNM.

She is Past-President of SACNAS, a society of scientists dedicated to fostering the success of Hispanic/Chicano and Native American scientists—from college students to professionals—to attain advanced degrees, careers, and positions of leadership in science.

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Joycelyn Wilson
Spelman College

Danyelle Winchester
Howard University

Katrina Yamazaki
California State University, Los Angeles

Nilin Zhang
University of Pennsylvania

Hotel Floor Plans

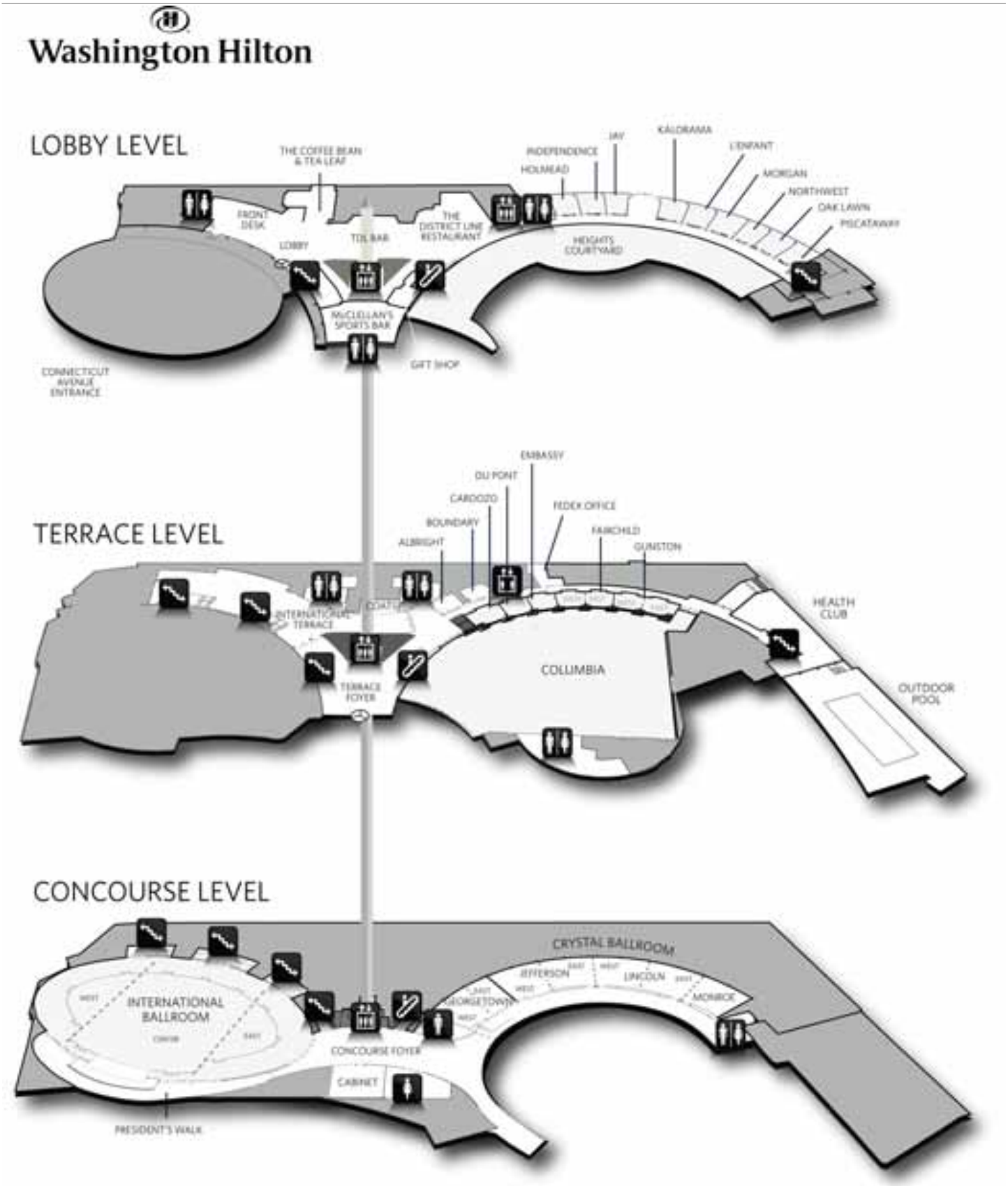

Table	Institution
45	Albert Einstein College of Medicine
36	American Association for Cancer Research (AACR)
53	American Society for Microbiology (ASM)/Annual Biomedical Research Conference for Minority Students (ABRCMS)
60	Association of American Veterinary Medical Colleges
12	Auburn University
6	Boston University School of Medicine
59	Brookhaven National Laboratory
64	Brookhaven National Laboratory
47	Brown University Graduate School
8	Claflin University
5	Columbia University Medical Center Coordinated Doctoral Program
22	Columbia University School of Engineering and Applied Science
39	Consumer Financial Protection Bureau
38	Cornell University College of Engineering
19	Emory University Laney Graduate School
55	Florida International University
32	Food and Drug Administration (FDA)
16	Indiana University
4	Institute for Broadening Participation / Pathways to Science
62	Johns Hopkins University
34	Johns Hopkins University School of Medicine
29	Lawrence Berkeley National Laboratory
24	Marshall University JCE School of Medicine
58	Medical University of South Carolina
51	Michigan State University Graduate School
25	Morehouse School of Medicine
14	Northwestern University McCormick School of Engineering and Applied Science
52	Ohio State University Graduate School
17	Penn State College of Medicine Biomedical Sciences Graduate Program
2	Penn State University
7	Pennsylvania State University Office of Graduate Educational Equity Programs
11	Princeton University
50	Rensselaer Polytechnic Institute
28	Sackler Institute of Graduate Biomedical Sciences, NYU School of Medicine
35	St. John's University

Table	Institution
23	Stanford University School of Humanities and Sciences
43	Stony Brook University - Center for Inclusive Education Graduate School
49	Tufts University, Sackler School of Graduate Biomedical Sciences
18	UC San Diego
33	University of Chicago
30	University of Idaho College of Graduate Studies
48	University of Illinois at Urbana-Champaign
37	University of Iowa Graduate College
40	University of Massachusetts/MassNanoTech Institute
10	University of Michigan
56	University of Michigan - College of Pharmacy (PharmD & PhD Programs)
13	University of Michigan Program in Biomedical Sciences
42	University of Missouri Graduate Life Sciences Program
46	University of Notre Dame Graduate School
15	University of Pennsylvania Perelman School of Medicine
41	University of South Florida
54	University of Tennessee, Knoxville - Program for Excellence and Equity in Research
20	University of Texas Graduate School of Biomedical Sciences at Houston
21	University of the Virgin Islands Master of Marine and Environmental Sciences (MMES)
27	University of Washington Molecular and Cellular Biology Program
9	University of Wisconsin-Madison College of Engineering
31	UT Southwestern Medical Center Graduate School in Biomedical Sciences and MD/PhD Programs
26	Vanderbilt University
3	Washington University in St. Louis
57	Washington University in St. Louis / Biology and Biomedical Sciences
63	Wayne State University
44	Worcester Polytechnic Institute
61	XSEDE (Extreme Science and Engineering Discovery Environment)

Table 45
Albert Einstein College of Medicine
Graduate Division of Biomedical Sciences
1300 Morris Park Avenue
Belfer 203
Bronx, NY 10461

Contact(s): Victoria Freedman,
victoria.freedman@einstein.yu.edu

"Research knows no Boundaries" in the Graduate Division of Biomedical Sciences at the Albert Einstein College of Medicine (Bronx, NY). Established in 1957, Einstein has long provided an exciting intellectual environment in which students acquire the knowledge and skills necessary to attain the PhD and MD/PhD degrees in the biomedical sciences.

Graduate students work with faculty at the cutting-edge of disease-relevant research in areas such as: Biochemistry, Bioinformatics, Biophysics, Cancer, Cell and Molecular Biology, Genetics, Immunology Infectious Diseases, Neurosciences, Stem Cell Biology, Systems Biology, Epidemiology, Virology and more! New PhD tracks in Clinical Investigation and Translational Science are also offered.

A robust Career and Professional Development program, including career exploration and professional skills development, is offered to all graduate students.

All PhD, MD/PhD, and PREP students receive:
- Full tuition remission
- Annual stipend
- Health Insurance
- Subsidized housing

Contact us for more information: www.einstein.yu.edu/phd

Table 36
American Association for Cancer Research (AACR)
615 Chestnut Street
17th Floor
Philadelphia, PA 19106-4404

Contact(s): Robin Felder, robin.felder@aacr.org
Tamika Coleman, tamika.coleman@aacr.org

Founded in 1907, the American Association for Cancer Research (AACR) is the world's oldest and largest professional organization dedicated to advancing cancer research and its mission to prevent and cure cancer through research, education, communication, and collaboration. AACR membership includes more than 35,000 laboratory, translational, and clinical researchers, population scientists, other health care professionals, and cancer advocates residing in 97 countries. The AACR marshals the full spectrum of expertise of the cancer community to accelerate progress in the prevention, biology, diagnosis, and treatment of cancer by annually convening more than 20 conferences and educational workshops, the largest of which is the AACR Annual Meeting with over 18,000 attendees. In addition, the AACR publishes eight peer-reviewed scientific journals and a magazine for cancer survivors, patients, and their caregivers. The AACR funds meritorious research directly as well as in cooperation with numerous cancer organizations. As the Scientific Partner of Stand Up To Cancer, the AACR provides expert peer review, grants administration, and scientific oversight of team science and individual grants in cancer research that have the potential for near-term patient benefit. The AACR actively communicates with legislators and policymakers about the value of cancer research and related biomedical science in saving lives from cancer. For more information about the AACR, visit www.AACR.org.

Table 53
American Society for Microbiology (ASM)/Annual Biomedical Research Conference for Minority Students (ABRCMS)
Education Department
1752 N Street, NW
Washington, DC 20721

Contact(s): Irene Hulede, ihulede@asmusa.org

ASM: The American Society for Microbiology is the oldest and largest single life science membership organization in the world. Membership has grown from 59 scientists in 1899 to more than 39,000 members today, with more than one third located outside the United States. The members represent 26 disciplines of microbiological specialization plus a division for microbiology educators.

ABRCMS: ABRCMS is one of the largest, professional conferences for underrepresented minority students and students with disabilities to pursue advanced training in science, technology, engineering and mathematics (STEM), attracting approximately 3,600 individuals, including 1,850 undergraduate students, 450 graduate students and postdoctoral scientists and 1300 faculty, program directors and administrators. Students come from over 350 U.S. colleges and universities. All are pursuing advanced training in science, technology, engineering and mathematics (STEM), and many have conducted independent research. The conference is designed to encourage underrepresented minority students to pursue advanced training in STEM and provide faculty mentors and advisors with resources for facilitating students' success. More than 500 representatives from graduate programs at US colleges and universities as well as scientists from government agencies, foundations, and professional scientific societies join ABRCMS in the exhibitors program to share information about graduate school and summer internship opportunities. These representatives present research opportunities, funding sources, and professional networks.

During the four-day conference, over 1,700 students participate in poster and oral presentations in twelve disciplines in the biomedical and behavioral sciences, including mathematics. All undergraduate student presentations are judged and those receiving the highest scores in each scientific discipline and in each educational level will be given an award during the final banquet.

Table 60
Association of American Veterinary Medical Colleges
1101 Vermont Avenue, NW
Suite 301
Washington, DC 20005
Contact(s): Lisa Greenhill, lgreenhill@aavmc.org

The Association of American Veterinary Medical Colleges (AAVMC) is a Washington, D.C. based nonprofit organization dedicated to protecting and improving the health and welfare of animals, people and the environment by advancing academic veterinary medicine.

Table 12
Auburn University
Office of Diversity and Multicultural Affairs
101 M White Smith Hall
381 Mell Street
Auburn, AL 36849

Contact(s): Chukwudi Chidume, chidugc@auburn.edu

Auburn University is one of the few Universities to carry the torch as a land, sea and space grant University. Our students can choose from more than 140 degree options in 13 schools and colleges at the undergraduate, graduate and professional levels. Auburn University's Office of Diversity and Multicultural Affairs aims to celebrate diversity. We work to create an environment where you receive kindness and consideration out of respect and receive equal attention based on effort, knowledge, ability, talent and hard work.

Table 6
Boston University School of Medicine
Graduate Medical Sciences
72 E. Concord Street
L-317
Boston, MA 02118

Contact(s): Kayleigh Klegraefe, kay416@bu.edu
Lynese Wallace, lynesewa@bu.edu

The Division of Graduate Medical Sciences at Boston University School of Medicine is a recognized leader in research and graduate education in the biomedical sciences. The school has about 900 graduate students from 40 states and 12 countries offering different pathways to pursue academic and professional goals.

Our PhD Programs provide 4 options for PhD study. The first is the Program in Biomedical Sciences is an interdisciplinary PhD program which integrates the foundations of biomedical research with focused investigation and preparation for career advancement. The second option is department-based PhD programs; Anatomy & Neurobiology, Behavioral Neuroscience and Pharmacology. The third is a university-wide Neuroscience program. Finally, the MD-PhD program balances both clinical and scientific training to develop exceptional physician scientists.

Professionalism, Career Development and Mentorship: All PhD students will have the unique opportunity to participate in a dynamic professionalism and mentoring program. Students build professional networks with faculty members who have significant research and publication experience, and who can assist with career development.

Summer Training as Research Scholars Program (STaRS): STaRS is designed to promote access to graduate education for talented undergraduates from minority groups traditionally underrepresented in the biomedical sciences: African-American, Hispanic, Native American/Native Alaskan, and Pacific Islander/ Native Hawaiian. STaRS is designed specifically for the enhancement of skills required for successful entrance and completion of a graduate program or an MD/PhD program in the biomedical sciences.

Table 59 and Table 64
Brookhaven National Laboratory
Bldg. 400B
Human Resources
Upton, NY 11973

Contact(s): Sandra Charles, scharles@fnal.gov
Terrence Buck, tbuck@bnl.gov

America's National Laboratory System: A Powerhouse of STEM

Transformational advances in knowledge and technology come from discovery science. As the nation’s largest funder of basic research in the physical sciences, the U.S. Department of Energy (DOE) sponsors discovery science that is advancing human understanding in physics, chemistry, biology, environmental science, and computer science. Each year, DOE’s National Laboratory System serves tens of thousands of scientists and engineers from across academia, government, and industry, providing the unique skills, highly specialized equipment, and world-class facilities needed to answer the most fundamental questions in science today. Acting as engines of discovery for the U.S. and global scientific communities, the National Labs

play a critical role in sustaining America's leadership in science and innovation, incubating new technologies and industries, and educating the next generation of scientists and engineers.

Table 47
Brown University Graduate School/The Leadership Alliance
47 George Street
Box 1867
Providence, RI 02912

Contact(s): Jabbar Bennett, jabbar_bennett@brown.edu
Medeva Ghee, medeva_ghee@brown.edu

Since 1850, graduate education has been an integral part of Brown University. Graduate students are key partners in helping the University achieve its mission of serving the community, the nation, and the world by discovering, communicating, and preserving knowledge and understanding in a spirit of free inquiry. With 80 graduate programs we aim to educate and train a very distinguished and diverse cohort of master's and doctoral students in preparation for exemplary careers in practice, research and teaching.

The Leadership Alliance is a national consortium of more than 30 leading research and teaching colleges, universities, and private industry. The mission of The Leadership Alliance is to develop underrepresented students into outstanding leaders and role models in academia, business and the public sector. Since 1992, The Alliance has produced more than 300 PhDs who as undergraduates participated in its Summer Research-Early-Identification Program.

Table 8
Claflin University
Master's in Biotechnology
400 Magnolia Street
Orangeburg, SC 29115

Contact(s): Nankwanga Cherry, ncherry@claflin.edu

Claflin University is a comprehensive institution of higher education affiliated with the United Methodist Church. A historically black university founded in 1869, Claflin is committed to providing students with access to exemplary educational opportunities in its undergraduate, graduate and continuing education programs. Claflin seeks to foster a rich community comprised of students, faculty, staff, and administrators who work to nurture and develop the skills and character needed for engaged citizenship and visionary and effective leadership. Claflin's graduate programs provide opportunities for advanced students to increase their specialization in particular fields of study oriented toward professional enhancement and academic growth. Its continuing education programs provide students with expanded avenues for professional development and personal fulfillment.

Table 5
Columbia University Medical Center
Coordinated Doctoral Program
630 West 168th Street
P&S 3-435
New York, NY 10032

Contact(s): Fred Loweff, fl12@columbia.edu

The Coordinated Doctoral Programs in Biomedical Sciences at Columbia University are grouped in five divisions:

- Integrated Program in Cellular, Molecular and Biomedical Studies
- Program in Neurobiology and Behavior
- Program in Biomedical Informatics
- Programs in Basic Cell and Molecular Biology
  - Biochemistry and Molecular Biophysics
  - Cell Biology
  - Genetics and Development
  - Microbiology, Immunology and Infection
- Programs in Molecular Basis of Health and Disease
  - Cellular Physiology and Biophysics
  - Nutritional and Metabolic Biology
  - Pathobiology and Molecular Medicine
  - Pharmacology and Molecular Signaling

In addition to coursework, the first year curriculum emphasizes research rotations in three different laboratories including those outside the home program. An elective is also available providing students an opportunity to interface with physicians and patients thereby deepening their understanding of the fundamentals of human disease as they relate to diagnosis and treatment.

Table 22
Columbia University School of Engineering and Applied Science
500 West 120 Street, MC 4708
Room 530 Mudd
New York, NY 10027

Contact(s): Tiffany Simon, tms26@columbia.edu

Columbia University's Fu Foundation School of Engineering and Applied Science offers graduate degrees in Applied Physics, Applied Mathematics, Biomedical Engineering, Chemical Engineering, Civil Engineering, Construction Engineering Management, Data Sciences, Engineering Mechanics, Computer Engineering, Computer Science, Earth and Environmental Engineering, Electrical Engineering, Financial Engineering, Industrial Engineering, Operations Research, Management Science and Engineering, Materials Science Engineering, Medical Physics, Mechanical Engineering, Metallurgical Engineering, Mining Engineering, and Solid-state Science Engineering. Distance education and MS/MBA programs are also available. A joint master's degree program in Computer Science and

Journalism is also available. The School also offers the Scientist to Engineer (S2E) master's program in Chemical Engineering for students without an undergraduate degree that is equivalent to an ABET accredited Chemical Engineering bachelor's degree.

Table 39
Consumer Financial Protection Bureau
1275 1 Street, NE
Washington, DC 20002

Contact(s): Michael Rivera, michael.rivera@cfpb.gov

Our mission is to make markets for consumer financial products and services work for Americans - whether they are applying for a mortgage, choosing among credit cards, or using any number of other consumer financial products.
Help us inform and evaluate policy by developing a deeper understanding of consumer decision-making, household financial behavior, and markets for consumer financial products and services.

Table 38
Cornell University
College of Engineering
146 Olin Hall
Ithaca, NY 14853

Contact(s): Sara Hernandez, sh267@cornell.edu

Steeped in an environment of questioning, and with a focus on innovation, Cornell Engineering pursues excellence in all areas. Its faculty, students, and alumni design, build, and test products, improve the world of medicine, inform and shape our laws, create and drive businesses, become research luminaries, and overcome real and perceived barriers to achieve scientific breakthroughs that advance the quality of life on our planet.

Table 19
Emory University Laney Graduate School
201 Dowman Drive
Administration Building, Room 209
Atlanta, GA 30322

Contact(s): Damon Williams, damon.l.williams@emory.edu

Emory's Graduate School was organized as a distinct division of the University in 1919, and awarded its first PhD to a student in Chemistry in 1948. In the years since, graduate education at Emory has made tremendous advances. The Laney Graduate School now offers the PhD and Masters degrees in more than 40 programs across the humanities, the social sciences, biomedical and natural science, public health, nursing and business.

Table 55
Florida International University
11200 SW 8th Street PC 230
Miami, FL 33199

Contact(s): Albert Hoyt, ahoytiii@fiu.edu

As a leading public research university, Florida International University focuses on student learning, innovation, and collaboration. It encompasses a nationally and internationally renowned faculty recognized for its outstanding teaching and cutting-edge research. More than 180 baccalaureate, masters and doctoral degree programs are offered in the following: College of Architecture and the Arts, Arts and Sciences, Business Administration, Education, Engineering and Computing, Law, Medicine, Nursing and Health Sciences, Public Health and Social Work, Journalism and Hospitality and Tourism.

Table 32
Food and Drug Administration (FDA)
Office of the Chief Scientist
10903 New Hampshire Avenue
WO32, Room 2332
Silver Spring, MD 20993

Contact(s): Bernadette Williamson-Taylor, bernadette.williamson-taylor@fda.hhs.gov
Devin Thomas, devin.thomas@fda.hhs.gov

The Food and Drug Administration (FDA) is a government agency staffed by approximately 10,000 scientists that is responsible for protecting the public health. The Agency ensures the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation.

FDA also advances the public health by helping to speed innovations that make medical products more effective, safer, and more affordable and that enhance food safety in an increasingly globalized economy. FDA regulates the manufacture, marketing, and distribution of tobacco products to protect the public health and to reduce tobacco use by minors. The Agency also plays an important role in our nation's counterterrorism capability by ensuring the security of the food supply and by fostering development of medical products to respond to deliberate and naturally emerging public health threats.

Whether you're a biologist, chemist, epidemiologist, nurse, pharmacist, physician, social or behavioral scientist, statistician, veterinarian, or an engineer, FDA offers scientists the chance to be part of a pioneering regulatory science culture that is advancing cutting-edge research on critical issues involving novel product development, evaluation, and safety.

For a comprehensive look at FDA's extensive scientific professional development opportunities and how we attract and retain our outstanding talent, visit our web site at: http://www.fda.gov/ScienceResearch/ScienceCareerOpportunities/default.htm.

Table 16
Indiana University
727 East Third Street
Swain West 117
IU Physics Department
Bloomington, IN 47405

Contact(s): Garfield Warren, gtwarren@indiana.edu

From Finance to the Fine Arts, our graduate degree programs are led by the most distinguished minds in academia. The University Graduate School is a recognized leader in developing new concepts and best practices for graduate education, which makes IU Bloomington a premier location to earn your graduate degree. We assist departments in recruiting, supporting, retaining, and graduating outstanding scholars. Through our work with national higher education organizations such as Council of Graduate Schools, Committee on Institutional Cooperation, Educational Testing Service, McNair Scholars Program , we take the lead in forging the future directions of graduate education. Most of all, we stand to support you in all your academic endeavors, to create a learning environment where you can soar, and to maintain a set of standards that guarantee the value of your degree from IU.

Table 4
Institute for Broadening Participation
Pathways to Science
PO Box 607
281 Main Street
Damariscotta, ME 04543

Contact(s): Aisha Terrell, terrella30@gmail.com
Jeramie Strickland, jeramietroy@hotmail.com

Pathways to Science is a project of the Institute for Broadening Participation (IBP). Pathways to Science supports pathways to the STEM fields: Science, Technology, Engineering, and Mathematics. We place particular emphasis on connecting underrepresented groups with STEM programs, funding, mentoring and resources. Use this website (www.pathwaystoscience.org) to find programs such as undergraduate summer research opportunities, graduate fellowships, postdoctoral positions, as well as resources and materials pertaining to recruitment, retention, and mentoring.

The mission of the Institute for Broadening Participation is to increase diversity in the Science, Technology, Engineering and Mathematics (STEM) workforce. We design and implement strategies to increase access to STEM education, funding, and careers, with special emphasis on diverse underrepresented groups.

Table 62
Johns Hopkins University
3400 N. Charles Street
Baltimore, MD 21218

Contact(s): Joan Miller, joan@jhu.edu
Steven Farber, farber@ciwemb.edu

The Hopkins CMDB program is directed towards cross-training doctoral students in all of the following areas. All of our graduate students, whether involved in research in cell biology, molecular biology, which includes genetics, developmental biology, and biophysics, which includes biochemistry, participate in a core curriculum involving molecular, cellular, developmental biology, and biophysics. Students continue to broaden their knowledge in these areas throughout their graduate training, while they specialize in their own research areas. Through this cross-training, PhDs emerge from the CMDB with preparation to tackle complex problems in 21st century biosciences.

Table 34
Johns Hopkins University School of Medicine
Johns Hopkins University Arts and Sciences Engineering Medicine Public Health
1830 E. Monument Street
Suite 2-107
Baltimore, MD 21205

Contact(s): Catherine Will, cwill@jhmi.edu
Arhonda Gogos, agogos1@jhmi.edu

Please visit table #34 for more information.

Table 29
Lawrence Berkeley National Laboratory
One Cyclotron Road
MS 7R0222
Berkeley, CA 94720

Contact(s): Joseph Crippen, jrcrippen@lbl.gov
Rachel Carl, rscarl@lbl.gov

Lawrence Berkeley National Laboratory (Berkeley Lab) addresses the world's most urgent scientific challenges by advancing sustainable energy, protecting human health, creating new materials, and revealing the origin and fate of the universe. Founded in 1931, Berkeley Lab's scientific expertise has been recognized with 13 Nobel prizes. The University of California manages

Berkeley Lab for the U.S. Department of Energy's Office of Science.

Table 24
Marshall University JCE School of Medicine
1600 Medical Center Drive
Suite 2403P
Huntington, WV 25701

Contact(s): Shelvy Campbell, campbels@marshall.edu

Marshall University's Joan C. Edwards School of Medicine is a state-supported, community-based medical school established in 1977. Our faculty and administration are committed to providing high quality medical education and graduate training to meet the changing health care needs of our nation's citizens. We specialize in rural health issues as expressed in special efforts to recruit students from rural West Virginia and place graduates in clinical practice in rural areas. We believe that a diverse population offers a rich environment that leads to greater knowledge, understanding, acceptance and mutual respect and we promote an inclusive environment by attracting, recruiting and retaining individuals who represent varying backgrounds and perspectives.

Table 58
Medical University of South Carolina
College of Graduate Studies
68 President Street, BioE Room 101
MSC 501
Charleston, SC 29425

Contact(s): Ed Krug, krugel@musc.edu

As a free-standing academic health center, the Medical University of South Carolina (MUSC) has a special mission to translate advances in fundamental science to improvements in health care. The College of Graduate Studies at MUSC offers MS, PhD, MD/PhD, DMD/PhD, and PharmD/PhD programs in the biomedical sciences. Located in scenic Charleston, South Carolina, we offer competitive stipends, paid health insurance and paid tuition for PhD students. We also have a robust Summer Undergraduate Research Program that provides funding for undergraduates to obtain research experience for 10 weeks in the summer.

PhD students participate in an interdisciplinary first year curriculum composed of comprehensive didactic units, self-selected laboratory rotations, and seminars to teach skills important for successful scientific careers. Please visit our web site at: http://academicdepartments.musc.edu/grad for more information.

Table 51
Michigan State University
Graduate School
Chittenden Hall
466 W. Circle Drive, Room 130
East Lansing, MI 48824

Contact(s): Steven Thomas, deshawn@msu.edu
Kyana Young, kryoung@msu.edu
Kamahra Ewing, ewingkam@msu.edu
Cameron Herman, hermanc5@msu.edu
Phillip Brooks, brooksph@msu.edu
Rodney Singleton, single44@msu.edu
Noraica Davila, davilame@msu.edu
Yolanda Brooks, brooksyo@msu.edu
Abdifatah Ali, aliabdi1@msu.edu
Percy Pierre, pierre@msu.edu
Fredy Rodriguez, rodri395@msu.edu

Michigan State University is accepting applications for graduate school and summer internships from students interested in the Science, Mathematics and Engineering fields as well as the Social Behavioral Sciences (Sociology, Psychology, Criminal Justice, Communication, Economics, Anthropology, etc.). Post-doctoral and Post-baccalaureate opportunities are also available in various departments.

Table 25
Morehouse School of Medicine
720 Westview Drive, SW
Hugh Gloster Building, Room 209
Atlanta, GA 30310

Contact(s): Jamillah McDaniel, jmcdaniel@msm.edu
Kirlin Ward, kward@msm.edu
Jeronay King, jking@msm.edu

The Graduate Education in Biomedical Sciences (GEBS) Program at Morehouse School of Medicine offers programs leading to the PhD in Biomedical Sciences, MS degrees in Biomedical Research, Biomedical Technology, Clinical Research and Medical Science. Morehouse School of Medicine is a Historically Black College and University located in Atlanta, GA.

The program develops leaders in research who will advance scientific knowledge, enhance health care and strive to eliminate racial, cultural, and socioeconomic disparities in health and disease. Some of the research strengths of the institution include Cancer, Cardiovascular Disease, Circadian and Sleep Biology, HIV/AIDS and Neuroscience.

Exhibitor Descriptions

Table 14
Northwestern University McCormick School of Engineering and Applied Science
2145 Sheridan Road
L-261
Evanston, IL 60208

Contact(s): Bruce Lindvall, b-lindvall@northwestern.edu

The master's and PhD programs at Northwestern University's McCormick School of Engineering attract graduates from some of the most competitive institutions around the world. We offer PhD programs in 12 disciplines, as well as 20 different full- and part-time master's degree programs, each tailored for students at different phases of their career. Our community of nearly 1,400 graduate students provides an ideal environment for interdisciplinary collaboration: McCormick students work with world-class researchers both inside and outside Northwestern, from the Feinberg School of Medicine to Argonne National Laboratory. McCormick is committed to mentoring students for both academia and industry, with many programs offering internship opportunities.

Table 52
Ohio State University Graduate School
230 North Oval Mall
247 University Hall
Columbus, OH 43210

Contact(s): Cyndi Freeman, halsell.5@osu.edu

Ohio State is one of the world's best comprehensive, public research universities, which means that whatever you want to do, you can likely do it here. Ohio State offers over 90 doctoral programs and approximately 115 master's degrees. You can augment those programs with numerous interdisciplinary specializations and graduate minors. You also have a unique opportunity to participate in research and other programming being undertaken in Ohio State's numerous interdisciplinary research centers and institutes.

Ohio State ranks among the top 10 public research universities in the country, according to the National Science Foundation's assessment of sponsored research expenditures. Ohio State is ranked 19th among the nation's public universities and has been among the top 25 public research universities in each U.S. News and World Report ranking. More than 10,000 graduate students enroll at Ohio State each year from a wide variety of ethnic, racial, and cultural backgrounds, including approximately 2,500 students from more than 100 countries around the world.

Table 17
Penn State College of Medicine
Biomedical Sciences Graduate Program
500 University Drive, H133
Hershey, PA 17033

Contact(s): Kristin Smith, kec17@psu.edu

The Biomedical Sciences Graduate Program with Options in Biochemistry and Molecular Genetics, Translational Therapeutics, and Virology and Immunology provides students curricular training with a unique focus on human health and disease and the opportunity to concentrate in one or more disciplinary approaches including biochemistry, biophysics, cell biology, genetics, immunology, pharmacology, physiology, structural biology, and virology. Students receive rigorous training that provides the skills necessary to be leaders in biomedical research and other endeavors, including education, law, journalism, and public policy. The Program is an interdepartmental program that engages faculty from twenty basic and clinical science departments. This broad-reaching Program provides students a wide ranging understanding of multiple disciplines with specific expertise in a chosen area, and encourages interdisciplinary research that is the hallmark of biomedical sciences in the 21st century.

Table 2
Penn State University
204 Deike Building
University Park, PA 16802

Contact(s): Ronald Redwing, rdr101@psu.edu
James Guyton, jrg6@psu.edu
Wayne Gersie, wmg109@psu.edu

Please visit table #2 for more information.

Table 7
Pennsylvania State University
Office of Graduate Educational Equity Programs
111D Kern Graduate Building
University Park, PA 16801

Contact(s): Stephanie Danette Preston, sdp163@psu.edu
Joyce Hopson-King, JUH4@psu.edu

Penn State's Graduate School is one of the largest in the nation with more than 10,000 graduate students enrolled at the University Park campus, Penn State Erie, The Behrend College, Penn State Great Valley, Penn State Harrisburg, and the Penn State College of Medicine. Certain professional degree programs (M.Eng., M.Agr., M.Ed., etc.) are also offered at other locations and through the Penn State World Campus.

We take pride in being one of the largest graduate schools in the nation and in our exemplary faculty and high-quality degree programs, many of which are nationally ranked.

The Graduate School is committed to ensuring that all individuals regardless of ethnicity, gender, or other personal characteristics are afforded the opportunity to achieve their full potential as scholars and professionals. Our international enrollment has increased to an all-time high with more than 2,600 students from China, India, South Korea, Taiwan, Canada, Mexico, Brazil and a host of other countries. Furthermore, we are particularly proud of our efforts directed toward increasing the enrollment of underrepresented graduate students.

Table 11
Princeton University
Department of Chemistry
Frick Laboratory
Princeton, NJ 08544

Contact(s): Susan VanderKam, skillian@princeton.edu

The Department of Chemistry at Princeton University provides facilities for students intending to work toward the degree of Doctor of Philosophy (PhD). The Department of Chemistry is a vital, expanding hub of scientific inquiry with deep historic roots and a ready grasp on the future. In the world-class Frick Chemistry Laboratory, faculty and students work at the frontiers of science where the lines between chemistry and other disciplines merge. They conduct collaborative, interdisciplinary research with wide ranging applications from pharmaceutical drug design to materials for use in the alternative energy industry. Researchers also are immersed in the classic pursuit of chemistry -- to examine the composition of substances and investigate their properties and reactions. Our department includes research groups in Chemical Biology, Catalysis and Organic Synthesis, Inorganic Chemistry, Materials, Physical Chemistry, and Theoretical Chemistry. In addition to pure chemical research, many of the groups in our department have close collaborations with other sciences including Molecular Biology and Geology as well as Chemical, Electrical, and Mechanical Engineering. Cross-campus collaborations are encouraged through dedicated centers including The Andlinger Center for Energy and the Environment and the Princeton Institute for the Science and Technology of Materials. For more information please visit our website: http://chemistry.princeton.edu.

Table 50
Rensselaer Polytechnic Institute
Office of Graduate Admissions
110 8th Street
Troy, NY 12180

Contact(s): Jarron Decker, gradadmissions@rpi.edu
Michael Conward, gradadmissions@rpi.edu

Rensselaer Polytechnic Institute is the nation's oldest technological research university. Located in the Capital District of New York State, Rensselaer offers a broad range of graduate programs across six schools - Architecture, Engineering, Science, Lally School of Management, Humanities and Social Sciences, and Information Technology and Web Science. Unique programs include interdisciplinary degrees in information technology, the MFA and PhD in Electronic Arts, and extensive opportunities in biotechnology, nanotechnology, and energy and the environment.

Table 28
Sackler Institute of Graduate Biomedical Sciences, NYU School of Medicine
341 East 25th Street, 2nd floor
New York, NY 10010

Contact(s): Susanne Tranguch, susanne.tranguch@nyumc.org
Joel Oppenheim, joel.oppenheim@nyumc.org

The Sackler Institute at the NYU School of Medicine offers programs in the basic medical sciences leading to the PhD degree and, in coordination with The Medical Scientist Training Program, combined MD/PhD degrees. Students can do their thesis research in the laboratories of more than 180 faculty members at the NYU Langone Medical Center who have appointments in basic science or clinical departments, as well as associated faculty located at the main campus.

Table 35
St. John's University
Office of Graduate Admission
8000 Utopia Parkway
Queens, NY 11439

Contact(s): Andrew White, whitea@stjohns.edu

The graduate schools at St. John's University in New York City offer more than 60 graduate degree and professional certificate programs in five acclaimed colleges, a School of Law, and institute dedicated solely to the growing field of biotechnology. Earn your master's degree, doctoral degree, or professional certificate online, in New York, or in Rome.

Table 23
Stanford University School of Humanities and Sciences
Building One, Main Quad
450 Serra Mall
Stanford, CA 94305-2070

Contact(s): Joseph Brown, jlbrown@stanford.edu

Please visit table #23 for more information.

Table 43
Stony Brook University- Center for Inclusive Education Graduate School
2401 Computer Science Building
Stony Brook, NY 11794

Contact(s): Kathryne Piazzola, katryne.piazzola@stonybrook.edu
Angel Gonzalez, angel.i.gonzalez@stonybrook.edu
Kenneth Takeuchi, kenneth.takeuchi@stonybrook.edu
Amy Marschilok, amy.marschilok@stonybrook.edu

Stony Brook University's internationally recognized academic programs and collaborative relationships with Brookhaven National Laboratory and Cold Spring Harbor Laboratory make it an ideal choice for students interested in scientific research.

The Center for Inclusive Education, a division of the Graduate School, is home to multiple externally funded initiatives aimed at increasing the participation of underrepresented scholars in the academic, scientific, and technology workforce. These programs include: the NSF-sponsored AGEP-T FRAME Program, the NSF-sponsored LSAMP Bridge to the Doctorate Fellowship, the GEM Fellowship, the NIH-sponsored IMSD-MERGE Program, the NIH-sponsored IRACDA NY-CAPS Postdoctoral Fellowship, the NSF-sponsored Research Experiences for Undergraduates (REU) Program in Nanotechnology, and the New York state funded W. Burghardt Turner Fellowship. All these programs share the same goal of promoting and integrating the talents of underrepresented scholars at the highest degree levels through targeted and strategic outreach, advisement, support, and advocacy. With a combined budget of over two million per year, the CIE provides direct services for close to 200 students in 38 graduate and professional programs across all disciplines.

The Center's mission is to promote action and knowledge that broadens the participation of disadvantaged Americans in higher education, the scientific work force, and the Academy. For information please visit our booth.

Table 49
Tufts University, Sackler School of Graduate Biomedical Sciences
136 Harrison Avenue
Boston, MA 02111

Contact(s): Naomi Rosenberg, Naomi.Rosenberg@tufts.edu

The Sackler School of Graduate Biomedical Sciences at Tufts University is located in the heart of downtown Boston. The School offers six PhD Basic Biomedical Programs: Cell, Molecular, and Developmental Biology with tracks in Structural and Chemical Biology, Cancer Biology, Cellular and Molecular Medicine and Developmental and Regenerative Biology, Genetics, Immunology, Molecular Microbiology, Neuroscience, and Pharmacology and Experimental Therapeutics. The School also offers specialized tracks including the Medically-oriented Research in Graduate Education - Infectious Disease Track (MERGE-ID) and the Mammalian Genetics JAX Track in Immunology, Molecular Microbiology and Genetics PhD programs. In addition, the School offers a Medical Scientist Training Program (MD/PhD), a Master's of Science in Pharmacology and Drug Development as well as Post-Baccalaureate Research Internships, and summer internships for undergraduate students interested in pursuing research careers in the biomedical sciences are also available. Please visit our website for more information: http://sackler.tufts.edu.

Table 18
UC San Diego
Graduate Division
9500 Gilman Drive
La Jolla, CA 92093-0003

Contact(s): Elisa Maldonado, emmaldonado@ucsd.edu
Joshua Francois, jfrancoi@ucsd.edu

The Graduate Division is the central resource for all matters related to graduate education at UC San Diego. Our team is there at every step in a graduate student's career, helping students navigate their path from admission to graduation and beyond. Working behind-the-scenes and in collaboration with faculty, staff and students, the Graduate Division guides today's scholars on their upward trajectory to becoming tomorrow's leaders.

Table 33
University of Chicago
Biological Sciences Division
924 E. 57th Street
BSLC, Suite 104
Chicago, IL 60637

Contact(s): Nancy Schwartz, n-schwartz@uchicago.edu
Ingrid Reiser, ireiser@uchicago.edu
Chinonye Nnakwe, ccnnakwe@uchicago.edu

The University of Chicago is a multicultural, international community of more than 15,000 students and 20,000 faculty and staff, each supporting the university's mission of inquiry and academic excellence. Diversity is central to our mission of discovery as it drives ideas, builds careers, and enriches communities. Having the greatest number of representatives from the most diverse pool of thinkers poses the most likely opportunity to address a problem from all its perspectives. The Biological Sciences Division is committed to attracting, mentoring, and promoting a diverse community of scholars in an environment conducive to excellence for students from all backgrounds.

Table 30
University of Idaho
College of Graduate Studies
875 Perimeter Drive MS 3017
Moscow, ID 83844

Contact(s): Sean Scoggin, sscoggin@uidaho.edu

The College of Graduate Studies was formally organized in 1925 (then designated as the Graduate School), but the university has awarded advanced degrees since 1898. The Graduate College encompasses all graduate programs of the university.

As the graduate degree-granting college for the University of Idaho, the College of Graduate Studies combines nationally competitive academic and research opportunities - the kind you would expect at a large metro institution - with the small town, hands-on approach that will jump start your research and your career.

Located just minutes from the forests, rivers and lakes of northern Idaho, you can easily enjoy the area's outstanding recreational activities through the university's award winning Outdoor Program.

Table 48
University of Illinois at Urbana-Champaign
Graduate College
204 Coble Hall
801 S. Wright Street
Champaign, IL, 61820

Contact(s): Ave Maria Alvarado, amalvara@illinois.edu
Jesse Thompson, jthomps5@illinois.edu

The University of Illinois at Urbana-Champaign (Illinois) offers numerous opportunities to students from U.S. populations historically underrepresented in graduate study at Illinois. Academic opportunities, application fee waivers, and funding packages are extended to prospective and current graduate students intended to support their pursuit of an advanced degree. Illinois offers graduate degrees in over 130 graduate programs, including those in the social sciences, arts and humanities, biological sciences, natural sciences, physical sciences, behavioral sciences, and engineering. Numerous interdisciplinary and several joint degree programs, such as the MBA/PhD, MD/PhD, and JD/PhD are granted. Assistantships, traineeships, and fellowships, supplemented with a tuition waiver and stipend are offered to students in all disciplines. The Summer Research Opportunities Program (SROP) and the Summer Pre-Doctoral Institute (SPI) provide participants with an opportunity to conduct research and receive monetary awards and many other benefits. Please visit our website at: http://www.grad.illinois.edu/ and http://www.grad.illinois.edu/diversity for more information.

Table 37
University of Iowa Graduate College
410 Gilmore Hall
Iowa City, IA 52242

Contact(s): Joseph Henry, joseph-henry@uiowa.edu

With just over 30,000 students, the University of Iowa is one of the nation's top public research universities, a member of the Big Ten conference since 1899, and an Association of American Universities member since 1909.

Iowa is known around the world for its balanced commitment to the arts, sciences, and humanities. It's home to one of the nation's largest academic medical centers, the pioneering Iowa Writers' Workshop, and hundreds of options for affordable, accessible education. The University of Iowa is located in the casual yet cosmopolitan environment of Iowa City, widely recognized as one of the country's most livable communities.

Table 40
University of Massachusetts
MassNanoTech Institute
710 N. Pleasant St.
Room 370 LGRT
Amherst, MA 01003-9305

Contact(s): Michael Westort, mwestort@research.umass.edu

The MassNanoTech Institute is the University of Massachusetts Amherst's campus-wide initiative for nanoscale science and engineering. The campus has built a strong reputation for innovation in nanoscale research, with breadth across many departments, including Chemical Engineering, Electrical and Computer Engineering, Mechanical and Industrial Engineering, Polymer Science and Engineering, Physics, and Chemistry. We offer a ten-week Research Experience for Undergraduates (REU) every summer with free travel, housing and competitive stipend. We also offer numerous graduate-level scholarships, funding options, and fee waivers. Stop by our exhibit for more details.

Table 10
University of Michigan
500 S. State Street
Ann Arbor, MI 48109

Contact(s): Bob Megginson, meggin@umich.edu

The University of Michigan offers 100 graduate programs ranked in the Top 10. Over 1,000 faculty in the College of Literature, Science, and the Arts--experts in anthropology through zoology--teach courses that explore the world's cultural, social, and scientific big questions. Our faculty members produce some of the most notable research in their respective fields. Admitted gradu-

ate students are offered funding packages that cover at least 5 years of study, including tuition, stipend, and health insurance for students and their dependents. In addition, our facilities include one of the most extensive library systems in the world, seven museums, and research labs for the natural and physical sciences. A vibrant literary and performing arts tradition in the College enriches the minds and hearts of the campus community. All that a college experience should be--the intellectual challenges, the exposure to the new, the growth of knowledge and of individuals--can be found here, in the College of Literature, Science, and the Arts at the University of Michigan.
At ERN, we are recruiting students for natural and physical science graduate programs including Applied Physics, Astronomy, Ecology and Evolutionary Biology, Biophysics, Chemistry, Earth and Environmental Science, Math, Molecular, Cellular, and Developmental Biology, Physics, and Statistics. Talk to us about additional program at UM as well.

Table 56
University of Michigan - College of Pharmacy (PharmD & PhD Programs)
428 Church Street
Ann Arbor, MI 48109-1055

Contact(s): Cherie Dotson, crdotson@umich.edu

The University of Michigan - College of Pharmacy offers graduate (PhD) degrees in Medicinal Chemistry and Pharmaceutical Sciences. Graduate students in Medicinal Chemistry are trained in research pertaining to drug discovery and drug design while those in Pharmaceutical Sciences are focused on the study of drug transport and drug delivery systems.

Students with interests in obtaining clinical training with regard to the practice of pharmacy are encouraged to consider the Pharm.D. program. The University of Michigan - Pharm.D. program provides students with opportunities for patient contact and clinical experience throughout the four years of study. The educational training and exposure provided through the program prepares students for a broad range of career opportunities upon graduation.

Summer undergraduate research opportunities are available through the Interdisciplinary REU Program: https://pharmacy.umich.edu/reu.

For further information, regarding these programs please visit: https://pharmacy.umich.edu/.

Table 13
University of Michigan Program in Biomedical Sciences
1500 E. Medical Center Dr. SPC 5619
F6555 UH South
Ann Arbor, MI 48109

Contact(s): Lisa Garber, lfletch@umich.edu

The University of Michigan Program in Biomedical Sciences (PIBS) invites you to explore your passion for science through our interdisciplinary gateway program, which coordinates admissions and first-year graduate studies for 14 doctoral programs with 500+ faculty laboratories. PIBS offers you the flexibility and convenience of applying to any of our programs through one application. Learn more at medicine.umich.edu/phd.

Table 42
University of Missouri Graduate Life Sciences Programs
150c Bond Life Sciences Center
1201 Rollins Street
Columbia, MO 65211

Contact(s): Debbie Allen, allendebra@missouri.edu
Elizabeth Bryda, allendebra@missouri.edu

Experience the Joy of Discovery and Innovation - Graduate Study in the Life Sciences at the University of Missouri

The joy of discovery has propelled the University of Missouri to one of the top-ranked Life Sciences research institutions in the 21st Century, offering doctoral degrees in over 25 life sciences departments and programs.

Our PhD programs emphasize interdisciplinary collaboration and innovation. University of Missouri faculty from diverse disciplines come together to develop cures for human diseases, to improve our nation's food supply, to develop new sources of biofuels and to preserve and protect our environment.

The campus is also home to the nation's largest university research reactor. The Colleges of Agriculture, Food and Natural Resources, Arts and Science, Engineering, Veterinary Medicine, and Schools of Medicine, Nursing, and Health Professions compliment MU's research diversity.

Our PhD students use cutting-edge technologies to solve problems. Our research core facilities include state-of-the-art DNA sequencing, proteomics, nanotechnology, microscopy and whole-animal imaging technologies.

We are committed to the success of our graduate students, with strong mentorship programs and career-directed resources. We offer a comprehensive support package including stipend, paid tuition, health insurance and travel funding. Columbia, Missouri

is a vibrant, diverse and affordable city with impressive amenities. Consistently ranked as one of the nation's most livable cities, Columbia is conveniently located in the center of the I-70 corridor in Missouri- just two hours from St. Louis or Kansas City.

To learn more please visit http://www.missouri.edu/research/ or send an email to gradlifesci@missouri.edu.

Table 46
University of Notre Dame Graduate School
502 Main Building
Notre Dame, IN 46556

Contact(s): Nyree McDonald, nmcdonal@nd.edu

The University of Notre Dame is renowned worldwide for academic excellence, and gifted students from around the globe join us to be part of our vibrant intellectual community. As a graduate student at Notre Dame, you will benefit from generous financial support that allows you to focus on your degree objectives and from exposure to and participation in innovative, collaborative, and interdisciplinary pursuits. We believe that our voice is best heard through the success of those we train at the highest level to become the academic and professional leaders of tomorrow. To that end, we work in concert with a world-class faculty across a variety of disciplines to mentor and develop our students by engaging them in meaningful research and other professional activities.

All of these pursuits take place in a setting that is small enough to provide you with individual attention and large enough to provide you with all the tools necessary for your transformation from a student of a chosen discipline to a steward of that discipline. Notre Dame is committed to fully funding all doctoral-degree seeking students and many masters-degree seeking students. If you would like more information, please feel free to contact the director of graduate studies in your prospective department of interest.

If you would like to browse our Web site or apply on-line, visit us at *http://graduateschool.nd.edu*. Visit our Facebook page: *http://www.facebook.com/notredamegraduateschool*.

Table 15
University of Pennsylvania/Perelman School of Medicine
3620 Hamilton Walk
Philadelphia, PA 19104

Contact(s): Arnaldo Diaz Vazquez, diaza@mail.med.upenn.edu

The University of Pennsylvania School of Medicine is the nation's first, with the Hospital of the University of Pennsylvania being the nation's first built medical school.

Biomedical Graduate Studies was established in 1985 and serves as the academic home students pursuing a PhD in the basic biomedical sciences. BGS is composed of more than 600 faculty members and provides training through seven graduate groups - Biochemistry and Molecular Biophysics, Cell and Molecular Biology, Epidemiology and Biostatistics, Genomics and Computational Biology, Immunology, Neuroscience, and Pharmacology.

In addition to our graduate programs, BGS is pleased to offer research training for individuals at the undergraduate and post-baccalaureate levels.

Table 41
University of South Florida
College of Engineering
4202 E. Fowler Avenue, ENB 118
Tampa, FL 33620

Contact(s): Bernard Batson, bbatson@usf.edu

The University of South Florida (USF) is a high-impact, global research university dedicated to student success. USF is classified by the Carnegie Foundation for the Advancement of Teaching in the top tier of research universities. Signature STEM research areas include: Aging and Brain Repair, Neurodegenerative Diseases, Bioengineering, Neuroengineering, Cancer Biology, Computer Vision and Pattern Recognition, Microwave/RF Communications, Cybersecurity, Nanocomputing, Robotics, Drug Discovery, Environmental Biotechnology, Water Resources and Sustainability, Renewal Energy Systems, Global Health, Marine Science, Geosciences, Nanotechnology and Advanced Materials, and Rehabilitative Engineering.

Graduate funding for eligible STEM students is available through assistantships and the McKnight Doctoral, NSF Florida-Georgia Louis Stokes Alliance for Minority Participation (FGLSAMP) Bridge to the Doctorate Activity, USF Presidential, and USF Graduate Student Success fellowship programs. Recently, USF became one of only five schools awarded a Alfred P. Sloan University Center of Exemplary Mentoring to provide graduate scholarships for underrepresented doctoral students. Our students and alumni have won competitive pre-doctoral, dissertation, and postdoctoral awards (NSF, Ford, UNCF Merck, Whitaker, Fulbright, and National Research Council).

Summer undergraduate research opportunities are available in Computer Science, Chemistry, Applied Physics (Biophysics and Biomedical Physics, Atomic Molecular and Optical Physics, and Solid State and Materials Physics) and Interdisciplinary Environmental Science.

Table 54
University of Tennessee, Knoxville- Program for Excellence and Equity in Research
1414 Cumberland Avenue
F317 Walters Life Science Building
Knoxville, TN 37996

Contact(s): Sekeenia Haynes, shaynes6@utk.edu

The Program for Excellence and Equity in Research (PEER) at the University of Tennessee, Knoxville is a training opportunity funded by a grant from NIH designed to enhance the graduate experience of first and second year doctoral students who are underrepresented in eligible graduate programs at UT and increase their competitiveness after graduation. PEER provides professional and skills development that goes beyond traditional classroom and research skills. PEER's holistic approach to graduate training ensures that scholars develop skills and attributes that will be needed for successful careers, well beyond the PhD degree. We offer a comprehensive financial package including a salary, paid tuition and health insurance and travel funding. PEER is currently accepting applications. Application deadline is March 15, 2015.

Applications will be reviewed on a rolling basis for positions in the following departments:

- Biochemistry, Cellular and Molecular Biology
- Genome Science and Technology
- Chemistry
- Mathematics
- Microbiology
- Ecology and Evolutionary Biology
- Psychology/Neuroscience
- Engineering
- Public Health
- Cellular and Molecular Nutrition
- Animal Science
- Chemical and Biomolecular Engineering
- Mechanical, Aerospace and Biomedical Engineering
- Plant, Soils and Insects
- Biophysics

For more information please visit our website: peer.utk.edu.

Table 20
University of Texas Graduate School of Biomedical Sciences at Houston
6767 Bertner Avenue
Mitchell Building, BSRB, Suite S3.8344
Houston, TX 77030

Contact(s): Marenda Wilson-Pham,
marenda.a.wilson@uth.tmc.edu
Andrew Bean, a.bean@uth.tmc.edu

Please visit table #20 for more information.

Table 21
University of the Virgin Islands
Master of Marine and Environmental Science
2 John Brewers Bay
St Thomas, VI 00802

Contact(s): Marilyn Brandt, mbrandt@uvi.edu

The Master of Marine and Environmental Science (MMES) degree provides students with the training and skills necessary for planning, conducting, and evaluating research in marine and environmental science. Additionally, students explore how to utilize research to manage natural resources, with a particular focus on the issues and challenges related to natural resource management in the Caribbean region. The program draws upon the expertise of faculty within several units of UVI, in particular the Center for Marine and Environmental Studies and the College of Science and Mathematics. Further, it is a bridge between academia and natural resource management sectors within the US Virgin Islands, the greater Caribbean, and beyond. The program structure allows students to become conversant in the language of both research and resource management, and then to focus on their area of particular interest. Graduates of the program are prepared for a wide array of careers in academic, government, non-profit, and private sectors. Scholarships as well as Research and Teaching Assistantships are available.

Table 27
University of Washington
Molecular and Cellular Biology Program
1959 NE Pacific
Box 357275
Seattle, WA 98195-7275

Contact(s): MaryEllin Robinson, maryell@uw.edu

Recognizing the need for highly trained scientists conversant across disciplines, the University of Washington and the Fred Hutchinson Cancer Research Center created an interdisciplinary research program, the Molecular and Cellular Biology Graduate Program (MCB). For more than 20 years, MCB has combined the strengths of the FHCRC and UW to foster an innovative and flexible graduate training program. Joined by the Institute for Systems Biology and Seattle Biomed, MCB offers a broad range of opportunities for research in all areas of biomedical science.

Table 9
University of Wisconsin-Madison
College of Engineering
2209 Mechanical Engineering
1513 University Avenue
Madison, WI 53706

Contact(s): Kelly Burton, kburton@engr.wisc.edu
Douglass Henderson, henderson@engr.wisc.edu

The Graduate Engineering Research Scholars (GERS) program was created in 1999 to increase the number of underrepresented minority (URM) students receiving graduate degrees (specifically PhDs) in engineering and enter the professoriate. While completing their degrees, the students in GERS create a community of scholars who meet twice a month for personal and professional development opportunities. Since its inception, the program has graduated 56 PhDs and 61 MS. Already, 14 of the 56 graduates are in faculty positions and an additional 5 are in post-doctoral positions. Of the 56 PhDs awarded 33 (57%) were to women.

Table 31
UT Southwestern Medical Center Graduate School in Biomedical Sciences and MD/PhD Programs
5323 Harry Hines Blvd
Dallas, TX 75390-9004

Contact(s): Nancy Street, nancy.street@utsouthwestern.edu

UT Southwestern provides world class opportunities to prepare for careers in the biomedical sciences through study and research leading to the PhD degree through the Division of Basic Science and the MD/PhD degree through the Medical Scientist Training Program. Over 290 faculty offer training in genomics, cancer biology, computational biology, developmental biology, biomedical engineering, molecular genetics, structural biology, cell biology, chemical biology, systems biology, pharmacology, microbiology, neurosciences and immunology. Our NIH-sponsored MSTP contains a highly integrated curriculum, premiere teaching hospitals and renowned clinical faculty. The essence of education at UT Southwestern is an exciting research experience in an active, productive and critical scientific environment.

We also have two undergraduate research programs focused on providing world-class research experiences during the summer. Information about these programs is available at www.utsouthwestern.edu/SURF and www.utsouthwestern.edu/qp-surf.

Table 26
Vanderbilt University
6301 Stevenson Center Ln
Nashville, TN 37235

Contact(s): Dina Stroud, dina.m.stroud@vanderbilt.edu

More than 19,000 students have earned graduate degrees from Vanderbilt in nearly 70 fields and specialties. Vanderbilt's PhD alumni can be found pursuing careers in every direction imaginable, including in the commercial sector, in government service and on the faculties of both small colleges and major research universities. In addition to the PhD track, we have the Fisk-Vanderbilt Master's to PhD Bridge Program, which allows students to do high level research in a caring environment while preparing them to be fully ready for transition to PhD work.

Table 3
Washington University in St. Louis
4444 Forest Park Avenue
Saint Louis, MO 63108

Contact(s): Cherilynn Shadding, cshaddin@genome.wustl.edu

Washington University in St. Louis is a world-renowned research university, which fosters a commitment to research, teaching, scholarship and service. To fulfill this commitment we strive to create an inclusive and diverse community of scholars with various programs. The Initiative to Maximize Student Development (IMSD) is once such program, designed to enhance the experience of students from underrepresented backgrounds matriculating in the Biology and Biomedical PhD programs at Washington University in St. Louis. IMSD is a part of the Division of Biology and Biomedical Sciences (DBBS), which is home to 12 stellar PhD programs. IMSD provides funding for the first two years for students accepted into DBBS and provides professional development, travel funds and academic enhancement and social activities throughout the students' matriculation. Washington University in St. Louis provides a collaborative and interdisciplinary research environment with top ranked and award winning faculty. We also offer summer research opportunities as well as a postbaccalaureate program for students interested in pursuing the PhD.

Table 57
Washington University in St. Louis
Biology and Biomedical Sciences
660 S. Euclid
Box 8226
St. Louis, MO 63110

Contact(s): Jennifer Brown, lawlerj@wustl.edu

Organized in 1973, the Division of Biology and Biomedical Sciences is a graduate educational consortium which includes faculty affiliated with twenty clinical and basic science departments in the School of Medicine and in the College of Arts and Science, all at Washington University in St. Louis. Division programs provide a broad interdisciplinary approach to graduate education. Students may choose from more than 450 faculty members for laboratory rotation and dissertation research mentors. The Division offers training in 12 programs that lead to the PhD, combined MD /PhD, and a Summer Undergraduate Research Program. More information may be found at http://dbbs.wustl.edu

Exhibitor Descriptions

Table 63
Wayne State University
294 Irvin
Plymouth, MI 48170

Contact(s): Claire Ofiara, Claire.Ofiara@wayne.edu

Are you ready to move forward in your education and excel in your career? At Wayne State, you will experience all the advantages of learning at a premier urban research university in the heart of Detroit - one of the country's greatest hubs for innovation, opportunity and entrepreneurship. You will work alongside experts in your field, conducting groundbreaking research with a global reach. And on our Midtown campus, you are just steps away from industry leaders in technology, health care, engineering and more. We are driving the future of a great American city, and we want you to join us. Come be part of a university that is reshaping our social and economic culture.

Apply to one of our prestigious master's, doctorate or certificate programs today, and discover how a Wayne State graduate degree can help you succeed.

Learn more at virtualtour.wayne.edu and gradschool.wayne.edu.

Table 44
Worcester Polytechnic Institute
100 Institute Road
Worcester, MA 01609

Contact(s): Michael McGrade, grad@wpi.edu

A leader in science, engineering, and business, Worcester Polytechnic Institute anticipated some of the latest trends in higher education by nearly two generations.

WPI's founding principle of balancing theory with practice underlies a project-based, experiential curriculum that prepares students to solve important problems through interdisciplinary study and applied research.

The Institute's long-standing partnerships with biotechnology, IT, and manufacturing concerns have enabled it to answer recent national initiatives that call for new professional graduate programs in science and engineering.

Through their collaborative work and creative approaches to problem-solving, faculty and students at WPI will continue to make breakthroughs that improve the quality of our lives.

Table 61
XSEDE (Extreme Science and Engineering Discovery Environment)
1201 New York Avenue, NW
Washington, DC 20005

Contact(s): Linda Akli, akli@sura.org
Mark Jack, mark.a.jack@gmail.com

The Extreme Science and Engineering Discovery Environment (XSEDE) is the most advanced, powerful, and robust collection of integrated advanced digital resources and services in the world. It is a single virtual system that scientists can use to interactively share computing resources, data, and expertise. Our missions is to enhance the productivity of researchers, engineers, and scholars through access to advanced digital services supporting open research; and to coordinate and support leading cyberinfrastructure resources funded by the NSF XSEDE offers:

- Extended Collaborative Support that includes teaming with individual research groups or with research communities to extend their capabilities.
- An advanced hardware and software architecture rooted in user requirements and hardened by systems engineering that allows for individualized user experiences, consistent and enduring software interfaces, improved data management, and ways for campus resources to be transparently integrated into the overall XSEDE infrastructure.
- Specialized community-provided services that serve a particular function and allow for rapid innovation and experimentation.
- Training, Education, and Outreach that expand participation in XSEDE-based projects, curriculum development, and more traditional training opportunities.
- Advanced support for novel and innovative projects.

Abstracts

Graduate Student Abstracts for Oral Presentation A2
Biological Sciences A2
Chemistry and Chemical Sciences A11
Computer Sciences and Information Management A22
Ecology, Environmental, and Earth Sciences A26
Mathematics and Statistics A35
Nanoscience A36
Physics A41
Science and Mathematics Education A43
Social, Behavioral, and Economic Sciences A45
Technology and Engineering A47-A58

Undergraduate Student Abstracts for Oral Presentation A58
Biological Sciences A58
Chemistry and Chemical Sciences A77
Computer Sciences and Information Management A80
Ecology, Environmental, and Earth Sciences A85
Mathematics and Statistics A94
Nanoscience A100
Physics A102
Science and Mathematics Education A107
Social, Behavioral, and Economic Sciences A108
Technology and Engineering A111-128

Undergraduate Student Abstracts for Poster Presentation A128
Biological Sciences A128
Chemistry and Chemical Sciences A204
Computer Sciences and Information Management A230
Ecology, Environmental, and Earth Sciences A244
Mathematics and Statistics A274
Nanoscience A281
Physics A289
Science and Mathematics Education A296
Social, Behavioral, and Economic Sciences A298
Technology and Engineering A304-A340

Abstract Index by Last Name A343-A356

Graduate Student Abstracts for Oral Presentation

Biological Sciences

Grad. 1

Subcategory: Cancer Research

Altering Cell Proliferation and Migration Pathways in Human Brain Tumor Cells Using Rosehip Extracts

Jennifer N. Ausland, North Carolina Agricultural & Technical State University
Co-Authors: Patrice Cagle and Patrick M. Martin, North Carolina Agricultural & Technical State University Greensboro, NC

Glioblastoma multiform (GBM) is one of the deadliest types of human brain tumors. GBM is highly malignant and classified by the World Health Organization as a grade IV astrocytoma. Rosehip extracts are derived from the wild rose Rosa canina and have previously shown to reduce proliferation of cancer cells. This study investigates the efficacy of rosehip extracts to inhibit proliferation of human glioblastoma cell lines A-172, U-251 MG, and U-1242 MG. Each glioblastoma cell line was treated with 1 mg/mL - 25 ng/mL of rosehip extract followed by colorimetric cell death assays, cell cycle analysis by flow cytometery, and western blots. Results demonstrate that rosehip extracts significantly reduced cell proliferation without promoting apoptosis. Decreased AKT, MAPK, and p70S6K phosphorylation following rosehip exposure suggests that rosehip extracts prevent GBM cell proliferation by blocking MAPK and AKT signaling mechanisms. Furthermore, rosehip extracts increase efficacy of Temozolomide, a chemotherapeutic drug used to treat patients with glioblastomas. Rosehip also increases the efficacy of Temozlomide in preventing brain tumor cell migration.

This study shows the capacity of rosehip extracts to prevent cell proliferation and migration in human brain tumor cells. More importantly, this study also demonstrates that rosehip extracts aid in making Temozolomide more effective as an anti-tumorigenic compound.

Funder Acknowledgement(s): I thank Dr. Martin for guidance on this project. Funding was provided by NIH-NCI 1P20CA138020-01 and NIH-NIGMS 5P20MD000546-07.

Faculty Advisor: Patrick M. Martin, pmmartin@ncat.edu

Grad. 2

Subcategory: Cancer Research

Rhodiola Crenulata Inhibits Cononical WNT Signaling in MDA-MB-231 Triple Negative Breast Cancer Cell Lines

Lotfi Bassa, University of Massachusetts Amherst
Co-Authors: Elizabeth G. Amaro, Holy Cross College, Worcester, MA
Sallie S. Schneider, Pioneer Valley Life Science Institute, Baystate Health, Springfield, MA

Breast cancer is the second leading cause of cancer death in women, second to lung cancer.[1] Triple Negative Breast Cancer (TNBC) tumors are the most aggressive form of breast cancer and lack expression Her2/Neu receptor, estrogen and progesterone receptors, making it difficult to target using conventional SERMS or Her2/Neu inhibitors. The Wnt signaling pathway is essential in normal cell development and has been implicated in breast cancer where it plays a role in cell invasion and cancer stem cell maintenance. Rhodiola crenulata (RC) is a Tibetan mountainous plant, commonly used in eastern alternative medicine, and is classified as an adaptogen. Previously we have shown that RC inhibits migration and invasion behaviors and increases sensitivity to cell death in TNBC cell lines[2] . In this study, we sought to identify the mechanism by which RC could impart these effects. We demonstrate that RC inhibits the canonical WNT signaling pathway in MDA-MB-231 cells. We demonstrate this activity by showing reduced β-catenin reporter and WNT target gene expression in the presence and absence of RC. We demonstrate that the inhibition is intracellular by showing that RC inhibits β-catenin activity even when induced ligand independently though inhibition of GSK3β (LiCl). We narrow it down further by showing that the inhibition prevents βcatenin nuclear localization ruling out interference in the nucleus. These data suggest that RC inhibition of Wnt/ β-catenin pathway occurs between the β-catenin degradation complex and entrance to the nucleus. Our results convincingly show that RC inhibits a critical pathway (WNT/ β-catenin signaling) in a triple negative breast cancer cell line and suggests a likely mechanism by which RC inhibits invasion and results in an increased sensitivity to death.

References: [1]"Breast cancer detailed guide" (2013) Retrieved August 30, 2013 from http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-key-statistics.
[2]Kelly J.Gauger et al. (2010) "Rhodiola crenulata inhibits the tumorigenic properties of invasive mammary epithelial cells with stem cell characteristics" Journal of Medicinal Plants Research Vol. 4(6), pp. 446-454.

Funder Acknowledgement(s): Rays of Hope, Springfield, MA

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Grad. 3

Subcategory: Cancer Research

Modeling the Heterogeneous Breast Tissue Microenvironment in a 3D MCF10A Breast Cell Culture System

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Breast cancer development and progression rely on complex interactions between breast epithelial cells and the microenvironment composition and density. Those interactions may be suitably investigated in 3D in vitro culture systems. However, current 3D breast tissue systems do not account for the heterogeneous density and composition of the extracellular matrix (ECM) observed within breast tissue. Here we hypothesized that embedding polylactide beads into our 3D matrix would more closely mimic the heterogeneous microenvironment of breast tissue, leading to the formation of 3D structures. Briefly, MCF10A breast epithelial cells were grown in 3D collagen / Matrigel® matrices embedded with polylactide beads for 14 days. Treatment groups included polylactide beads coated with saline (PBS: control), culture media and collagen I. The development of complex structures i.e., acinus- and duct-like structures was monitored over time. Results indicate that polylactide beads coated with either media (117±4 um) or Collagen I (124±2um) had significantly smaller diameters on average than control beads in PBS (133±3um). The MCF10A cells formed complex structures surrounding cluster of beads with cell strands migrating outward. The cell strands included both acinus- and duct-like structures. The length and the complexity of the cell strands formed in 3D matrix embedded with polylactide beads coated with either PBS, media or collagen I tended to differ. The data modulating the MCF10A 3D in vitro breast tissue system presented here are an essential step to the definition of reliable tools for the evaluation of early breast cancer progression and the testing of specific treatments. Whether in vitro 3D test system with defined heterogeneity may fully model the effects of heterogeneous density on normal human mammary gland development and cancer progression will be assessed in future studies.

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Grad. 4

Subcategory: Cancer Research

Plant Polyphenols Reduce Invasive Potential of Human Melanoma Cells

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Melanoma is the most serious type of malignant skin cancer due to its ability to metastasize, and appears highly resistant to many forms of cancer treatments. Plant polyphenols have a number of beneficial health effects, and are well noted for their anti-cancer properties. To develop more effective treatments for melanoma, we assessed the chemotherapeutic potential of various plant polyphenol derivatives on the migration ability of A375 human melanoma cells as an *in vitro* model. Treatment of A375 cells with polyphenols MLN-1249, MLN-1337, and MLN-2287 resulted in inhibition of cell migration. Employing cell viability assays, the compounds resulted in dose-dependent cytotoxicity at concentrations ranging from 0 to 100 µM. Using cell invasion assays, we found that the polyphenols inhibited activity on cell migration at concentrations of 1 µM over a 72 h time period. The inhibition of cell migration correlates to the expression of genes involved in the apoptosis, NFκB, and epithelial-to-mesenchymal transition pathways. Together, these results show that the polyphenols have the ability to inhibit cell migration, a crucial step of metastasis.

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Access to Research Comprehension and Careers (ARCC) program

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Grad. 5

Subcategory: Cancer Research

Biological Signaling Pathways and Potential Mathematical Network Representations: Biological Discovery Through Optimization

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Establishing the role of different genes in the development of cancer can be a daunting task starting with the detection of genes that are important in the illness from high throughput biological experiments. These experiments belong to the –omics denomination, as in genomics, proteomics, metabolomics and the like. Furthermore, it is safe to say that even with a list of

potentially important genes; it is highly unlikely that these show changes in expression in isolation. A biological signaling path is a more plausible underlying mechanism. This work attempts the analysis of a microarray experiment to build a mathematical network problem through methods such as the Traveling Salesman Problem and Minimum Spanning Tree. A pre-selection of genes is carried out with a multiple criteria optimization framework previously published by our research group. Preliminary results are presented in lung cancer. If validation succeeds, uncovering signaling pathways of potential biomarkers could possible further the understanding of the origins and evolution of cancer.

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National Science Foundation (NSF); under Grant HRD 0833112 (CREST)

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Grad. 6

Subcategory: Cancer Research

Targeted Approach to Overcome ABCG2-mediated Drug Resistance in Cancer

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ATP-binding cassette (ABC) transporters such as ABCB1/P-glycoprotein and ABCG2/BCRP that function as plasma membrane efflux pumps are important factors that limit oral bioavailability, facilitate hepatobiliary elimination, and restrict penetration of cancer chemotherapeutics into brain and fetus. For any new drug to be approved by FDA, just like cytochrome P450's, information about its interaction with ABCB1 and ABCG2 transporters must be disclosed to avoid side effects or drug-drug interactions. The multidrug resistance (MDR) phenotype caused by the overexpression of ABC transporters by tumor cells promotes the cellular efflux of a variety of anticancer drugs and may lead to cancer treatment failures (Tiwari et al., 2011). Based on our in silico screening and structure-activity relationship studies, we synthesized novel molecules to inhibit ABCG2 transporters. In our experiments, we found several of these molecules to be excellent reversal agents against ABCG2 transporters using cell-based MTT assays. These compounds potentiated the cytotoxicity of several ABCG2 substrates such as mitoxantrone and doxorubicin but not non-ABCB1/ABCG2 substrate cisplatin, and significantly reversed the MDR of cancer cells in a concentration-dependent manner. Additionally, these molecules have limited PXR stimulatory effects. Further in vivo studies are required to implement these molecules for in clinic application against difficult-to-treat tumors.

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Grad. 7

Subcategory: Cancer Research

Further Conversations for Native Cancer Patient Navigators in Indian Country: Conversations of Native Navigators and the Hybridity of Western Medicine and Native Traditional Medicine

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Further Conversations for Native Cancer Patient Navigators in Indian Country: Conversations of Native Navigators and Western Medicine have continued for two years. These new findings will be presented in relation to using a hybrid of Traditional Native Medicine and Western Medicine in addressing cancer care Hypothesis American Indians and Alaska Natives face poor survival rates due to medical illness that are contrary to the progress and improvements typical of modern medicine. Western medicine has increased the lifespan and decreased the burden of disease for many populations in North America. (Pfefferbaum, Pfefferbaum, Rhoades, & Strickland, 1997) Patient navigation to address the barriers around the cancer continuum has been around since the 1980s, beginning in Harlem, NY with African American women with breast cancer (Freeman & Chu, 2005). Harold Freeman the founder of Patient Navigation describes navigation as engaging specifically trained individuals to help others (i.e., patients, families) navigate the health care system (Freeman, 2004). Navigation processes can be described as education and outreach, aiding with access to screening. Methods: This study was conducted to examine the lived experiences of Native American Cancer Patient Navigators (Native Navigators) with cancer screening and cancer health. The term Native Navigator was used to describe a Native American who helps an individual in a Native American community in navigating the complex system of healthcare along the cancer continuum (Eschiti, Burhansstipanov and Watanabe-Galloway, 2012). The research design for this study was developed using qualitative methods in alignment with a phenomenological approach. For data analysis, a phenomenology framework was used. Initially, the Native Navigators recruited were from the Western and Central United States. This preliminary study sample then expanded using a snowball recruitment approach. Eventually, Native Navigators and their experiences were included from as states as distant

from each other as Florida and Alaska. Results and Discussion: Native Navigators were recruited from across the United States. Native Navigators representing American Indian and Alaskan Native tribes were interviewed from both urban and rural settings. Collected data consisted of field notes, supporting documents and in-depth ethnographic Native Navigator interviews. Results included the exclusive roles these Navigators play in their communities and resulting themes of Spirituality, Kinship, Native Ways of Helping and Being the Bridges between Native Traditional Medicine and Western Medicine. Conclusion and Future Research: In spite of the remarkable progress in recent years in Western Medicine, with respect to the health status of Americans Indians and Alaska Natives, in virtually all health measures, the status of Indian health remains below that of other U.S. Citizens. (Pfefferbaum, R.L., Pfefferbaum, B., Rhoades, E.R., & Strickland, R.J. , 1997.)

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Grad. 8

Subcategory: Cell and Molecular Biology

Platinum Group Elements from Road Dust Activated JNK in Lung Epithelial Cells in Vitro

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The Platinum Group Elements (PGE), platinum (Pt), Palladium (Pd), and Rhodium (Rh) are released from automobile catalytic converters during driving in the form of nano-sized particles. Significant concentrations of rhodium, palladium, and platinum have been reported in tunnel dusts and surface road dusts in the Houston area. Humans can be exposed to these metals through inhalation of airborne particulate matter (PM) that may provoke respiratory diseases and other adverse effects. Exposure to atmospheric PM is known to induce many respiratory diseases especially in susceptible populations such as children. But it is not clear which constituents of atmospheric PM are responsible for the observed health effects. Although chemically inert, platinum, like other transition metals exist in several different forms having different oxidation states. It is well known that bioavailability and toxicity of metals are linked to their chemical species. Recent studies on PGE toxicity and environmental bioavailability indicated that once entering environment, anthropogenic PGE might easily be mobilized and transformed into more toxic forms under the actions of various biogeochemical processes, and thereby, enhanced their bioavailability and posed potential health risks to human beings through food chain. Very little is known about the mechanism and biomolecular response pathways of mammalian cells to PGE. We hypothesize that PGE exerts its effects by activating the pro-inflammatory signaling pathways in cells. To test this hypothesis, we examined the effect of PGE on the c Jun N-terminal kinase (JNK) and P38 mitogen activated protein (MAP) kinase pathway in lung epithelial cell lines. The MAP kinases are serine/threonine protein kinases that play pivotal roles in a variety of functions in several cell types. Different signaling pathways regulate the three subfamilies of MAP kinases consisting of ERK, JNK, and p38-MAPK that show different functions. We investigated the effect of road dust with PGE on JNK pathway in A549 lung epithelial cells. Our results indicate that PGE activated the JNK pathway by phosphorylation of JNK. Under similar conditions, the P38MAPK pathway was not activated by PGE.

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Grad. 9

Subcategory: Cell and Molecular Biology

Characterization of the Pathogenesis of Northern Leaf Blight in Maize Using Advanced Bioimaging Techniques

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Maize is a crop of worldwide significance that is afflicted by many diseases. One of the most common diseases associated with maize, the Northern Leaf Bligh (NLB) is caused by fungus (Setosphaeria turcica). Genetic resistance to this disease is the only realistic way to control it. Resistance to the NLB is attributable to ~30 genomic loci that have been previously identified in genome-wide association studies. To test the hypothesis that different loci act through different mechanisms of action and to characterize their effects on pathogenesis, we are integrating genetics and bio-imaging. Pairs of genetic stocks with distinct alleles at each genomic locus in an otherwise identical genetic background (near-isogenic lines [NIL]) are spray inoculated with either of the fungal spores. At variable time points during pathogenesis, leaf punches are collected, and conserved using a glutaraldehyde fixative. Images of the fixed samples are captured with a digital camera in other to record the macroscopic features on the leaf surface. Samples are stained with Wheat germ agglutinin (WGA) conjugated to AlexaFluor594 that specifically stains fungi and Calcofluor that stains plant cell walls. In order to image all the way through the sample we modified a technique known as Scale, which is a chemical treatment that clears tissues while maintaining the

structural integrity of the sample. A final treatment with glycine enhances the image quality by removing nonspecific auto fluorescence caused by excess aldehyde groups and thereby increasing the ratio of signal-to-noise. After the sample treatments are completed, preliminary images are taken at low magnification using a Zeiss LSM5 DUO High-speed Confocal Microscope to compile a microscopic overview of the leaf punch. Images are processed using Fiji Image software and then visually analyzed for regions with fungal infection. These areas of interest are then viewed at higher magnifications on a Zeiss LSM510 NLO Multiphoton Confocal Microscope, capable of acquiring higher resolution 3D images. Together, these images reveal previously unknown information about these fungi including the path of infection, type of invasion (vascular vs non-vascular), morphological changes, and other events during the disease incubation period. Comparing image data from NIL pairs enables us to understand what mechanisms are employed by the host to achieve genetic resistance. The data collected from this imaging is crucial in the development of durably resistant crop germplasm.

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Grad. 10

Subcategory: Cell and Molecular Biology

Glutathione S-transferases as Mediators of Cell Growth, Development, and Differentiation in Dictyostelium Discoideum

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Glutathione S-transferases (GST) catalyze the conjugation of glutathione (GSH) to many endogenous electrophilic and xenobiotic compounds. In addition to their role in detoxification, GSTs are implicated to play important functions in signal transduction, development, and differentiation in eukaryotic cells. Recent studies show that the eukaryotic model, Dictyostelium discoideum, undergoes altered development and sensitivity with changes in GSH levels. The function of many GSH -mediated enzymes in D. discoideum is poorly understood. Many D. discoideum genes are orthologous to mammals, and sequence analysis of D. discoideum (strain AX4) reveals that five transcripts GST isozymes (α1-α5 class) are hypothesized to be expressed within the organism. The unique exclusivity of alpha class isozyme expression raises interesting questions regarding their importance in D. discoideum growth and development. This study characterized the identity, expression, and activity of GST enzymes in D.discoideum. Our studies reveal the expression of functional GSTs in D.discoideum. Initial measurements of GST activity within vegetative cells of Dictyostelium using the general substrate 1-chloro-2-4-dinitrobenzene (CDNB) revealed the existence of functional enzymes. GSTs activity assayed in the presence of ethacrynic acid (common GSTs inhibitor) decreased the activity by 50% indicating the specificity of the observed sum GST activity. Also, GST activity exhibited distinctly different profiles in vegetative amoebae when compared to aggregate/ chemotactic amoebae, the activity was 48% lower in aggregate/ chemotactic amoebae as compared to vegetative amoebae. A GSH-agarose pull down assay identified a doublet band at approximately 24 kDa, and the mass spectrophotometric analysis of these bands identified GSTα3 as the major isozyme isolated followed by GSTα1, and GSTα2. Western blotting of Dictyostelium homogenates also revealed the presence of 24 kDa species that were consistent with GST isozymes expressed in mouse liver. These results provide strong evidence of role of GST metabolism in vegetative amoebae of Dictyostelium. Future studies will characterize: a) the substrate specificities; b) level(s) of isozymes in different stages of Dictyostelium development; and c) studying the effect of altered expression of GSTs on the growth and development of Dictyostelium.

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Grad. 11

Subcategory: Cell and Molecular Biology

Regulation of Sterol Transport in Response to Aging

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The objective is to understand how sterol transport is affected by caloric restriction (CR) and aging. Sterol synthesis generally increases as cells age. Yet, despite this increase, the sterol content of selected organelle membranes, such as lysosomal membranes, declines with age and adversely affects cellular functions. We are interested in a better understanding of changes in sterol transport to membranes of vacuoles (the yeast counterparts of mammalian lysosomes) in response to anti-aging and pro-aging manipulations.

The protein Erg6 is involved in sterol synthesis, while Atg15 is associated with autophagy, a process for degradation of damaged materials by vacuoles (or lysosomes). Wild Type (WT) cells have been found to live longer with CR, while the lifespan of the erg6Δ and atg15Δ mutants is significantly shortened by

CR. In a comparison of microarray data from erg6Δ and atg15Δ mutants with WT during CR, we looked for changes in expression of genes that could be involved in lifespan extending mechanisms triggered by CR. We used microarray data to determine the responses to different combinations of mutations and food availability pairs to examine differential expression of those genes. We constructed "heat maps" using R to identify the relevant genes and determined their roles in biological pathways using this information to draw relevant gene interaction networks.

Our analysis show that the two genes with still unknown functions DR124W and YBR238 are less expressed and the gene SIP18 is much more expressed in the WT during CR than in any other evaluated combination of genotype and food availability. Hence, these genes could be involved in a still undiscovered lifespan extending mechanism triggered by CR in WT but not in erg15Δ or erg6Δ knockout mutants. Conclusions and further work: SIP18 is the most promising candidate gene because it is expressed much higher in the WT during CR than in any other condition thus making it very sensitive to CR and possibly causing the lifespan extension associated with CR. In addition, deletion of SIP18 leads to deformed vacuoles. Hence, SIP18 is a good candidate for involvement in both autophagy and the sterol synthesis pathway. In the future we plan to consider multiple publically available microarray datasets to cross-validate lifespan regulating candidate genes for final verification in wet-lab experiments.

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Grad. 12

Subcategory: Cell and Molecular Biology

The Use of Molecular Modeling to Design a Safe and Effective Drug for American Trypanosomiasis

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American trypanosomiasis affect over 8 million people in the Americas. The current drugs offered by CDC, benznidazole and nifurtimox, are not effective unless treatment is started within two months of infection. Moreover, they are associated with serious side effects in over 40% of treated patients. We here present our preliminary results in the use of molecular modeling techniques to design novel safe and effective drugs for American trypanosomiasis, also known as Chagas disease. We have created a validated 3D model of tubulin dimer of the causative organism, Trypanosoma cruzi using molecular modeling techniques availed in the MOE platform. The binding pocket discovery and docking was done with the imidonaphthoquinone derivatves, the antitrypanosomal activities of which were previously reported by our laboratory. It was affirmed that the binding pocket of these T. cruzi tubulin polymerization inhibitors were in the intra-dimer region of the T. cruzi dimer, as has been observed with the binding of the majority of tubulin polymerization inhibiting compounds. A typical example of these compounds is colchicine. We employed computational techniques, such as pharmacophore consensus to map the pharmacophore features common for the best ligands in their optimal poses. Together with electronic maps and surfaces of the receptor pocket, we were able to create a pharmacophore query constraint that we used to search over 2000 compound linkers for ligand optimization. The output compounds were further sorted and selected according to binding energies, synthetic feasibility, and mutagenicity. The 1JFF was used as a human tubulin model and docked with tubulin polymerization inhibitors mined from CHEMBL to validate the discovered binding pockets. Finally the selected compounds were docked in the human tubulin model to screen for those selective for T. cruzi tubulin.

Homology modeling of T. cruzi tubulin was performed using PDB 1JFF as the template. The pairwise residue alignment for both alpha and beta chains showed similarity of about 80% between template and T. cruzi, meeting the threshold 60% similarity needed for good modeling. The justification for the use of PDB1JFF as a model template for human tubulin was based on the fact that homology between beta chains of 1JFF (which is from Bos Taurus) and human is 90-100% while the alpha chain isotype is similarly at 90-99%, depending on the human tubulin isotype being considered. The modeled compounds were screened by docking on the human template model. We selected those ligands that interacted poorly with it as the best candidates for selective drugs. Synthesis of the optimized ligands and subsequent validation via assay studies shall hopefully avail alternative drugs for further evaluation and clinical studies. This has provided us with a novel technique that resolves the elusive task of designing a potent drug that is assured to be safe by design in its mechanism of action.

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Grad. 13

Subcategory: Cell and Molecular Biology

Runt-Dependent Regulation of the Cis-Regulatory Modules of Wingless at the Blastoderm Stage in Drosophila Melanogaster

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Transcriptional regulation of gene expression is crucial to the process of development and if not properly regulated can often lead to disease. Cis-regulatory modules (CRM) are distinct DNA elements that can increase or decrease the level of transcription. The sloppy-paired 1 (slp 1) locus, a segment polarity gene, has two cis-regulatory elements upstream of the start site that drives periodic expression of this gene during establishment of the segmented body pattern in the Drosophila blastoderm embryo. This stripe pattern of slp 1 is dictated by having each element respond to different combinations of pair-rule factors. Wingless (wg), another segment polarity gene also has two possible CRMs, one that is upstream of the transcription start site and another that is downstream within the second intron. Pair-rule factor manipulation on the upstream CRM revealed two pair-rule genes that differentially regulate expression between the reporter and the endogenous gene. Here I investigate the function of the downstream CRM labeled wg2946.

Transgenic lines for wg2946 were constructed using transformation vectors that give transgene integration into the same chromosomal site using ΦC31-mediated recombination. Gain of function appropriates were used to examine response of wg2946 to different pair-rule transcription factors. Uniform ectopic expression of different pair-rule genes were obtained using the NGT (nanos-GAL4-tubulin) maternal GAL4 expression system. Double fluorescent in situ hybridization was used to label 3-hour-old embryos with a fluorescein (FITC) label for the lac Z probe and digoxigenin (DIG) label for the wg probe.

The expression pattern of wg2946 differs from the expression pattern of wingless by having broad head expression as well as early even stripe expression. Most of the pair-rule manipulations examined here show that the reporter responds slightly differently than the endogenous gene. Future directions will include creating a composite reporter with both the upstream and downstream CRMs and this composite will be evaluated for its ability to fully recapitulate the endogenous expression in all pair-rule manipulations.

Reference: Prazak L, Fujioka M, Gergen JP. 2010. Non-additive interactions involving two distinct elements mediate sloppy-paired regulation by pair-rule transcription factors. Developmental Biology 344:1048-59.

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Grad. 14

Subcategory: Computer Science & Information Systems

Analysis of Aflatoxin Accumulation in Maize for Gene Expression Prediction

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Aflatoxin is a toxin produced by the fungus Aspergillus flavus. The consumption of the toxin even in tiny parts, has proven to be detrimental to farm animal and human life. The Corn Host Plant Resistance Research Unit of the USDA is working to develop corn plants that resist A. flavus, or do not allow it to produce aflatoxin. In this study, analyzing the single nucleotide polymorphisms (SNPs) and insertions and deletions (InDels) in maize DNA sequences will help link them with genes that may have functionalities related to resistance in maize. One method used was an alignment program which was developed to automatically align DNA sequences and identify InDels. The goal of this method was to take the time and worry out of manually aligning DNA sequences. Another method used to analyze the data was a pipeline of scripts that locates genes nearest the SNPs in any user-defined window and then retrieves the annotations for the found genes from various public databases (maizegbd, maizeseq, TAIR, and Phytozome). Ultimately the goal is to be able to select progeny from crosses of maize lines which have the resistance form of a gene and maize lines with the susceptible form of the gene in order to ensure that new maize cultivars are resistant and future outbreaks of the toxin will be much less.

Funder Acknowledgement(s): NSF REU

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Grad. 15

Subcategory: Genetics

Molecular Evolution of Exon 26 of Apolipoprotein B Across Mammal Orders

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Apolipoprotein B (APOB) is the one of the largest proteins in mammals. This gene is 43,000 bp long and encodes for 4,553

amino acids. The gene has 29 exons and 28 introns. APOB is created by the liver and is the only component of low density lipoproteins (LDL). APOB is also the also the ligand responsible for the removal of LDL in blood stream circulation. Exon 26 of APOB encodes for the binding domain that removes LDL. Consequently, Exon 26 is the longest exon a little over 7,200bp and 2553 amino acids. Which means, exon 26 comprises over half of the amino acids APOB encodes; the other 2,000 amino acids are spread among the other 28 exons. Elevated levels of LDL are associated with coronary heart disease, in humans. Yet, other mammals, like carnivores, can consume diets high in LDL and not suffer any health problems. Much research has focused on how cholesterol and LDL levels affect human health. But, research has yet to explore how or why different mammals can consume varying levels of LDL. The goal of this project is to better understand the molecular evolution of APOB in mammals to answer the following question: Is there a functional adaptation in exon 26 of APOB associated with diet in mammals? I hypothesize exon 26 of APOB adapted to selective pressure associated with diet preferences across mammalian orders. Exon 26 was blasted in every mammal genome on NCBI and additional sequences were obtained from collaborating with other labs. Sequences were obtained from 62 mammalians and 15 orders. The sequences were aligned in 5' to 3' and translated in to amino acid sequences. A branch site test in PAML was used to estimate dN/dS ratios at each branch. In accordance with my hypothesis, functional differences were evident in several orders, particularly carnivores. Future studies include continuing to analyze this data to understand with amino acids give rise to each order, looking at the evolution of this exon across the entire animal kingdom.

Funder Acknowledgement(s): Frontiers Master's Program Smithsonian Institute

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Grad. 16

Subcategory: Genetics

Crop Wild Relatives - Major Genetic Sources for Crop Improvement

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The growth and yield of important crops worldwide is limited significantly by biotic and abiotic challenges, and these environmental stresses are becoming increasingly important due to climate changes, land degradation and declining water quality. In order to feed the increasing world population, we must find ways to produce more food besides increasing crop yield; one solution is to understand the genetic basis underlying plant stress resistance and develop stress-resistant crop varieties. Many crop wild relatives (CWR) can tolerate environmental extremes and are important genetic reservoirs used to improve crop performance in harsh environments. We will use wild soybean as a model system, integrating genetics, genomics, and biochemistry to understand genetic basis of biotic and abiotic stresses, such as soybean cyst nematode resistance and tolerance.

Funder Acknowledgement(s): University of North Carolina at Charlotte

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Grad. 17

Subcategory: Physiology and Health

Interleukin-10 Administration to Dystrophic Mice Modulates Muscle Inflammation and Increases Muscle Differentiation

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Duchenne muscular dystrophy (DMD) is a fatal disease characterized by muscle necrosis and inflammation. Pro-inflammatory M1 macrophages increase dystrophic muscle damage by releasing cytolytic free radicals. Subsequently, anti-inflammatory M2 macrophages promote muscle regeneration. Recent findings show that interleukin-10 (IL-10) can shift muscle macrophages to an M2 phenotype, which coincides with muscle differentiation. Those findings suggest that IL-10 influences muscle differentiation and regeneration through an M2 macrophage-mediated process. We tested that possibility by injecting mdx mice with IL-10 and then assaying effects on macrophage phenotype and muscle differentiation. Our findings show that IL-10 treatments decrease M1 macrophages, reflected by reduction in inducible nitric oxide synthase (iNOS) and CD68 expression, while M2 macrophages increase, indicated by elevated arginase (Arg-1) and CD163 expression. Additionally, elevated levels of MyoD and myogenic regulatory factor-4 (MRF4) in treated muscles indicate an increase in satellite cells at early stages of differentiation. Muscle cells treated with IL- 10 in vitro show elevated MRF4 expression although co-culturing muscle cells with M2 macrophages does not affect MRF4. This indicates that IL-10 effect on MRF4 expression in vivo may be direct, and not be mediated by M2 macrophages. In addition, treating muscle cells with IL-10 in vitro increases protein accumulation, indicating a direct effect of IL-10 on promoting muscle growth. We anticipate that an improved understanding of the relationship between IL-10 production and muscle inflammation and regeneration may lead to identifying alternative therapeutic strategies for DMD.

Funder Acknowledgement(s): NIH

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Grad. 18

Subcategory: Plant Research

A Microscopic Investigation of C. heterostrophus Infection in Maize

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Southern Leaf Blight is one of many diseases that afflict maize worldwide and is caused by the fungal pathogen Cochliobolus heterostrophus. Resistance to this disease can be attributed to ~50 genomic loci that have been identified through genome wide association studies. Naturally conferred quantitative resistance is the best, most durable and most useful form of resistance for maize farmers compared with treating the crops with fungicides. Examining the effects of specific loci can help determine the most effective allele combination that will improve quantitative resistance, which is superior to qualitative resistance that is dictated by single genes and can be easily overcame by the pathogen. Each locus acts in different mechanisms and to prove this hypothesis we have integrated molecular genetics and bioimaging. Genetic lines with an identical background containing contrasting alleles at each of the specific locus (near-isogenic lines [NIL]) are paired together for image analysis which will reveal the form of action for that locus. Leaf punches are collected at different time points after each line of maize has been spray inoculated with fungal spores and infected. These samples are preserved in a gluteraldehyde fixative, stained and cleared using a technique known as ScaleP. Two stains are used to visualize both the leaf tissue and the fungus. Images are taken first using a Zeiss LSM5 DUO Highspeed Confocal Microscope to compile an overview of the infection on the entire leaf punch. These compilations are formed by taking numerous images in a tile-like fashion until the entire punch is imaged. These are later reassembled using algorithms created by our computer science collaborators.

Once the fungal infection has been mapped the sample is then imaged at much higher resolution on a Zeiss LSM510 NLO Multiphoton Confocal Microscope. Interesting fungal features can be gathered three dimensionally and at great detail using this instrument. The data from this microscope can be analyzed one step further by the formation of 3D renderings using the Amira software program.

In addition to viewing these reconstructions on a monitor, University of Delaware has available to its students a visualization studio known as the CAVE. This data will provide a means to further examine fungal-plant interactions in ways that may not be so easily observed otherwise.

Funder Acknowledgement(s): NSF PGRP 1127076 and EPSCoR awarded to Randall Wisser, Primary Investigator, University of Delaware, Newark DE 19713.

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Grad. 19

Subcategory: Plant Research

The Use of Computer-Analyzed Acoustics in the Detection of Red Palm Weevils

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The date palm Phoenix dactylifera is an important part of the economy in Saudi Arabia, home to over 23 million date palms, third worldwide in date fruit yield. The red palm weevil Rhynchophorus ferrugineus Olivier (RPW) is a pest of palm, reducing productivity, collapsing trees, and infesting 50% of all date palm-growing countries. That includes Spain, where it infests the date palm and the canary palm Phoenix canariensis among others that are important both agriculturally and ornamentally. Luckily, RPW has not yet become widespread in the US; a brief Laguna Beach, CA entry was probably wiped out in 2010. Accurate detection methods are useful for RPW because the weevils have a long life cycle, growing in infested trees as larvae before emerging as flying adults.

RPW larvae and adults produce sound when they feed and move. Vibrations produced in palm trees in Saudi Arabia, Spain, and Aruba were recorded using the AED-2010 preamplifier and field recorder. The recordings were analyzed using a lab-developed program, DAVIS, to assess presence or absence of RPW in the trees from spectral and temporal patterns within the recordings. Trees and offshoots were inspected for presence/ absence of insects and other visual signs of infestation. We found a strong correlation between visual inspection of tree infestation and acoustical results. As a result, we were able to use acoustics to follow a real-time experiment on the effect of insecticidal fungus Beauvaria bassiana on the survival of RPW larvae. Over the course of time, the larvae died of infection. This was shown by and correlated to decreased feeding and movement sounds from the larvae over time.

This presents strong evidence that acoustics can be used in the creation of an automated detection device for RPW. We are beginning to develop such a device, which must be significantly

cheaper than the AED-2010, and must have DAVIS translated into a different programming language and included in it.

Funder Acknowledgement(s): NSF Graduate Research Fellowship; King Abdulaziz City of Science and Technology, Riyadh, Saudi Arabia; Glenn Biotech SL Co; Spanish Ministry of Science and Innovation; Malaysian Ministry of Education; USDA-ARS-CMAVE

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Chemistry and Chemical Sciences

Grad. 20

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Synthesis of Novel Amino Acids in the Application of Antimicrobial Peptides

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Low molecular weight peptides are important compounds and are well acknowledged for their pharmacological applications in biological systems. The relevance of this work comes from an executive summary from the CDC in 2013 stating that pathogens are becoming resistant and have the potential to become a worldwide health hazard. The focus of this work involves the synthetic construction of small peptides (i.e., di/tri) that mimic the primary structural framework of known antimicrobial peptides that are incorporated with an alaninic unit (s). Thus, this research pre-validates optimal possibilities of antibiotic activity due to similarities in structures as well as the rational substitutions of novel alaninic (e.g., phenylalaninic) moiety within the resulting peptide. This research has been successful in the synthesis of two phenylalaninic (i.e., phenylalanine-type) amino acids and our laboratory is currently exploring the rational synthesis and design of relevant di/tri-peptides. This work also seeks to explore structure and activity profile building by utilizing cyclic amino acid units. Small peptides that contain cyclic unit are known to be rigid which facilitates receptor binding selectivity which translates into pharmacological specificity. In addition, Dipeptides consisting of cyclic units are known to be resistant to enzymatic degradation due to the inhibition of hydrolytic breakdown which typically begins at the C- or N-termini of the peptide unit (Jiménez-González et al., 2012). Cyclic dipeptides can be constructed by the rational use of bridging molecular units. The ultimate resolution of this work lends application to the development of antimicrobial peptide that display optimal efficacy toward resistant microbial strains.

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Grad. 21

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Characterization of Agonist-Induced PPAR-γ Conformational Changes

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The peroxisome proliferator-activated receptors (PPAR's α, β/δ, and γ) are ligand-regulated transcription factors that play a critical physiological role in lipid sensing and homoeostasis. Synthetic PPAR-γ (thiazolidinedione) ligands have been used in the treatment of diabetes; however they have been limited due to adverse cardiovascular side effects. These agonists bind to PPAR-γ causing the dismissal of co-repressors NCOR1/SMRT and the recruitment of co-activator PGC-1α. This promotes histone acetylation and further generates DNA-dependent events such as transcription, replication, and repair.

A combined computational/experimental study was carried out to develop PPAR-γ/δ agonists. Twenty-three compounds were designed, synthesized and evaluated. After detailed analysis, docking simulations predicted compound 9 as the most promising compound with high binding affinity for both PPAR-γ and PPAR-δ. Consequently, 9 was experimentally determined to inhibit gamma and activate delta, and as a result did not exhibit the adverse side effects normally affiliated with full PPAR-γ agonists. Different endogenous ligands induce distinct structural changes to the protein that further dictate which genes to activate. For instance, compound 9 elevates expression of genes associated with fatty acid oxidation and insulin sensitivity. Our current effort seeks to characterize the major conformational changes induced by compound 9 upon PPAR-γ and PGC-1α. Molecular dynamics (MD) simulations of PPAR/PGC-1α/agonist complexes have been performed to explain the differences between 9, rosiglitazone, and other selective PPAR modulators.

Reference: Bioorg. Med. Chem. Lett., 2013, 23, 87-879. Molecular Endocrinology. 2006. 20(4):809-830. Nature 2011. 477: 477-481. PPAR Research: 2008 2:11, 181047. Genes and Development 19:453-461. 2005.

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Grad. 22

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Development of a Proximity Assay for Adiponectin in Microfluidic Systems

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Adiponectin is a primary endocrine hormone secreted from adipocytes, and its level in blood is an important indicator of diabetes, obesity, and other metabolic diseases. With the assistance of 18-20 week old male C57BL/6J mice we can obtain fat pads by surgical extraction, to further this study of adiponectin. Unfortunately, current methods for sampling adipocytes lack the cells natural environment, which is why we created microfluidic perfusion systems for primary adipocyte culture and sampling. Microfluidic systems made of polydimethylsiloxane (PDMS), can decrease experimental costs and increase lab space. This microfluidic system can allow small-volume flowing cell culture systems, which more accurately represents the constant flow culture systems for biological conditions, and can be useful to reduce animal numbers needed for hormone secretion assays. For our chosen assay we have modified the proximity ligation assay (PLA) to test the production of multimeric formations of adiponectin. PLA is used to quantify adiponectin in smaller volume samples. This way, microfluidic secretion sampling can offer improved temporal resolution, and the adiponectin PLA can be used as the readout. We observed the greatest assay response when using the same antibody with two different oligonucleotide signaling arms, with a current limit of detection of 30 fmol and a dynamic range from 30 - 6 600 fmol. The assay also showed higher sensitivity toward multimers of higher molecular weight compared to trimers. We are currently planning to use two different oligonucleotide signaling arms to test the assays sensitivity for the use of serum samples or small volume secretory samples. Future work will focus on the length and connectivity of the oligonucleotide arm sequences to enhance performance.

Funder Acknowledgement(s): National Institutes of Health

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Grad. 23

Subcategory: Biochemistry (not Cell and Molecular Biology and Genetics)

Preparation of Novel-Imidazole Compounds for its Biological Applications

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Imidazopyridines (IMPs) have been confirmed to be novel anticancer agents showing the ability to have inhibitory on LnCap prostate Cancer cell proliferation without inhibiting the activity of normal prostate cells. The approach for this study was that metastatic prostate cancer cells relapses over a short period of time were androgen deprivation therapy is insufficient. In present studies, our group has included the development of additional derivatives of the IMPs with the goal to further improve potency of the therapeutic effect. The molecular design of new IMP molecules will explore different functional groups that may have direct association with affinity for protein kinases.

We have used IMP-Benzenamine (IMP-AMD) and IMP-N'N-Dimethyl aniline (IMP-DME) molecules as reference/control as they have been established in recent studies to have anti-proliferation of prostate cancer cells. Results show a high yield percent of synthesized compounds for pharmaceutical development proposes. Further results show IC50 values for N,N -bidentate molecule that are higher than that of both IMP-AMD and IMP-DME. Lastly results show that the derived products are selectively binding to Phosphatidylinositol-3 Kinase (PI3K) in Hela and prostate cancer cell lines. Future studies will elucidate the underlying suppression mechanism on CR PCa cells and HeLa Cells.

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Grad. 24

Subcategory: Chemistry (not Biochemistry)

Sustainable Synthesis of 3-Substituted Isoindolin-1-ones

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The 3-methylene-isoindolin-1-one motifs are present in many naturally occurring substances and possess various biological

activities varying from anti-hypertensive, anti-inflammatory, anti -psychotic, and anesthetic to anxiolytic, antiviral, and antileukemic agents. [1] Hence, direct and efficient synthesis of such medicinally important compounds has received much attention. Classical preparative methods, however, involve time consuming, multistep processes and/or the use of expensive precious metals as catalysts and environmentally harmful reaction media. [2a-l, 3]

Our method reduces the synthesis process to a simple one-pot reaction in neat water and utilizes an inexpensive CuCl/ Phosphine catalyst system (10 mol%) in short reaction times (20 -90 minutes). In a tandem one-pot reaction, a 2-iodobenzamide substrate undergoes a Sonogashira-type cross-coupling with a terminal alkyne, followed by in-situ heteroannulation in the presence of base. In our method, TMS-protected alkynes (obtained from inexpensive aryl halides and TMS-acetylene) are also suitable starting materials, thus widening the reaction scope at significantly lower cost. It was found that the use of either conventional heating or microwave irradiation affords the products without any significant difference in yields. Considering the low cost of copper, our method represents one of the most economic reported to date. In addition, the use of water as the sole reaction media avoids the generation of harmful solvent waste.

More than 20 isoindolin-1-one derivatives have been synthesized using various iodobenzamide substrates, terminal and TMS-protected alkynes. Products were obtained in good to excellent yields, depending upon the electronic nature of the starting materials, and were characterized using 1H,13C and 19F NMR spectroscopy where relevant. Regioselectivity was unambiguously confirmed by single crystal X-ray crystallography as well as Nuclear Overhauser Effect (NOE) studies showing predominantly the Z-isomer. Future research efforts include further functionalization of the products into value-added compounds.

References: 1. (a) Blasko´, G.; Gula, D. J.; Shamma, M. J. Nat. Prod. 1982, 45, 105. 2. (a) Flitsch, W.; Peters, H. Tetrahedron Lett. 1969, 10, 1161. (b) Pigeon, P.; Decroix, B. Tetrahedron Lett. 1996, 37, 7707. (c) Griesbeck, A. G.; Warzecha, K.-D.; Neudo¨rfl, J.-M.; Go¨rner, H. Synlett 2004, 13, 2347. (d) Bousquet, T.; Fleury, J.-F.; Daı¨ch, A.; Netchitaıilo, P. Tetrahedron 2006, 62, 706. (e) Couture, A.; Deniau, E.; Grandclaudon, P.; Lebrun, S. Synlett 1997, 1475. (f) Kundu, N. G.; Khan, M. W. Tetrahedron 2000, 56, 4777. (g) Couty, S.; Liegault, B.; Meyer, C.; Cossy, J. Org. Lett. 2004, 6, 2511. (h) Cao, H.; McNamee, L.; Alper, H. Org. Lett. 2008, 10, 5281 (i) Sun, C.; Xu, B. J. Org. Chem. 2008, 73, 7361. 3. Li, L.; Wang, M.; Zhang, X.; Jiang, Y.; Ma, D. Org. Lett. 2009, 11 (6), 1309.

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Grad. 25

Subcategory: Chemistry (not Biochemistry)

On the Molecular Interactions of Acetic Acid and Acetamide Homodimers: A Computational Perspective

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Characterization of small molecules to accurately describe the chemical phenomena of large, complex systems, such as proteins, is the routine strategy of investigation for a computational chemist. However, quantitatively accurate descriptions of necessary thermodynamic and spectroscopic properties are computationally expensive, and there exists an uncertainty in the performance of various theoretical methods. In this work, computational methods were used to quantitatively characterize the relative thermodynamic stabilities for homodimers composed of acetic acid and acetamide by explicitly including corrections for anharmonicity. Albrecht et. al assessed the aggregation properties of acetamide by low-temperature, FTIR spectroscopy and explicitly expressed need for anharmonic corrections in theoretical approaches. Because the low- and high-frequency stretching modes (OH/NH stretching) are responsible for the strength of the hydrogen bond, they were analyzed to determine the relative stability of the dimers within each set, and to verify a correlation of the infrared intensities with the binding and hydrogen bond energies.

All computations were performed using Gaussian 09 Rev. C.01 software corrections for anharmonicity were computed using Barone's formalism. Computations were performed using second-order, Möller-Plesset perturbation (MP2) and several density functional theories (DFT) that include the standard B3LYP and wB97xD which accounts for the dispersive nature of these systems. In an evaluation of acetamide clusters, Mahadevi and coworkers showed that energetic values computed without explicit inclusion of a dispersion correction leads to an underestimation of interactions energies.

Preliminary calculations were performed using Dunning's augmented cc-pVDZ basis set and inclusion of corrections for basis set superposition error at the MP2 level caused significantly large changes in the computed thermodynamic parameters which is possibly reminiscent of the relatively small basis set. The anharmonicity-corrected Gibbs free energy of binding (ΔGB) indicates that of all six dimers investigated for acetic acid, only the cyclic dimer with two hydrogen bonds of the form O-H···O=C will exist at 298 K. Calculations with corrections at the MP2 and B3LYP levels of the vibrational modes showed very good agreement with experiment. Further studies are being performed to assess the basis set effects of these systems by employing the augmented cc-pVTZ basis set.

Because of an observed linear correlation with between binding energies and intensities of the stretching modes, both low- and high-frequency, validation of additive property of binding energies has been attempted by comparison of the work of Cato and coworkers6 on formic acid and formamide dimers. Further, the nature of the lowest six fundamentals of all dimers is very similar, and the in-plane bending and stretch-bend fundamentals of the dimers are concluded to also modulate the strength.

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Grad. 26

Subcategory: Chemistry (not Biochemistry)

Synthesis of Novel Chelating Complexes with N'N-Bidentate Ligands for Carbon Nanotube Modification

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Early detection for cancer reduces the probability of mortality, so we synthesized novel metal complexes of planar geometry that has a highly desirable detection properties. This potential property leads to the strong π-π stacking interaction between the imidazoles and carbon nanotubes. The π-π stacked modified carbon nanotubes have properties that are useful for drug delivery and biomedical sensing. Several of the Imidazole compounds were prepared with fused aromatic rings that possess almost perfect planar geometry. Upon completing Imidazole synthesis we prepared novel metal chelating complexes. The synthesis of the ligands was a success which resulted in a pure compound that was used in a metal chelating compound. Crystals were formed using the iron and copper metals. The hope is to further develop these crystals for further x-ray studies, ESR, UV-VIS, and thermal analysis. Using the Bromo compound as a foundation we can begin to look for other modification compounds.

Funder Acknowledgement(s): Clark Atlanta University & Center for Functional Nanoscale Materials. Clark Atlanta University & Center for Functional Nanoscale Materials.

Faculty Advisor: Xiu Bu, jbu@cau.edu

Grad. 27

Subcategory: Chemistry (not Biochemistry)

Crystal and Molecular Structures of New Metallocarboranes, Au25 Gold Cluster and Metal Sensor Molecules

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In this study, we hypothesized that the Inorganic complexes readily icosahedral clusters, and it is important to understand why very different types of molecules form. It is also important to understand the relationship between their molecular and electronic structures. Two very unrelated icosahedral complexes were studied: Re(C-H)B9Hz and [N(C8H18)4] [Au25 (S CH2CH2C6H5)18] by X-ray crystallography and magnetic susceptibility method techniques.

The results obtained showed that one cluster is a distorted icosahedron made of one Re atom, two C atoms and nine B atoms. The cage is empty, and the metal forms part of it and has one NO and two CO ligands attached. One of the C atoms is substituted with an O-CH2-CH2-O-CH2-CH2-I group. This cluster is an analog of the core of 2 but without the central atom occluded in the cage. The molecule is diamagnetic but has interesting properties. The other cluster is a the "spherical" Au25 cage inside the [Au25(S{CH2}nC6H5)18]- anion. The core of this anion consists of a central occluded Au atom surrounded by the 12 vertices of the icosahedron. Around the 12-vertex core of Au25 are the ligands Au-(S CH2CH2C6H5) in "staple" form. Reports of some analogs of Au25 examined the materials via their magnetic properties, and observed abrupt phase changes, i.e. abrupt changes in electronic structure. Therefore the electronic structure of cluster 2 was also examined magnetically to search for electronic phase changes, and at the same time, the molecular structure was determined at a series of temperatures to check for molecular phase. There was no abrupt change in molecular structure.

The icosahedral core of Au25, nor the "staple" shell around it produce any electronic or molecular phase changes. More measurements and theoretical work to resolve the question: are the [Au25(S{CH2}nC6H5)18]- ions very small nanoparticles or are they better considered "molecular".

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Grad. 28

Subcategory: Chemistry (not Biochemistry)

CO_2 Hydrogenation to Methanol and DME by Pd-Pd_2Ga Catalysts Supported Over Ga_2O_3 Polymorphs

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Carbon dioxide is a greenhouse gas, and the increased concentration of carbon dioxide in the atmosphere influences earth's radiation balance. Hydrocarbons, such as methanol and dimethyl ether, are potential alternative fuels that may be produced from CO_2. This is an important approach to reduce CO_2 emissions. The CO_2 hydrogenation requires the presence of a bi-functional catalyst. This material must have basic properties for the adsorption of CO_2, such as a metal oxide and a species capable of adsorbing hydrogen dissociatively such as a transition metal. The production of methanol and dimethyl ether (DME) via CO_2 hydrogenation was studied using Pd catalysts supported on α-Ga_2O_3, α-β-Ga_2O_3 and β-Ga_2O_3 polymorphs in a packed bed flow reactor. The formation of a Pd_2Ga intermetallic compound was observed using XRD and XPS. The catalytic activity improves with an increase in the content of the Pd_2Ga intermetallic compound. The content of Pd_2Ga on Pd/Ga_2O_3 depends on the Ga_2O_3 crystalline phase of the catalyst. A slight catalytic deactivation was observed for all samples studied. The Pd/α-β-Ga_2O_3 catalyst displayed the largest deactivation. The deactivation appears to be caused by a loss of basic sites, observed by CO_2 chemisorption. The selectivity to dimethyl ether is not dependent on the Pd_2Ga content, but depends on the catalyst acidity, studied using pyridine adsorption. This assertion was tested by adding niobia to the catalysts, thus increasing the DME selectivity from 0 to 53%. The content of Pd_2Ga over Pd/Ga_2O_3 catalysts was identified to be a crucial parameter for CO_2 hydrogenation to methanol. Future research involves understanding the role of Pd_2Ga in CO_2 hydrogenation and the relation between the selectivity to DME and the acidity type (Brønsted or Lewis acidity).

References: S.E. Collins, D.L. Chiavassa, A.L. Bonivardi, M.A. Baltanás, Catal. Lett. 103 (2005) 83-88.
X. Wang, Q. Xu, M. Li, S. Shen, X. Wang, Y. Wang, Z. Feng, J. Shi, H. Han, C. Li, Angew. Chem. Int. Edn. 51 (2012) 13089-13092.
H. Lorenz, R. Thalinger, E.-M. Köck, M. Kogler, L. Mayr, D. Schmidmair, T. Bielz, K. Pfaller, B. Klötzer, S. Penner, Appl. Catal. A: Gen. 453 (2013) 34-44.

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Grad. 29

Subcategory: Chemistry (not Biochemistry)

Self-Assembly of Hairy Nanoparticles: Organic Cores vs. Inorganic Cores

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Substances that consist of nanoscale fillers dispersed in a polymer matrix are known as polymer nanocomposites. These materials are appealing since they have the potential for a wide array of applications due to their mechanical, electrical and thermo-electrical properties. One of the primary difficulties associated with PNCs is that the nanofillers have a tendency to aggregate into clusters, which cause the desired properties of the system either to diminish or vanish altogether. Hairy nanoparticles avoid issues such as agglomeration that normally plague conventional PNCs. By tailoring the architecture (functionalization of polymer chains, degree of polymerization, grafting density) of HNPs, it is possible to control the extent of inter-particle interactions and tailor the self-assembly of nanoparticles into ordered structures. A question that then arises is: if you not only adjust the parameters of the HNP but also change its core, making it organic/inorganic, how will the self-assembly of the system be affected?

The purpose of this project is to investigate how the self-assembly of HNPs can be affected by altering the basic HNP architecture. The systems being investigated are organic hairy nanoparticles consisting of an organic core (polystyrene crosslinked with divinylbenzene) to which polydimethylsiloxane chains are tethered, as well as two traditional hairy nanoparticle systems composed of inorganic cores (silica particles) to which either polystyrene or polydimethylsiloxane chains are tethered. These systems are synthesized via living anionic polymerization and characterized using DSC, NMR, GPC, TGA, and SEM.

In addition, we will use molecular dynamics simulations to study the thermodynamic properties and possible self-assembly of the HNP systems. SEM imaging has shown that mHNPs with surface functional groups serve as building blocks that self-assemble into well-ordered hierarchical suprastructures via manipulation of architecture. Computational and experimental studies are currently under way to determine if the same highly ordered structures can be formed by varying the parameters of the traditional HNPs.

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Grad. 30

Subcategory: Chemistry (not Biochemistry)

Process for Functionalization of Polyaniline for Biosensing Application

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Biotin-avidin technology is a widely explored interaction in bioscience. Biotin's affinity for the protein avidin makes it ideal for protein and nucleic acid detection or purification methods. This strong interaction if often used in pretargeting strategies for cancer treatment. In most cases a probe molecule (antibody) is connected to a marker molecule (fluorophore or nanoparticle) through the biotin-avidin bridge. Biotinylated nanoparticles can play a role in improving this interaction and creating an electronic or optical detection method. Polyaniline is a polymer which can be easily functionalized to be specific for various biomolecules and has ideal sensor characteristics. In this study we will design a process to functionalize polyaniline with biotin to create a biotin-avidin biosensor. We began with 2-acetamidophenol which is a hydroxyl substituted aniline monomer. This monomer was tailored to yield a polymer with a more reactive hydroxyl functional group via a Williamson esterification. The polymer's hydroxyl group was functionalized by Steglich esterification which refluxes a carboxylic acid with an alcohol. This esterification drives the reaction and dehydrates the products shifting the equilibrium towards the product. In this reaction DCC (dicyclohexylcarbodiimide) activates the carboxylic acid of biotin to further reaction and DMAP (4-dimethlyaminopyridine) acts as the acyl transfer catalyst. The biotinylated polyaniline derivative was characterized using FT-IR spectroscopy, 1H NMR spectroscopy, UV-VIS spectroscopy, and Scanning Electron Microscopy.

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Grad. 31

Subcategory: Chemistry (not Biochemistry)

Metal Extractions Using a Solid Supported Quinoxolinol Base Salen Ligand

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In spite of famous accidents like Chernobyl or Fukishima, the increasing need for low cost reliable energy, while wanting to reduce atmospheric emissions, makes the use of nuclear power from uranium fission an attractive option. Though nuclear power plants produce a large amount of energy with little greenhouse emissions, it also creates a plethora of nuclear waste and contamination. The mass accumulations of waste contains not only toxic metals, but recyclable radioactive metals, that can be reused if detected and scavenged. Some issues associated with current methods include mobility, cost, and sample preparation. Along with this, the concentrations of contaminants found at sites are relatively low, giving off a very weak signal. Research has shown that the signal can be enhanced using a matrix or chelate. 2-quinoxalinol salen ligand synthesized by Gorden et al. showed binding capabilities of 2+ metal ions, incorporating this solid supported ligand could aid in the extraction of metals in the environment, reduce the amount of waste thus preventing future nuclear disasters.

Our group has successfully synthesized a polystyrene aminomethyl resin that binds to a symmetric isopropyl-2-quinoxalinol salen ligand; it has been used to extract copper in as little as 30 minutes. Our group has preceded to use polyvinyl alcohol as the resin with the asymmetric dihydroxyl-ditertbutyl-2-quinoxalinol ligand, which showed promising results using a two phased system and analyzing with a small volume fluorimeter as well a solid phase spectrophotometry. We are now looking to expand our knowledge by modifying the salen ligand and using a different resin. An ethanol-polyvinylpyrrolidone, EtOH-NVP, resin was synthesized following a previously published method by Engstöm et al, products were confirmed using 1H-NMR, FT-IR, and Mass spectroscopy. Following a similar synthetic route proposed by the Gorden et al. publication, the salen ligand employed consists of a 2-quinoxolinol backbone doubly substituted with 3-hydroxybenzene-1,2-dicarbaldehydes, creating a tetradentate chelating system is being synthesized to bind to the EtOH-NVP resin. This complex will be used as a metal scavenger to determine if it can be used as a detectable sensor. Future work entails utilizing this resin-ligand complex to scavenge actinides and recyclable radioactive metals, allowing an insight of the fundamental chemistry of the metals.

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Grad. 32

Subcategory: Materials Science

Multi-metallic Doped Mesoporous MCM-41Nanocatalysts for Hydrogen Production via Steam Reforming of Alcohols

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The quest to supplement non-replenishable fossil fuel energy with an array of renewable energy sources is the primary goal of the 21st century to help mitigate the prevalent global energy shortages and environmental crisis. Steam reforming of energy-dense liquids like methanol, ethanol and glycerol is a highly favored route to produce pure hydrogen (on-board vehicles) as fuel for proton exchange membrane fuel cells (PEMFC). The challenge is that, steam reforming of alcohols produces carbon monoxide- CO (as a co-product) which poisons the anode electrode catalyst of the PEMFC; hence the fuel cell is incapacitated in a considerably short time. It is therefore indispensable to design and explore robust catalysts that could have exclusively high selectivity for hydrogen and literally zero selectivity (less than 20ppm) for carbon monoxide. We hypothesize that the development of large surface area multifunctional mesoporous nanocatalysts could significantly lower metal loadings, improve catalyst stability by minimizing sintering, maximize conversion, increase hydrogen selectivity and lower CO selectivity during the hydrothermal reforming process.

In this work, we have successfully synthesized high surface area mesoporous SiO2 (MCM-41), CeO2 and mixed MCM-41/CeO2 supports doped with multi-metallic catalysts using an optimized one-pot hydrothermal procedure. The effect of interactions between the metals (Cu, Ni, Zn, Sn) and the supports on steam reforming of methanol (SRM) and steam reforming of glycerol (SRG) to produce pure hydrogen is under investigation. The catalysts have been extensively characterized. N2 adsorption-desorption isotherm studies indicated that while MCM-41 support had a large surface area of 1039m2/g, the crystalline CeO2 support possessed a lower surface area of 111m2/g. Bimetallic Cu-Ni/MCM-41catalysts possessed significantly high surface area in the range of 634-1000 m2/g compared to CeO2 supported catalysts which showed a surface area in the range 84 -122m2/g; depending on the total metal loading. Small angle XRD studies confirmed a long range ordered structure in the Cu-Ni/MCM-41 catalysts. So far the catalysts have been tested for percent conversion and H2/CO selectivity via steam reforming of methanol and glycerol in a down flow fixed bed tubular reactor. Preliminary SRM results revealed that 15%Cu-MCM-41 showed impressive performance in terms of methanol conversion (~ 90%), H2 selectivity (100%) and CO selectivity (0.79%) at 300 °C and SRG using 12%Cu3%CeO2-MCM-41 yielded ~99% H2 selectivity, 27%CO selectivity and 63% conversion at 450oC. Our future work will focus on comprehensive deactivation studies of the newly prepared and spent catalysts.

References: Hirunsit, P.; Faungnawakij, K.; Cu-Cr, Cu-Mn, and Cu -Fe Spinel-Oxide-Type Catalysts for Reforming of Oxygenated Hydrocarbons. Journal of Physical Chemistry C2013.

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Grad. 33

Subcategory: Materials Science

Spontaneous Thermal Dispersion of LiCl in M(bdc)(ted)$_{0.5}$ (M= Zn, Ni or Cu) Metal Organic Frameworks

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Metal organic frameworks (MOFs) have been studied to elucidate or understand their potential for applications that include gas storage, adsorption based separations, catalysis, sensors and drug delivery among others. Although great strides have been made to functionalize these materials in an attempt to address several challenges related to applications, hurdles remain ahead in order to accomplish this via simple or flexible means. In order to accomplish this, our group has focused on the possibility of adding an alkali metal onto the surface of MOF via impregnation and spontaneous thermal dispersion of LiCl. The work focused on a 3D MOF with a M^{n+}(bdc)(ted)$_{0.5}$ composition (M^{n+}: Zn^{2+}, Ni^{2+} or Cu^{2+}; bdc: 1,4-benzenedicarboxylate; ted: triethylenediamine). According to X-ray diffraction, the LiCl was homogeneously dispersed onto the surface of the pore channels of the Zn and Ni variants. A displacement of the peaks related to the diffraction planes (110), (002), (200) and (220) suggested that the structures underwent an expansion/contraction process. In the case of Cu (bdc)(ted)$_{0.5}$, the data revealed a remarkable loss in crystallinity. ^{13}C cross-polarization magic angle spinning nuclear magnetic resonance (^{13}C CPMAS NMR) and diffuse reflectance infrared Fourier transform (DRIFT) spectroscopy suggested a LiCl location near the secondary building unit interacting with protons of the *ted* and *bdc* linkers of the Zn and Ni based MOFs, respectively. X-ray photoelectron spectroscopy data gathered for the Cu variant exhibited a shift in binding energy in the 2p3 line probably related to a change in the metal node valence from cupric to cuprous. When combined with the ^{13}C CPMAS NMR and DRIFT data, this observation suggest a destruction of the Cu(bdc)(ted)$_{0.5}$ framework plausibly due to the formation of a CuCN·LiCl

complex. Adsorption-desorption of CO_2 onto the LiCl and apohost $M^{n+}(bdc)(ted)_{0.5}$ (M^{n+}: Zn or Ni) resulted in long- and local-range structural changes. A significant hysteresis was observed in the case of $(LiCl)[Zn(bdc)(ted)_{0.5}]$. In addition, different equilibration time intervals revealed what appears to be a multi-domain or pseudo equilibrium process, involving structural changes characterized by time-scales larger in comparison to those required to achieve adsorption-desorption equilibrium. Future work will include the use of Raman spectroscopy to develop a model for the interactions of the alkali metal with the MOF structures.

References: Hernández-Maldonado, A.; Guerrero-Medina, J.; Arce-González, V. *J. Mater. Chem. A* 2013, *1*, 2343.
Tan, K.; Nijem, N.; Canepa, P.; Gong, Q.; Li, J.; Thonhauser, T.; Chabal, Y.J. Stability and Hydrolyzation of Metal Organic Frameworks with Paddle-Wheel SBUs upon Hydration. *Chem. Mater.* 2012, *24*, 3153.
Lee, J. Y.; Olson, D. H.; Pan, L.; Emge, T. J.; Li, J. Microporous Metal-Organic Frameworks with High Gas Sorption and Separation Capacity. *Adv. Funct. Mater.* 2007, *17*, 1255.

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Grad. 34

Subcategory: Materials Science

Synthesis and Characterization of Novel Phenolic Resin System Based on Lignin Extracted from Different Biomass Resources

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Resole phenolic resins have been used in various applications due to their outstanding physical and chemical properties of flame retardancy, solvent resistance, and thermal stability. However, major disadvantages are associated with the synthesis of these resins. One disadvantage includes the toxic effects of the starting materials, phenol and formaldehyde, on the human body. Many studies are using renewable resources, lignin, as partial replacement with the phenolic synthesis starting precursors to produce less hazardous materials. As a natural and renewable raw material, obtainable at an affordable cost, and great chemical and physical properties, lignin's substitution potential extends to any products currently sourced from petrochemical substances. In order to create less hazardous materials, the current research was geared towards extracting lignin from different biomass resources to be used to produce resole phenolic-type resins using the best thermally stable extracted lignin. Hence, lignin was extracted from wheat straw, pine straw, alfalfa fiber, and flax fiber by organosolv treatment. The unmodified control resole phenol formaldehyde resin was synthesized using phenol and paraformaldehyde in the presence of a basic catalyst. The phenolic materials were reacted with paraformaldehyde at 75-80° C for one hour and cured using a multi-temperature cure schedule. Phenolic-type resins were created similarly with the exception of using lignin as a partial replacement for phenol and reacting for three hours. It was found that lignin obtained from alfalfa fiber gave provided the greatest lignin yield of the various sources. FT-IR spectra showed homogeneity in the extracted lignin samples chemical structure using organosolv treatment. DSC observed the heat of reaction of the lignin samples. Enthalpy measurements were higher for lignin from flax fiber and alfalfa at 190.57 and 160.90 J/g, respectively. The source of the lignin samples were seen to affect the thermal properties. TGA was used to observe the degradation of biomass. Overall, lignin extracted from flax fiber had the greatest thermal stability and highest char yield of 39.22 % followed by wheat straw (40.41 %), alfalfa (35.04 %), and pine straw (29.45 %). The increase in thermal degradation allowed char to be formed which keep the underling layers from being burned. Therefore, providing a greater char yield overall proves that the lignin samples have great fire properties which can be attributed to its chemical structure which can provide enhanced thermal properties when using as partial replacements in polymeric systems. In addition, void-free, homogenous, solid novel resole phenolic type resin systems were synthesized using various ratios of the extracted lignin from flax fiber. Future studies involve the production of novel resole phenolic type systems using lignin extracted from alfalfa fiber as well as examining resulting material's thermal and flammability properties.

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Grad. 35

Subcategory: Materials Science

Exploring Luminescent Phenomena in Novel Scintillating Heterometallic Metal-Organic Frameworks Towards Applications in Nuclear Radiation Detection

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Advancement in radiation detection technology is needed for more reliable, more efficient and less costly screening in a variety of situations. Fluorescent metal-organic frameworks (MOFs) as scintillating materials are detectors using efficient light output after ionization. MOFs are multidimensional porous structures that are synthesized from metals, metal ion clusters and organic ligand linkers.

MOF synthesis has been conducted under solvothermal conditions. Heterometallic metal-organic frameworks (HMOFs) were synthesized to introduce additional properties to the MOF. Upon crystal formation, the HMOFs were taken through a sequence of chloroform washes to prepare it for specific characterization methods. Single Crystal X-ray Analysis (SCXA) was performed to discover/verify HMOF structure and geometry. X-ray diffraction was utilized to discover/verify diffraction patterns to further investigate unit cell parameters of the crystal.

The HMOFs photoluminescent properties were probed using spectrofluorometer instrumentation. Vibronic peaks were resolved for each HMOF and presented us with a deeper understanding of the HMOF properties. Red shifts were observed for the HMOF peaks in respect to the spaced ligand standard. Fluorescent lifetime decay measurements were performed to understand the impact of each lanthanide metal on the relative efficiency of radiative and non-radiative decay.

Radiation detection investigations were performed at Sandia National Laboratory, Livermore, CA. This involves constructing a setup to perform a time-correlated single-photon counting experiment. This setup involved a multicomponent “light box” to observe and record time-resolved radioluminescence spectrum from the scintillating MOFs. Time-resolved radioluminescence spectrum was investigated for the HMOF with the shortest fluorescent lifetime decay measurement.
In conclusion, a novel series of HMOFs were synthesized and probed as potential radiation detectors. The observed fluorescence phenomena of the HMOFs have introduced expanded possibilities in applications. These unforeseen HMOFs show promise.

For future work, the Near-IR luminescent spectra are to be investigated on HMOFs to increase its potential in photo-optic applications. Radioluminescence investigation of the entire series of HMOFs will be explored. Also, substitutions of different scintillating ligands may be used to unearth new wavelengths, strengths and characteristics of MOF crystals.

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Grad. 36

Subcategory: Materials Science

Superior Transition Metal Modified SBA-15 for the Adsorption of Emerging Contaminants from Water

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Removal of contaminants of emerging concern (CECs) from water sources using current technologies present great challenges due to chemical properties and low concentration levels. However, methods based on separation via adsorption with nanoporous materials could present a potential solution to this quandary. Ordered mesoporous silica materials, such as SBA -15, have generated great interest for the development of water treatment adsorbents due to excellent textural properties and large concentration of surface silanol groups. The latter offers flexibility for the effective functionalization of the surface. Although these characteristics are a suitable platform for the development of adsorption surfaces, poor hydrostability limits the potential of SBA-15 at industrial scale. This is due to the presence of micropores within the surface of the mesopore walls that promote structural framework dissolution.

This work focuses on the post-synthesis modification of mesoporous silica SBA-15 materials to develop enhanced hydrostability as well as selectivity for the removal of CECs at ambient conditions via adsorption. SBA-15 was functionalized with amino-organic groups and transition metals (Co^{2+}, Ni^{2+} or Cu^{2+}) by employing thermal pre-treatment and grafting. The resulting variants were characterized using X-ray diffraction, thermal gravimetric analysis, inductively couple plasma mass spectroscopy, X-ray photoelectron spectroscopy, nitrogen adsorption and zeta potential to determine structural, chemical, and textural properties. The variants were evaluated for the adsorption of naproxen, salicylic acid, caffeine, carbamazepine and clofibric acid, respectively, from aqueous solutions via batch equilibration tests. In general, the transition metal modified SBA -15 exhibited a better affinity and adsorption capacity toward anionic and acidic CECs, while the as-prepared SBA-15 prevailed for neutral and hydrophilic CECs. The results also suggested that the adsorption driving force was influenced by a combination of electrostatic, hydrophilic-hydrophobic and metal complex interactions. Also, the metal amino-organic groups effectively blocked the mesopore wall micropores, thus leading to a new strategy for enhancing hydrostability and adsorption performance.

Future research will involve conducting equilibrium and dynamic fixed bed adsorption tests of multi-component adsorption to elucidate competitive adsorption, breakthrough curves, and kinetic transport.

References: Y. Luo, W. Guo, H.H. Ngo, L.D. Nghiem, F.I. Hai, J. Zhang, S. Liang, X.C. Wang, A Review on the Occurrence of Micropollutants in the Aquatic Environment and Their Fate and Removal During Wastewater Treatment, Sci. Total Environ., 473 –474 (2014) 619-641.
S.M. Rivera-Jiménez, S. Méndez-González, A. Hernández-Maldonado, Metal (M = Co^{2+}, Ni^{2+}, and Cu^{2+}) Grafted Mesoporous SBA-15: Effect of Transition Metal Incorporation and pH Conditions on the Adsorption of Naproxen from Water, Micropor. Mesopor. Mat., 132 (2010) 470-479.
A. Galarneau, M. Nader, F. Guenneau, F. Di Renzo, A. Gedeon, Understanding the Stability in Water of Mesoporous SBA-15 and MCM-41, J. Phys. Chem. C, 111 (2007) 8268-8277.
M. Song, C. Zou, G. Niu, D. Zhao, Improving the Hydrothermal Stability of Mesoporous Silica SBA-15 by Pre-treatment with $(NH_4)_2SiF_6$, Chinese J. Catal., 33 (2012) 140-151.
R. Cini, G. Tamasi, S. Defazio, M.B. Hursthouse, Unusual Coordinating Behavior by Three Non-Steroidal Anti-Inflammatory Drugs from the Oxicam Family towards Copper(II). Synthesis, X-Ray Structure for Copper(II)–Isoxicam, –Meloxicam and –Cinnoxicam-Derivative Complexes, and Cytotoxic Activity for a Copper(II)–Piroxicam Complex, J. Inorg. Biochem., 101 (2007) 1140-1152.

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Grad. 37

Subcategory: Materials Science

Electroactive Polymeric Nanofibers for as Active Components in Biosensors

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Electroactive nanofibers decorated with functional groups capable of specifically interacting with biomolecules has tremendous potential to be utilized as single molecule detectors. A solution (Chlorobenzene and dimethylformamide as solvents) of α,ω-bi[2,4-dinitrophenylcaproic][poly (ethyleneoxide)-b-poly(2-methoxystyrene)-b-poly(ethylene oxide)], polystyrene and single-wall carbon nanotubes (SWCNT) was electrospun onto a silicon substrate at 10kV to prepare fibers with average diameters about 300 nm. Binding specificity of the nanofibers containing 1% single-walled Carbon Nanotubes with anti-DNP IgE (Immunoglobulin E) was studied using fluorescently tagged IgE. The fibers were decorated with the DNP functional groups. It was observed that the DNP groups decorating the nanofibers were capable of specifically binding with anti-DNP IgE. The current-voltage (I-V) plots before stimulation of the fibers with IgE differed from the I-V plots after binding with IgE. Our study is additionally focusing on developing nanofibers which would be most sensitive in detecting IgE. This study includes preparing nanofibers composed of 2,4-dinitrophenylcaproic functionalized poly (styrene)-block-poly(ethylenoxide) diblock copolymers and high molecular weight polystyrene. Poly(styrene)-block-poly (ethylenoxide) diblock copolymers were prepared by living anionic polymerization. Composite nanofibers of 2,4-dinitrophenylcaproic functionalized poly(styrene)-block-poly (ethylenoxide)/polystyrene were prepared as a function of solvent systems, compositions, concentration and voltages. These electrospun fibers were characterized by Raman spectroscopy, Fluorescence microscopy, Scanning electron microscopy, Atomic force microscopy and Optical microscopy. The most appropriate conditions for preparing 2,4-dinitrophenylcaproic decrated nanofibers will be presented.

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Grad. 38

Subcategory: Materials Science

Investigation of the Methanol Steam Reform Reaction Pathways on Silica Supported Copper Clusters: A Computational Study

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Copper based catalysts have been the subject of extensive studies in the MSR process because of the ability to produce gas with high hydrogen concentration and high selectivity for carbon dioxide. The decomposition pathway of methanol on copper, in particular, the elementary steps in this pathway involves the dehydrogenation of methoxy (CH3O-) to formaldehyde (CH2O-) which plays a significant role in the MSR process. Additionally, when formaldehyde is fed with steam under MSR conditions, the same CO2 and H2 are produced. However, the subsequent steps leading to the CO2 and H2 products are much less understood than the initial dehydrogenation reactions. As a result, other proposals have progressed. For example, Takezawa and coworkers suggested

that for Cu/SiO2 catalysts, CH2O reacts with surface OH and O species by nucleophilic addition yielding intermediates such as formic acid (CHOOH), formate (CHOO-), and dioxymethylene (CH2OO-).

Given that experimental studies are limited in providing atomic details about reaction mechanisms, a computational protocol is provided to take a step in elucidating the MSR process. In this study, we provide a computational protocol to study on the adsorption of methoxy, formaldehyde and other MSR related species on silica supported copper clusters. For the initial selection of our copper clusters, we begin with a 7-atom model using the Birmingham Cluster Genetic Algorithm (BCGA). A reasonable structural model of the oxide surface was derived from the unit cell of edingtonite. Periodic DFT calculations were performed using the Quantum Expresso package, employing a basis set of plane waves, ultrasoft pseudopotentials and the Perdew-Burke-Ernzerhof (PBE) exchange-correlation functional. The energy and density cutoffs were 20Ry and 200Ry, respectively. The Brillouin zone was sampled at the gamma point. We used the Gaussian smearing method with a finite temperature width of 0.03 eV to improve convergence near the Fermi level. The locations of the energy and transition states (TSs) were calculated using the Nudge Elastic Band (NEB) method.

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Grad. 39

Subcategory: Pollution/Toxic Substances/Waste

NMR Based Metabolomics Study of Chromium (VI) Treated Pseudomonas Fluorescens

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Soil and groundwater contamination by heavy metals from nuclear waste and industrial waste is one of the major problems found at sites within the United States. Out of the 1699 sites on the National Priorities List from the Superfund Program administered by the Environmental Protection Agency, 1127 sites were reported to be highly contaminated with the heavy metal chromium. Even though chromium(VI) has been discovered as a strong carcinogen, chromium(III) is reported to be less toxic. Bioremediation uses microorganisms to transform hazardous contaminants into forms that are less toxic than the parent materials and is considered to be a cheap and environmental friendly method. Pseudomonas fluorescens species were reported to reduce highly toxic chromium(VI) to a less toxic chromium(III).

In this study, we use NMR based metabolomics to study the changes in metabolic pathways due to chromium stress on P.fluorescens Pf-5. P.fluorescens Pf-5 over night cultures containing 50 ppm K2Cr2O7 were incubated at 25 0C with shaking (200 rpm) for 6h and 24h. At each time point, samples were collected and processed to obtain bacterial pellets. The polar metabolites were extracted from the pellets through a methanol/water two phase solvent extraction process. The polar phase was dried and dissolved in NMR buffer. The NMR samples were analyzed using Bruker 700 MHz NMR. The results were statistically analyzed using Principal Component Analysis (PCA). Distinct metabolic profile separation was observed between each sample group (6h control versus 6h chromium stressed, 24h control versus 24h chromium stressed). Among all combinations, the metabolic profile separation observed between control samples at 24 h and chromium stressed samples at 24 h was most prominent. The metabolic profile separation observed in PCA suggests that the chromium stress could have induced a change in the metabolic pathway of P.fluorescens Pf-5. Further research will be done to analyze and identify potential critical metabolic pathways responsible for chromium resistance in P.fluorescens Pf-5 that can serve as a possible biomarker of chromium resistance.

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Grad. 40

Subcategory: Pollution/Toxic Substances/Waste

Estimation of Melting Points of Brominated and Chlorinated Congeners of Persistence Organic Pollutants using QSPR Techniques

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The occurrence of polyhalogenated persistent organic pollutants (POPs), such as Cl/Br-substituted benzenes, biphenyls, diphenyl ethers and naphthalenes has been identified in all environmental compartments. The exposure to these compounds can pose potential risk not only for ecological system but also for human health. Therefore, efficient tools for comprehensive environmental risk assessment for POPs are required. Among the factors of the highest meaning for environmental transport and fate processes is melting point of a compound. This phys/chem property is important in environmental studies, since it affects solubility. Factors deciding of environmental occurrence of chemical pollutants can be determined from computational modeling, without

necessity of performing extensive empirical studies, which are expensive and time-consuming. We estimated the melting points of 1436 chloro- and bromo-analogues of dibenzo-p-dioxins, dibenzofurans, biphenyls, naphthalenes, diphenyl ethers, and benzenes by utilizing quantitative structure—property relationship (QSPR) techniques by classifying structures using the Maximum Common Substructure algorithm. This project is currently being prepared for publication. Current and future studies include studying other vital properties of these compounds.

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Computer Sciences and Information Management

Grad. 41

Subcategory: Computer Science & Information Systems

Password Differences Based on Language and Testing of Memory Recall

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Two of the open questions with respect to password strength are the extent to which visual cues can affect password entropy and the relationship between native language and entropy. A third question is the extent to which visual cues can assist recall of a passphrase or password. We hypothesize that both visual cues and password rules can increase entropy; and that these cues can also increase recall. We further theorize that there is a relationship between password entropy, assisted recall, unassisted recall, and native language.

We implemented an Amazon Mechanical Turk study using mock account creation, including password creation by English-speakers and Spanish-speakers. We required individuals to generate a password, and then recall the password thirty days later. Significant and systematic character usage differences exist between Spanish-speakers and English-speaker. Over 70% of participants created passwords between 6 and 12 characters in length. There were differences between English and Spanish speakers in the use of special characters and numbers. Pass-words created by English speakers were found to contain a higher number of dictionary words compared to their Spanish-speaking counterparts. The exclamation point, "!" was used far more frequently than other special characters by both Spanish and English speakers. Even amongst the lesser used characters, some interesting usage patterns emerged. One example includes the special character "@"; it was never found to be used in the middle of a password, solely as the first or final character in the data set. Locations of different character types were analyzed, showing a trend with high frequency use of uppercase letters as the first character and a very low rate of special characters in the same location. The inverse was found for the last character used in passwords, where special characters far outranked the use of uppercase letters. Recall by participants who were required to create a password under our rules was less than those without rules and the entropy of the passwords was greater. Those given visual cues had greater recall with or without rules, but within each set of passwords entropy decreased recall. Future work will include a larger participant group and modification of schemas to give varying types of feedback, testing memory recall by varying the presentation of cues, and augmenting rules for creating passwords.

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Grad. 42

Subcategory: Computer Science & Information Systems

Scalable Modularized Framework for Designing and Implementing Adaptive Learning Environments

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Significant innovations in learning technologies are encouraging individuals, especially high school students, to seek enrichment learning opportunities that they normally could not take advantage of due to the limitation of traditional classroom offerings. With the increase in learners seeking alternates to traditional classroom learning, there is a need to offer tailored learning experiences with collaboration so courses can be customized to the learner's current knowledge as well as allow students to connect with other students outside of their current setting to capitalize on one another's resources and skills. Another aspect of learning technologies is they provide users access to information at any time and have very little time constraints on availability.

This presentation will review the development and evaluation of varies learning technologies and environments, explore adaptive -based algorithms to support real-time presentation of user content based upon selection with a prototype of this algorithm and propose a system design for a collaborative and adaptive-based application that will support informal e-learning.

Increasing adaptability e-learning environments allows the trajectory of the learning to be customized to each student so the core of the subject matter being taught can be mastered by the student. Based upon empirical studies of a web-based environment called ChemiNet, it showed that learning depends on how well the student understands the concepts. After observing users using the ChemiNet, we realized that more individualized instruction is needed in order to keep each student focused on the material being taught. Individualized instruction and providing more real-like feedback that would normally occur in a traditional classroom setting was an area survey participants felt the ChemiNet lacked. In order to address these concerns and to achieve a more viable environment, investigations in adaptive computer-supported collaborate learning (CSCL) was explored. This research paradigm allowed us to identify system designs that currently support collaboration and adaptability for informal e-learning.

Based upon research and usability testing, the ability to use this tool to support both formal and informal settings increased its appeal for both teachers and students; however privacy and protection issues were raised during these sessions. For future research, we will look at these privacy and protection issues with Computer-Supported-Collaborative Learning (CSCL) research area and if it has an impact on the quality of knowledge retained by students within these environments.

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Grad. 43

Subcategory: Computer Science & Information Systems

Virtual Evacuation Drill in a Multi-user Environment

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Co-Authors: Sharad Sharma, Bowie State University, Bowie, MD

Performing emergency evacuation drills in real world are complex as it is difficult to create emergencies, because we cannot put people lives at risk. The goal of this project is to perform emergency evacuation drill in a multi-user evacuation environment for a building using Unity 3d gaming engine and assets.

The hypothesis is that the “sense of presence” provided by the multi user virtual environment will allow running and conducting evacuation drills without the risk of injuries to live actors. Methods employed include developing multi-user environment with client and server, developing two kinds of agents: computer bots and human controlled characters. Waypoint algorithm is added as a component to the computer bots enabling navigation towards a goal. Collision detection is also employed to game objects to prevent characters from walking through each other. Make human application is used to model characters to simulate quick evacuation of occupants by adding different behaviors and emotions. In addition, intelligent signs such as two dimensional map of building floors and exit signs are provided to guide agents to safety.

Our results and findings include connecting ten clients to the server via photon network to perform virtual evacuation drills in real time either through immersive (oculus VR) or non-immersive virtual environment. This project presents a platform that will allow for experimental design approach for assessing human behavior such as stress, panic, anger, trust among a host of users in emergency evacuation using multi-user virtual environment. In conclusion evacuation drills can be used as a training and educational tool for emergency evacuations.

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Grad. 44

Subcategory: Computer Science & Information Systems

Snow Water Equivalent (SWE) Data-Processing Simulator for a Wideband Instrument for Snow Measurement (WISM)

Ka'Ren Byrd, Elizabeth City State University

This work describes the development of a data-processing simulator for a Wideband instrument for Snow Measurement (WISM) Radiometer. The program will display information on simulated time-stamped radiometer data-sets from Resistive Temperature Devices (RTD’s), current sensors, and the Radiometer measurement itself along with the associated state. The latter is accomplished by developing a series of random numbers for each data-set per the requirements indicated in the WISM radiometer requirement document. The overall goal of the project is to input this data into instrument calibration equations to estimate the overall functionality of the instrument.

Funder Acknowledgement(s): NASA NSTI

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Grad. 45

Subcategory: Computer Science & Information Systems

Immersive Virtual Reality Environment for Airplane Emergency Evacuation

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With the growth in the technology and generation, humans are travelling a lot every day and air transportation is one of the important parts of it. With the increase of air travelling the air traffic is also growing rapidly with high chances of air accidents. Our hypothesis is that immersive multi-user environment can be used to perform an evacuation drills to gather more accurate data without putting the user's life at risk. With the integration of haptic devices such as HMD and data gloves, emergencies in airplane's can be designed and can help in evacuation drills. With the help of gaming platforms like Unity3D it is possible to design real-time environments.

The method for developing multi-user airplane evacuation involves the following: Using unity 3D software we developed a terrain which resembles an airport with airplanes. The airplane we developed is a standard A-319 model and was developed using 3ds Max software which has a seating capacity of 138 passengers. For evacuation we used different methodologies which include animation of characters, way path algorithms for each computer bots, and placement of intelligent signs. Our research focuses on human behavior for the computer generated agents and how human controlled agents interact with them in emergency situations. We have incorporated fire and smoke as primary threats. Photon Networking is a cloud connectivity used to connect multiple players (up to 10) into the environment from anywhere in the world. The player will be deployed into the environment and can start the evacuation drill wearing oculus rift HMD and can navigate using a keyboard/ joystick.

The results of this project led to the successful completion of the airplane emergency environment with all the functionalities including the cloud networking and oculus rift HMD use. The client/server connection is working fine. Different users were able to join the cloud connection from different networks. The future work will include the crowd behavior of the computer generated agents like (speed vary, selfish, altruistic, hostile & non-hostile, wondering, and leader following behaviors).

In conclusion, we hope our research and contribution will help in saving human life in emergency situations and develop a better and safer world. We were approved by the IRB and further work will involve performing user studies for the developed immersive multi-user VR airplane evacuation.

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Grad. 46

Subcategory: Computer Science & Information Systems

Developing and Conducting Usability Tests to Improve Web Content Delivery of USGS Coastal Hazards Science

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The U.S. Geological Survey (USGS) Coastal and Marine Geology Program has compiled multiple large datasets, containing hundreds of scientific reports representing over 15 years of research, on the nature of America's coastlines as part of its National Assessment of Coastal Change Hazards project. This includes data on extreme storms, historical shoreline change, and coastal vulnerability to sea level rise. This information has previously been made available to the public across nearly 20 different websites. In an effort to integrate this data into a unified project and streamline public accessibility, the USGS is developing a web portal where stakeholders- such as landowner, scientist, policy maker, or student- can quickly and easily view and interact with the data within a single user-friendly web application. As part of this effort, user testing was performed to help elucidate areas where design improvements would improve the web portal to increase its effectiveness in relaying USGS science to the public. Usability testing is the testing of a product or service with potential users to identify how to best develop a product to meet its goals. Nine participants were asked to complete scenario based tasks on the web portal using written prompts. Post-test Likert scale evaluations provided further data about portal satisfaction, clarity, etc. The tests were evaluated against the stated goals of the web portal, which include: speed in finding information, clarity of information presented, and user satisfaction. Testing demonstrated areas on the portal that were consistently underperforming (through metrics such as time on task, error-free rate, and total clicks) and provided recommendations for portal improvement. Test results are used to inform ongoing web portal development and could serve as a framework for others interested in improving website usability. Future research would determine whether the usability problems encountered are applicable to other science websites, in order to better communicate science to the public generally.

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Grad. 47

Subcategory: Computer Science & Information Systems

Email Classification Using Supervised and Semi-supervised Learning Techniques

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In recent years, the use of email has become one of the most economical and fastest means of communication. This has increased the number of email users in the world. However, the increase of email users has also brought about the increase of spam emails which have an adverse effect on email communication. Therefore, emails have to be classified to mitigate the effects of spam emails and increase priority of relevant emails. This is as important as the email service itself because if emails are not classified and sorted, spam emails might erode email inboxes making it difficult for email users to identify relevant emails. It is also necessary as it will save email users the time they will spend trying to figure out relevant email messages.

Various methods have been used in classifying emails in the past. Some of those methods are Naïve Bayes and Support Vector Machines (SVM). In this research, Support Vector Machine was used in addition to stemming and stop words removal. Stemming is the reduction of a word to its root form. For instance, "producing" and "production" are both derived from produce. Stop words are conjunctions and prepositions that occur frequently in a document. Term frequency-inverse document frequency (tf-idf) is used for the removal of the stop words. tf-idf compares the most frequent words in a document to the least frequent words. The Enron corpus, a free set of email messages was used for this research. The finding in this research show that if SVM is used together with TF-IDF, a better spam filter is achieved.

Further research on this work includes the development of an intuitive that learns from a user thereby detecting the most important message needed by the user; and the automatic classification of messages into user-created folders.

References: Aberdeen, D., Pacovsky, O., & Slater, A. (2010). The Learning Behind Gmail Priority Inbox. Retrieved March 11, 2014, from http://static.googleusercontent.com/media/research.google.com/en/us/pubs/archive/36955.pdf
Trivedi, S. K., & Dey, S. (2013). Effect of feature selection methods on machine learning classifiers for detecting email spams. Retrieved January 25, 2014, from http://delivery.acm.org/10.1145/2520000/2513313/p35-trivedi.pdf

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Grad. 48

Subcategory: Computer Science & Information Systems

A Software Engineering Approach to Analyze Student Success Data Collected from Disparate Sources

Wai Yan Elsa Tai, University of Texas at El Paso

Increasing enrollment and retention in science, technology, engineering, and mathematics programs have become a national priority. Projects and broadening participation initiatives have been created at the University of Texas at El Paso (UTEP) with the goals to improve college readiness and student success. The goal of this research is to define the entities and relationships around student success data, whether it originates from UTEP's institutional data, research office, or faculty researchers. The outcome is a formalization of student success data that is used to derive new knowledge and to define the cyberinfrastructure needed to answer important questions: What initiatives are focused on student success? How can one access UTEP's student success data? How can different initiatives leverage institutional data related to students and grants? What knowledge can be inferred from the collective knowledge regarding college readiness and success?

To document student success entities and relationships, the project uses Unified Modeling Language (UML) class diagrams. It provides the means to discover the meaning of the data and serves as an analytical tool in establishing the correlation between the disparate data sources. The steps taken are as follows:

- Examination of questions formulated by evaluators tasked to review data collected from student success initiatives.
- Identification of multiple student success data sources
- Exploration, discovery, and identification of entities, attributes, relationships, multiplicity, and roles associated with the data source(s).
- Documentation via class diagrams to capture the gained knowledge and multiple perspectives.
- Validation of the class diagrams.
- Analysis of the class diagrams to understand the correlations between the different sources of student success data and how data is connected and could be connected to provide efficiencies.

Analysis of the diagrams has led to the discovery of redundant data being stored by different initiatives, the importance of articulating data ownership, and the value of relating disparate data sets to initiatives. The project has identified the core data needed to provide initiatives guidance on initiative data collection to support the ability to answer the questions that are

driving the research. The results of the project will guide the design and development of software systems needed to connect disparate data sources.

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Grad. 49

Subcategory: Education

High-Frequency Environmental Monitoring Using a Raspberry Pi-Based System

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The Learning Enhanced Watershed Assessment System (LEWAS) is a unique high-frequency real-time environmental monitoring lab on the campus of Virginia Tech. The lab contains the following data flow stages: 1) environmental sensors including an acoustic doppler current profiler, a water quality sonde and a weather station capable of measuring the environmental parameters every 1-3 min., 2) a local processor that collects data from the sensors, 3) a server that archives the data, and 4) the Online Watershed Learning System (OWLS) *(www.lewas.centers.vt.edu/dataviewer),* through which end users can access the LEWAS data for research and education. In order to improve the local processor in stage 2 of the LEWAS, this study developed and implemented a Linux-based system on a Raspberry Pi, a credit-card sized computer, during a 10-week REU project in summer 2014 that was part of an REU site on Interdisciplinary Water Sciences and Engineering at Virginia Tech. The Raspberry Pi was adopted because it offers the following advantages: lower power consumption, compatibility with multiple programming languages, expandability to any number of sensors and a lower purchase price.

During the REU program, a modular python program for each sensor was developed on the Raspberry Pi to collect, parse and store the environmental sensor data into a local MySQL database. These programs were successfully tested for each of the three environmental sensors listed above. This database presently has several tables specifically designed for each sensor. This system has the advantage of providing common hardware and software interfaces to all environmental sensors in the system, which is an advantage over using the individual proprietary software for each sensor.

Since the REU program, effort has been given to improve the reliability of the python programs and embed them into a batch file, to automate operation of the local processor. Future work involves mirroring a process to replicate the local database to a remote database on the server in real-time and connecting the remote database to the OWLS for high-frequency real-time LEWAS data to be available for education and research purposes. It may be noted that 5000+ engineering freshmen, 60+ civil engineering seniors at Virginia Tech and 300+ engineering freshmen at Virginia Western Community College have used the LEWAS and/or OWLS for water sustainability education and its use continues to grow within and outside VT.

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Ecology, Environmental, and Earth Sciences

Grad. 50

Subcategory: Civil/Mechanical/Manufacturing Engineering

Cottonseed Dehulling Process

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This research presents a new method for cottonseed dehulling processes. Retrieving undamaged cottonseed kernels for development of new food and feed products is a way to add value to cotton. Cottonseed can be dehulled to obtain whole kernels, which can be used to produce food protein concentrates for animals, as well as for oil extraction and human consumption as a packaged snack. Current methods used to dehull cottonseed provide a low percentage of undamaged kernels. The undamaged kernels are most desirable for new markets.

There are two types of dehulling machines currently being tested. The first is a dehulling machine which can be used with and without steam conditioning as it is being evaluated. The first trials of the machine were done by applying steam to the seed as it is augered to the cracking mill, where the initial crack takes place. These trials were performed at the optimal settings of the machine according to the machine developers and using a ten

pound cottonseed input. During the tests performed on the wet cottonseed, a few problems were encountered while operating the machine due to the seeds clogging up in the suction pipes and in the rollers of the mill. For the dry milling trials (without steam) we also used a ten pound cottonseed input, changing the settings of the machine such as the auger speed, cracking mill speed and the dehulling mill speed. A table was created to keep track of these trials, taking into consideration humidity, temperature, RPM of rollers and auger, weight of final output and waste, set up and run time, and different distances between the rollers. The second machine is a Cryogenic Dehuller which can be used with dry ice or liquid nitrogen.

The first objective of this project is to optimize a process for dehulling cottonseed to extract a high percentage of undamaged seed kernels. A series of setups of the dehulling machine are being tested in this project to identify the collection of settings that provides the highest yields. The second objective of this project is to find a method to separate the final outcome from the dehulling machine into whole kernels, large kernel pieces, mediums and fines.

Funder Acknowledgement(s): Delia Valles-Rosales

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Grad. 51

Subcategory: Civil/Mechanical/Manufacturing Engineering

Risk Based Decision Making Model for Flooding Mitigation Alternatives: A Case Study of the Rio Grande of Loiza Watershed

Natalia Sanabria, University of New Mexico

In recent years, there has been a noticeable increase of natural disasters such as wildfires, hurricanes and flooding leaving behind significant economic losses for the affected communities as well as negative social and environmental impacts. Effects such as anxiety, loss of life, water pollution and contamination of agricultural land have been found to be equally if not more important than the economic effects. Nevertheless, literature has shown that risk assessment incorporating economic, environmental and societal impacts are rare and mitigation measures are mostly compared based only on the economic criteria.

This study proposes a holistic approach for watershed flood management. First, a flood risk assessment framework capable of integrating economic, social and environmental impacts is introduced in order to assess the possible losses and risks within the communities of the watershed. The risk assessment is aided with the use of HAZUS software from FEMA. Second, in order to select from multiple mitigation alternatives, a decision making model (DMM) is introduced. The DMM incorporates stakeholder's opinions using an analytical hierarchical process (AHP) and a Monte Carlo Simulation (MCS) is proposed in order to compare the alternatives. Finally, the frameworks are illustrated with a case study of the Rio Grande of Loíza Watershed in the Commonwealth of Puerto Rico.

The results demonstrated the frameworks to be easily implementable and adaptable to the decision-maker's (DM) requirements. In summary, the model will provide DMs with the information they need in order to estimate the flood risks of a community and study the effects of the mitigation measures to be implemented. These results could be used for budget planning, grant proposals, resource allocation and establishing priorities for the watershed's flood management strategies. They are some limitations to the models, such as uncertainties and assumptions made due to the lack of available and up to date data. In order to reduce the uncertainties from the model, we proposed future research were we can improve the assumptions made and reduce the uncertainties resulting from the flood models and climate change.

Funder Acknowledgement(s): Center for Water and the Environment of the University of New Mexico

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Grad. 52

Subcategory: Climate Change

CO2 and Carbon Sequestration in a Biological/Terrestrial Context

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The correlation between atmospheric CO2 concentration and climate change is now irrefutable. It is this researcher's goal to investigate the biological sequestration of carbon(CS) in various components of terrestrial ecosystems (e.g., soil, coarse woody debris (CWD), litter, and living plants) in the Pea Ridge National Military Park in northwest Arkansas, with an ultimate goal of developing methods of data analysis which will enable the researcher to extrapolate just how much carbon can be stored in the various biological components of various ecosystem types on a larger scale.

The present research effort involves characterization of carbon flux in both oak-hickory and red cedar forests, and semi-native and managed grasslands. In addition, these data will be evaluated in the context of the changes that have occurred in the overall landscape of the Park (and by extension all of northwest Arkansas) since the 1940s.

After reaching a constant dried weight, all samples were prepared for the Elementar vario El cube for analysis of total C and N by high temperature combustion. This was accomplished

with a tripartite methodology: (1) grinding by a heavy-duty coffee grinder and/or mortar and pestle (in the case of soil samples), (2) a grinding milling machine first to obtain a 4 ml and then a 2 ml sample for the plant material, some of the CWD and twigs, and (3) using a bandsaw to obtain cross sections of CWD, which were subsequently ground with an oscillating spindle sander. The researcher has measured carbon content in either 20 or 40 mg samples (e.g., plant or soil, respectively). Results of the C and N concentrations are currently expressed as mg/kg on a dry weight basis and percentages are now in hand showing a clear delineation of not only which type of ecosystem was characterized by the highest value for CS but how much each of the various components within the ecosystem contributed to this value.

The results of this study will be instrumental in the decision making process for land use and forestry management practices. Continued research will be extended to include saprophytic as well as both endo- and ectomycorrhizal fungi as they relate to CS. In addition, this effort will include the inculcation of multi-resolution geospatial data for the macroscale perspective of CS.

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Grad. 53

Subcategory: Climate Change

Comparative Study on Physiological Response of Three Oak Species to Elevated CO2 and Flooding

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The Gulf Coast of Mexico region will continue to experience climate change including increases in CO_2 level, temperature, precipitation, and extreme climatic events such as hurricanes in the next 50 years, and that increased precipitation will result in flooding in many places (USGCRP, 2009; IPCC, 2007; Melilo *et al.*, 2000; Burkett *et al.*, 2001; Ning *et al*., 2003). Understanding the responses of the urban tree species subjected to flooding is crucial for management of the natural resources in general and urban forests in particular. How urban tree species response to combined effect of elevated CO_2 and flooding may influence the full range of ecological processes that operate in urban forest systems, including sapling survival. The objective of this study is to assess the physiological responses of three commonly planted urban oak species to elevated CO2 and flooding by examining photosynthesis, respiration, stomatal conductance and transpiration.

Samplings of live oaks (*Quercus Nigra*), sawtooth oaks (*Q. Acutissima*), and Shumard oaks (*Q. Shumardii*) were grown in the 30 liter containers in the greenhouse. Twelve saplings/ containers (4 each species) were placed into four 450 liter tubs. To simulate periodical flooding, tubs were filled with water for two weeks, and then drained for three weeks (dry-down/ recovery cycle). For control (no flooding), a set of 12 (4 each species) saplings/containers were placed on the blocks adjacent to the flooded sapling/tubs. Data were collected during both the flooding (flood cycle) and the recovery period (dry-down cycle) using a LI-6400 portable photosynthesis system. To test the effect of elevated CO_2, data on photosynthetic rate, transpiration rate, and stomatal conductance were collected at 5 different CO_2 levels - 400, 500, 600, 700, and 800 µmol CO_2 mol^{-1} Independent T-tests, paired T-tests, and two-way ANOVAs were used to analyze data with R software (http://www.r-project.org).

During the flooding cycle, live oak was not affected by flooding significantly until the CO2 level was elevated to 800ppm. Flooding affected sawtooth oak photosynthesis, transpiration, and stomata conductance significantly at 400pm and 500ppm CO2 levels. Shumard oak Ps and Tr were significantly affected at 500 and 600ppm levels. In general, live oak was least affected during the flooding cycle. During the recovery cycle there are no significant difference between flood treated and control for all physiological parameters of all three species at all CO2 levels. In general, Shumard oak performed the best during the recover cycle compared to two other species.

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Grad. 54

Subcategory: Climate Change

Nutrient Enrichment Increases Invasions, but Warming has Weak Effects

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Anthropogenic factors including climate warming and nutrient enrichment may influence invasion success and alter community composition patterns. It is critical to experimentally evaluate multiple anthropogenic factor effects on plant invasions and their impact on native plants. We asked, 1) Do nutrients and climate warming reduce native species' performance? 2) Are impacts smaller on exotic species that occur at higher temperatures and nutrient levels in their native range? 3) How do nutrients and warming alter plant community composition

patterns? We conducted a 3×2×3 factorial outdoor mesocosm experiment. We established mesocoms in 454L tanks by adding 15cm of soil/sand mixture, municipal water, and 20 native snails. Mesocosms were randomly assigned to treatments: 1) plant addition: [native (4 species), exotic (3 species), or mix (7 species)], 2) nutrients: [ambient or high (6mg/L N)], and 3) warming: [ambient, low (+1°C), or high (+2°C) manipulated using solar water heaters]. We conducted monthly temperature and visual plant surveys. After 11 months, we harvested, sorted by species, and oven dried aboveground plant mass. Neither native nor exotic plant mass was affected by the presence of the other group in low nutrient conditions. However, increases in native plant mass with nutrients were significantly smaller when exotic plants were present. The same pattern existed for exotic plant mass (natives only reduced exotic mass with increasing nutrients). Communities with only exotic or native plants had higher mass on average than mixed communities (underyielding). These results suggest that native and exotic plants compete with each other and reduce each other's growth. The increases in exotic plant mass with nutrient addition were significantly larger than native plant mass in single origin communities (27-fold vs. 4-fold) and in mixed communities (16-fold vs. 3-fold). These results suggest that exotic plants are more able to take advantage of high resource conditions and that nutrient enriched ecosystems are more vulnerable to plant invasions. Warming did not significantly affect native or exotic plant mass but exotic plant mass tended to decrease (P=0.11) while native plant mass tended to increase with warming (P=0.26) suggesting that any effect of warming would reduce probability of plant invasions. Overall, our results indicated that nutrient enrichment is the critical anthropogenic factor that influences invasions in this freshwater ecosystem.

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Grad. 55

Subcategory: Ecology

The Ecomorphological Evolution of Lobe-Finned Fishes Through the Paleozoic

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Extant lobe-finned fishes (Sarcopterygii) include terrestrial tetrapods (~7,000 amphibians, ~5,000 mammals, ~20,000 reptiles) and aquatic sarcopterygian fish (six lungfish and two coelacanth species). This ratio of tetrapods to fish was reversed during one of the earliest and most important stages of lobe-fin evolution: the Devonian (418-359 MYA). More than 100 studies over the past decade have examined the diversification patterns of lobe-fins but these have focused primarily on later tetrapods or lungfishes. Thus, we know remarkably little about the mode and tempo of early lobe-fin evolution despite an excellently preserved and abundant Devonian fossil record. Lobe-fins might have undergone multiple adaptive radiations early in the Devonian in response to new resources and new dominance, late in the period in response to increased ecosystem complexity, cosmopolitanism or invasions of new areas, and after various biotic crises. In addition, previous research has shown that the Hangenberg mass extinction (unlike the preceding Kellwasser "Big Five" mass depletion) reshaped ecosystems such that terrestrial lobe-fins became dominant while aquatic lobe-fins declined, setting the pattern of modern lobe-fin biodiversity. However, patterns of selectivity and the mode and extent of ecological recovery have remained unclear. Here, we present results from new databases on over 400 Devonian lobe-fin species, involving biogeographical, ecomorphological, phylogenetic, shape, and temporal data. This data is being used to test multiple hypotheses of Devonian vertebrate evolution. We are applying phylogenetic comparative methods (PCM) and geometric morphometrics to test major hypotheses: 1) the intervals before and after the Hangenberg mass extinction, the Kellwasser mass depletion and other intervals are adaptive radiations marked by ecological release, 2) diversification of cranial and post-cranial traits, which are related to resource-use and habitat preference, is not linked and follows a predictable temporal pattern, 3) the trajectory and ecology of tetrapods and their relatives is significantly different from other Devonian lobe-finned fishes, and 4) modes of evolution reconstructed from extant lobe-fins apply to the early fossil record. Future studies of aquatic-terrestrial transitions (particularly early amphibians) will allow us to detect characteristic patterns of early vertebrate evolution which would be otherwise undetectable by examining only extant taxa.

Funder Acknowledgement(s): University of Michigan, Ann Arbor Rackham Graduate School; University of Michigan, Ann Arbor EEB Dept.

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Grad. 56

Subcategory: Ecology

Rehabilitation of Urban Wetlands: Approach of the Tolerance Capacity of Coastal Plants to Salinity and Hydric Stress

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The urban expansion to the coastal areas has resulted in excessive loss of green areas including the wetlands (USDA, 2000; Brady & Flather, 1994). The ecological rehabilitation of these systems aims to improve ecosystem functions and therefore the re-establishment of important ecological services. As part of these efforts is important to make an effective selection of plants species, considering the environmental conditions of these ecosystems and the physiological characteristics of these species in response to these conditions. This study evaluated the tolerance capacity of three coastal plants species: T. populnea, P. officinalis and A. latifolia to hydric and salt stress. The literature indicates that we can find P. officinalis in a large spectrum of coastal and riparian wetlands. Our hypothesis expose that P. officinalis is the species with the high tolerance capacity to these conditions. We evaluated the salinity, flooding and hydroperiod in the field to be used in controlled common garden experiments. During these experiments we use multi-flow hydroponic systems with different salt treatments (0ppt, 5ppt, 15ppt) and flooding treatments (24hr. flooded and 24hr. without flooding). We perform measurements of specific leaf area (SLA), chlorophyll content (SPAD), number of leaves, stem height (cm) and root and stem dry biomass (g), as indicator of the tolerance capacity of these species to this variable conditions. An ANOVA and Tukey-Kramer analysis we perform, to compare these parameters between species and between the same species individuals in the different treatments.

Preliminarily, we find that T. populnea (Tp) and A. latifolia (Al) showed significant differences in the chlorophyll content (Tp) $F=13.17$, $p< 0.05$, (Al) $F=5.48$, $p< 0.05$, SLA (Tp) $F=15.66$, $p < 0.05$) and number of leaves (Al- $F=6.93$, $p < 0.05$). We continue to develop analysis for Pterocarpus officinalis and comparisons in terms of biomass and stem height. These preliminary results showed significant reductions in these values when the salt and flooding conditions are increased. These results tell us about the ability of these species to maintain their functional structures in various hydric and salinity conditions that we can find in this type of ecosystems. As a projection, will develop new analysis between these species in terms of gas exchange, water use efficiency and water/osmotic potential, to understand the physiological response of these species to these stress conditions.

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Grad. 57

Subcategory: Ecology

Research on the Impacts on an Invasive Species on the Vertebrate Community of the Rio Mora Wildlife Refuge has Never Been Done

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Research on the impacts on an invasive species on the vertebrate community of the Rio Mora Wildlife Refuge has never been done. This anchor project has lead to many other projects that are currently looking in depth at how an invasive has had an impact on the native flora and fauna by the use of general methods, common study site, and techniques. The core of the project consists on evaluating the impact of bullfrog eradication on the community of aquatic vertebrates. For this purpose, a section of the Mora River was divided in two regions. One experimental where the bullfrogs were eradicated using different methods and another one, control, where bullfrog populations are not affected. Most of the project associated in this site looks at the impact of the presence or absence of bullfrogs on different aspects of the ecosystem.

Funder Acknowledgement(s): LSAMP; EPSCOR; New Mexico Highlands University

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Grad. 58

Subcategory: Environmental Engineering

Evaluation of Pathogen Disinfection in Direct Potable Reuse Water Systems

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As human populations grow and levels of development continue to improve globally, demands for healthy drinking water concomitantly increase. Despite this demand, supplies of high-quality waters are limited in the environment, and many sources have historically been over-exploited and are now compromised. Along these lines, many communities have investigated and invested in facilities to reuse treated wastewater for domestic consumption. This is a challenging task, as entire communities will come into contact with, and consume, reused water. These supplies of reused water must be treated for many constituents present in wastewater that are not removed by traditional wastewater treatment methods. Chief amongst this is pathogenic organisms, such as bacteria,

which are present in high concentrations in wastewater. Traditional wastewater treatment facilities remove the great majority of these organisms through technologies such as chlorination. However, current utility-scale facilities do not consistently achieve complete disinfection.

Consistently achieving complete disinfection of reuse waters is critical for both public health and social acceptability of a water reuse system. This project evaluates the performance of a disinfection system as part of an experimental pilot-scale water reuse system. The system, located in Southeast Florida, serves a four-bedroom apartment unit. Beyond the traditional issues of disinfection, the site is challenging due to climate conditions and diurnal usage patterns. The warm and humid conditions present year-round are highly conducive to the re-growth of algae and other bacteria at all stages of treatment, especially in storage tanks and filters. Likewise, the strong diurnal and weekly variation causes water to remain in stored for days at a time, which presents challenges in maintaining a residual. To address these issues a disinfection system based on the principle of multiple barriers is provided. Membrane, ultraviolet, peroxide, and free chlorine treatments are provided at various stages of the treatment process to remove pathogens. The experimental system demonstrated that the combination of treatment technologies was generally successful in achieving complete disinfection of wastewaters. However, trends of positive counts were recorded and correlated to variations in operations, demand conditions, and the local environment.

Funder Acknowledgement(s): National Science Foundation – EFRI; University of Miami College of Engineering
Engineered Control Systems

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Grad. 59

Subcategory: Geosciences and Earth Sciences

Cambrian Magmatism Along the Southern Laurentian Margin: New Petrologic Constraints from Well Cuttings in the Southern Oklahoma Aulacogen (USA)

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Magmatism in the Southern Oklahoma aulacogen (SOA) is associated with >250,000 km3 of early Cambrian aged mafic-silicic intrusives and effusive products possibly related to the opening of the Iapetus Ocean. In the vicinity of the Arbuckle Mts., thick mafic to intermediate lava packages interbedded with rhyolite lavas and sedimentary strata are exposed in the subsurface and penetrated by oil and gas exploration wells. We have sampled cuttings from six wells exposed along the strike of the SOA with the aim of petrographically, geochemically, and isotopically characterizing the rocks to better understand their tectonomagmatic affinity. Cuttings were observed under a binocular microscope to ensure textural homogeneity; XRF bulk chemistry from these samples show that they are relatively unaltered based on analytical totals and alteration indices. The samples plot as basalts to andesites (e.g., 47-64 wt. % SiO2) and are primarily tholeiitic. On discrimination diagrams, these samples fall in “intraplate” fields, consistent with continental basalt volcanism, including flood basalt eruptions. These lavas show Zr/Nb values ranging from 6.8 to 11.1, K/Nb values ranging from 300-600, and Ba/Nb values ranging from 10-20, which are similar to EM1 OIB. The samples also show trace element patterns consistent with OIB-like mantle sources when normalized to primitive mantle, and similar geochemical traits to the Roosevelt Gabbros that crop out along strike of the SOA in the Wichita Mts.. Sr, Nd, and Pb isotope analysis is ongoing. Chemostratigraphic variations show the possibility of several lava packages. The geochemical analyses of the SOA lava flows provide insight into how these magmas formed as well as what tectonic regime (e.g., lower-mantle derived plume, upper-mantle extension, or “leaky” transform fault) produced the volcanism that affected the southern margin of Laurentia during the formation of the SOA; we favor the involvement of a deep mantle plume.

Funder Acknowledgement(s): AAPG; Sigma Xi - Kansas State University Chapter AAPG; Sigma Xi - Kansas State University Chapter

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Grad. 60

Subcategory: Geosciences and Earth Sciences

Comparative Analysis of Home and Community Gardens for Trace Metals

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Given the industrialization of most urban areas coupled with the increase in urban gardening, trace metal (TM) contamination is a serious public health issue requiring attention from regulatory authorities. Direct exposure to soils contaminated with heavy metals, inhalation of dust with TM contaminants as well as ingestion from food products pose a health risk especially to children. It is therefore prudent that the quality of soils in at risk areas in urban settings, such as gardens, be assessed to not only safeguard public welfare but also act as a basis for any remediation decisions that may be needed for such gardens.
In this study, we compared trace metal contamination between home and community gardens in terms of occurrence and

concentrations in the District of Columbia. Further, an attempt is made to relate the occurrence of the metals with one another. Samples were collected from community and home gardens in DC, extracted using the Mehlich 1 solution and analyzed using an Inductively Coupled Plasma Mass Spectrophotometer (ICP/MS). Method blanks and internal standards were used for quality assurance as in-process and analytical controls respectively.

Experimental results show that there are no significant differences in the occurrence of trace metal contaminants between 47 home and 30 community gardens in wards 1, 3, 4, 5, 7, 8 in Washington, DC. Except for ward 7, there was a predominance of high copper and lead levels in home gardens than community gardens. Slightly higher levels of cadmium and chromium were found in home gardens when compared with community gardens. Arsenic levels were not significantly different (significance at differences of 10 % or greater) in home and community gardens. Community gardens in ward 8 had the highest lead levels with a mean of 21.9 mg/kg soil whereas ward 5 had the highest copper levels with mean of 8.8 mg/kg soil. Results also show that high lead levels were related with high copper levels.

Our data shows that even though the levels of TM contaminants are not alarming across Washington, DC it is important to raise concerns regarding the dangers of high concentrations of TM especially gardens where edible goods are produced and take adequate measures to minimize the risk of exposure. Further-more, the higher concentrations of TMs contaminants in home gardens could indicate that proximity to buildings and roadways could be significant sources of TM contamination in urban areas from paint flecking and vehicular emissions.

Further studies will focus on investigating the relationships between TM occurrence and the type of soil amendment being applied to the gardens, and also how TM occurrence is related to the levels of soil organic carbon.

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Grad. 61

Subcategory: Geosciences and Earth Sciences

On the Optimization of Inverse Problems for 2-Dimensional Imaging of the Earth Using Bouguer Gravity Anomalies

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Tracking changes in the gravitational attraction of the Earth can determine the density distributions of buried masses and their locations which is critically important for resource prospecting. Specifically, gravity anomalies measured at the Earth's surface contain information about natural resources (e.g., hydro-thermal vents, hydrocarbon deposits, ore bodies, volcanic magma chambers, salt domes, etc.) found in the substructure. Inverse modeling of gravity data presents a very ill-posed mathematical problem, given that solutions are non-unique and small changes in parameters (position and density contrast of an anomalous body) can highly impact the resulting structural composition model. However, it constitutes a cheap, non-invasive, and non-destructive technique for the imaging of the very complex shallow Earth structure.

Using different techniques, geophysicists and geologists obtain various models of the shallow substructure based on the density contrasts of anomalous bodies "with different densities with respect to a uniform region" or the boundaries between layers in a multi-layered environment. Implementing constrained optimization techniques (as developed in the mathematical numerical optimization community), we improve 2-D models of the Earth's structure through the use of known density constraints for transitional areas obtained from previous geological observations.

By removing geologically unfeasible models (as assessed by geologists and geophysicists) we overcome the ambiguity associated with the inversion of Bouguer gravity anomalies given the reduction of the solution space. Through the minimization of the differences between calculated and observed gravity anomalies, we focus only on those models that meet the constraints of the area as shown by previously obtained geophysical datasets (e.g. seismic and borehole data). We apply the technique to synthetic data and gravitational datasets previously obtained from the Cooper Flat Mine in Sierra County, NM.

Future work includes the application of primal-dual interior point methods for the optimization of 3-dimensional Bouguer gravity anomalies and its inclusion in a 3-dimensional joint inversion optimization framework for imaging of the Earth (through the inversion of receiver function, surface wave dispersion velocity observations and Bouguer gravity anomalies).

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Grad. 62

Subcategory: Microbiology/Immunology/Virology

Who Wins When Worms Compete?

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Competition is an ecological process that occurs when organisms vie for the same limited resources, such as food and space. This process can occur among individuals of the same species (intraspecific competition) or between species (interspecific competition) and plays a large role in the formation of natural communities. Although much is known about how free-living plants, animals, and microbes compete for resources, little is known about how co-occurring parasites interact. Parasites can interact directly for resources or space within a single host, but can also interact indirectly by triggering various immune responses that affect other species. Competition influences disease severity and transmission, which ultimately leads to adverse health outcomes in the host. In this study, we examined the benefits and consequences of competition among parasitic worms co-infecting African buffalo.

Identical to free-living species, individual size and fecundity are indicators of competition in parasitic worms. We hypothesized that both individual size and fecundity would decrease as parasite load increased. In order to perform this experiment, we photographed and measured the most prevalent parasite (Cooperia spp.) found in the gastrointestinal tract of African buffalo. We also counted the total number of eggs present the reproductive tract of female worms.

Next, we ran general linear mixed models and evaluated competition by testing for a correlation between parasite length or fecundity and the number of worms of the same or different species. We found no evidence that worm size was affected by competition between worms of the same species (intraspecific competition). However, we did find that worm length was affected by competition among worm species (interspecific competition). Specifically, we found that the effects interspecific competition were stronger in female worms and between Cooperia and Parabronema species. Future work will include obtaining worm samples from a larger number of buffalo hosts and increasing the number of worms measured per buffalo.

While most co-infection studies focus on the effects of multiple parasites on a single host, it is also important to understand the effects that these parasites have on one other. In this experiment, we studied how multiple parasites interact in African buffalo and how their interactions shape disease progression. Overall, parasite competition has large implications for the host and the parasites themselves.

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Grad. 63

Subcategory: Pollution/Toxic Substances/Waste

Arsenic Analysis in Urban Gardens

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Arsenic contamination in urban soil is a concern due to arsenic wide use and the rise of urban farming. Approximately 90 percent of industrial arsenic in the U.S. is currently used as a wood preservative, but also used in paints, dyes, metals, drugs, soaps and semi-conductors. Arsenic is a chemical element that is potentially toxic to human beings. More than 10 ppb inorganic arsenic level in food or water can pose risk to human health. With the development of urban gardening in the District of Columbia and little information about the baseline concentration of Arsenic in the soil, and determining the concentration of Arsenic in urban gardens is very crucial. The objective of this study is to assess Arsenic contamination in DC soils.

The hypothesis of this study is that Arsenic concentration in urban soil is higher than the EPA US EPA supplemental guidance for developing soil screening levels for superfund sites. The home garden would have more Arsenic level than community garden due to close proximity to buildings.

To test the proposed hypothesis, 109 soil core samples (0-15cm depth) have been collected from 8 wards of D.C community and home gardens. Each sampling site has been located by GPS, and imported to an Excel database. Soil content of extractable Arsenic has been determined using Mehlich 1 solution and ICP-MS.

Results show that the overall mean concentration of Arsenic in community and home gardens ranges from 0.81 to 1.12 ppm. The heights Arsenic level was recorded in Ward 1. The Arsenic level in community and home gardens are not significantly different. This preliminary result is very useful for further researches. The result of the analysis is incorporated in the ArcGIS map. The relation of busy traffic and arsenic level in the urban soil is being assessed to explore potential sources of Arsenic contamination in DC area.

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Grad. 64

Subcategory: Pollution/Toxic Substances/Waste

Identification of Chromium (VI) Resistance Genes in Pseudomonas Flourescens

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Hexavalent chromium pollution is steadily increasing with continuing industrial practices. Consequently, Chromium (VI) has been considered as one of the major environmental contaminants of soil and groundwater at industrial waste sites. Because of the toxic effects of hexavalent chromium to health and the environment, remediation strategies are imperative in order to reduce chromium (VI) into a less harmful form. Pseudomonas species have been recognized as an efficient chromate reducer under both aerobic and anaerobic conditions. The goal of this research was to generate chromium sensitive mutants in P. fluorescens Pf-5, examine them for chromium reduction capabilities, and identify the genes that are responsible for reducing Cr (VI) to Cr (III). Initial growth curve studies showed the optimal working concentration of K2Cr2O7 was 50 ppm. Pf-5 was conjugated with Escherichia coli BW20767 (pMiniHimarRB1) and mutants were generated using transposon mutagenesis. Ex-conjugates were plated on Luria Bertani medium with kanamycin and mutants were replica plated to identify chromium sensitive bacteria. Approximately 32,000 mutants were screened but no chromium sensitive mutants were identified. Possible methods to enhance mutant generation of chromium sensitive bacteria are currently being explored. Once successful chromium sensitive mutants have been generated, further analysis will be done to identify the genes responsible for chromium reduction.

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Grad. 65

Subcategory: Water

Soil and Water Quality Monitoring in Dover, DE Poultry Farm: Environmental Assessment of HUAP Pads

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Across the Delmarva Peninsula, coastal ecosystems are rapidly deteriorating due to changing land use patterns and shifts towards intensive agriculture. The regions intensely developed in the watershed have a high percentage of crop agriculture and contains a number of poultry feeding operations which enhances water quality degradation. The objective of this research is to determine if the use of heavy use area protection (HUAP) pads was effective in decreasing litter spillage and nutrient runoff at poultry facilities on the Delmarva Peninsula. The Chesapeake Bay drains more than 150 rivers and streams in the estuary from the District of Columbia and six states. Recently, certain negative factors (i.e. agriculture) have contributed to the pollution of the bay. To help reduce nutrient inputs, the initial step was to identify and limit excessive point source pollution being discharged to the Chesapeake Bay. We selected a poultry farm equipped with HUAP pads and collected soil and water samples each month and analyzed them for pH, EC, nitrate, nitrite, total phosphorous and total nitrogen throughout a year. We analyzed 16 soil samples (1-9 and 11-17) and 6 water samples (A-F). For EC, nitrate, nitrite, total phosphorous, and total nitrogen analysis, water sample B (where irrigation water meets pond water from poultry farm) had the highest concentrations of all samples. As the runoff from farms remains the leading source of impairments to surveyed rivers and lakes, agricultural activities on surface and ground water can be minimized by using management practices to reduce pollution.

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Grad. 66

Subcategory: Water

Nutrient Inputs to Houston Ship Channel and Galveston Bay and its Correlation with Chlorophyll a

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The Galveston Bay is the second largest estuary in the Gulf of Mexico. Annually, this Bay brings over 4.2 billion dollars in revenue to Texas economy by its valuable resources, including sport, commercial and recreation fishing. However, the Bay receives 60% of Texas's wastewater discharge, which is a substantial nutrient input to the Bay area. The abundant nutrient becomes a threat of the sustainability of ecosystem in Houston ship channel and Galveston Bay area. The study of the water quality in this area is essential for the improvement of the wastewater treatment strategies. Since the high-levels of treatment starting in the late 1960s and earlier 1970s, the Total Nitrogen (TN) and Total Phosphorus (TP) inputs in 1990 approximately equal to those in 1940 and continue to decrease thereafter. There is a need to identify if the current treatments

to control TN are sufficiently enough to support the sustainability of the ecological system in the bay area.
In this research, the nutrient (TN and TP) as well as the chlorophyll a, the sign of the biomass of plank-tonic algae and harmful algal bloom, since 1969 till 2012 are carefully studied. The water quality records in Houston Ship Channel and Galveston Bay were obtained from the Galveston Bay Estuary Program with funding from the Texas Commission on Environmental Quality (TCEQ) and U.S. Environmental Protection Agency (EPA), while the corresponding water flow records were obtained from U.S. Geological Survey (USGS). TN, TP, and chlorophyll a were studied. The temporal and spatial characteristics of TN and TP as well as their correlations with the change of chlorophyll a were analyzed using analytical tools such as the Geographic Information System (GIS), MS EXCEL, and Statistical Analysis System (SAS). Results show that, the decrease of TN and TP is positively correlated with the decrease of chlorophyll a before year 2000, while such correlation adversely inverted to negative values. This implies that even higher levels of treatments for TN and TP should be implemented. Further studies should be conducted to identify the main factors that result in the increase of chlorophylla.

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Grad. 67

Subcategory: Water

Modifying the Index Velocity Method Applied to a Small Urban Stream: A 10 Week REU Study

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The index-velocity method is an approach to estimate flow in a natural stream channel using velocity and stage measurements from an Acoustic Doppler Current Profiler (ADCP). This method relates the index velocity measured by an ADCP to the mean velocity of the channel estimated using either point velocity measurements from an Acoustic Doppler Velocimeter (ADV) or a boat mounted ADCP. This method is widely accepted in practice and has been standardized by the US Geological Survey (USGS), which has over 15,000 continuously deployed flow measurement stations across the United States. However, this method does not take into account the vertical cell velocity profiles recorded by the ADCP, which when regressed versus the mean velocity of the channel, could provide a better fit. In addition, other methods of estimating mean velocity when applied to small channels, such as installing a temporary flume or weir, may also provide better results.

This study seeks to improve upon the index velocity method applied at a stream in a small urban watershed (2.78 km2) by fitting the mean velocity to individual cell velocities delivered by the ADCP. In addition, an upstream weir provides a secondary mean velocity measurement to determine if weirs can give a more accurate estimate of mean velocity than handheld ADV's typically used for developing an index velocity rating in small streams. Data was collected over the span of a 10 week Research Experience for Undergraduates (REU) program at a location in Stroubles Creek on Virginia Tech campus in Blacksburg, VA. The index-velocity and cell velocities were measured using a Sontek Argonaut-SW ADCP. Mean velocities were estimated using a handheld Sontek FlowTracker and by stage measurements from a Global Water WL705 ultrasonic level transducer installed behind a weir. Results indicate that using cell velocities as opposed to an average index velocity in a small stream does not significantly improve the fit. This could be due to the small depth of water during peak flows at this location that limit the number of cells delivered by the ADCP to only two. Using a weir to estimate mean velocities instead of a handheld ADV improved the fit of the R2 from 0.93 to 0.99. These results indicate that for small streams this could be a viable and more reliable alternative than using a handheld ADV. Future research involves expanding the study to additional watersheds of various sizes and land cover characteristics.

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Mathematics and Statistics

Grad. 68

Subcategory: Mathematics and Statistics

Symmetric Outer Product Decomposition for Fully and Partially Symmetric Tensors

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Symmetric tensors have applications in scientific disciplines such as biology and image processing. Often, tensors represent large data sets. Therefore, tensor decomposition methods that will

decrease tensor complexity while lowering computational costs are in high demand.

Symmetric Outer Product Decomposition (SOPD) is a method which factors a fully (partially) [hereafter fully (partially) denoted by f(p)] symmetric tensor into a number of rank-one f(p) symmetric tensors. SOPD is often used with algorithms that determine true signals from noise and interference in signal processing. Few numerical methods exist for finding the SOPD. The standard method involving Alternating Least Squares (ALS) is inefficient- often yielding wrong solutions.

In this project, we propose a new iterative method for SOPD called Partial Column-wise Least Squares (PCLS). The term tensor refers to a complex multi-dimensional array and the order of a tensor is the cardinality of the indexed set. For example, a 3rd order tensor (cube) can be visualized as stacked matrices. A fully symmetric tensor is invariant under all permutations of its indices, while a partially symmetric tensor is invariant under at least one permutation of its indices.

In this experiment, we will work with 3rd and 4th order f(p) symmetric tensors. We first use the SOPD to find the best minimum sum of rank-one f(p) symmetric tensors. The tensor is then matricized and PCLS is applied to the generated sub-problems. For example, on a third order partially symmetric tensor, PCLS is applied to the two matricized sub-problems.

Numerical examples are provided to compare the performance of PCLS to ALS for the SOPD. In these examples, theoretical results show that PCLS removes swamps that are visible with ALS and the convergence rate increases. PCLS is successful in providing accurate results faster.

Future work will focus on the generalization of SOPD to even and odd higher order f(p) symmetric tensors as well as increasing the speed and efficiency of the current methods.

References: Carmeliza Navasca and Na Li, Iterative Methods for Symmetric Outer Product Tensor Decompositions. arXiv:1312.7629 (30 Dec 2013).

F.L. Hitchcock, The Expression of a Tensor or a Polyadic as a Sum of Products, J.Math. Phys., 6 (1927), pp. 164-189.

Kolda, T.G., and B.W. Bader. “Tensor Decompositions and Applications.” Society of Industrial and Applied Mathematics (SIAM) Review. 51.3 (2009): 455-457.

Li, Na. Variants of ALS on Tensor Decompositions and Applications. Clarkson University. 2013.

P Comon, X Luciani, ALF De Almeida Journal of Chemometrics 23 (78), 393-405.

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Grad. 69

Subcategory: Mathematics and Statistics

Probabilistic Particle Shape Measurement

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What is the relationship between the two dimensional shapes that can be generated from a three dimensional solid, by either a cross section or in silhouette, and what is the probability of any given two dimensional shape? Answering this question could result in many practical, diverse, and commercially important applications, including pharmaceuticals, civil engineering, metallurgy, health, food processing, rocket propellants, and comparison between lunar regolith versus lunar simulant. The goal is to develop a computer code that creates an approximation to be computed. We demonstrate here that probabilistic relationships between 2D, the 3D convex or concave shapes do exist, and can be used to constrain the nature of the solid given measures in 2D. We have demonstrated that useful, probabilistic relationships exist between the shape of the solids and the shapes of measurements taken in 2D from solids. All possible 2D measurements from a solid, both in plane of projection and plane of section, generate probability density surfaces in Aspect Ratio vs. Heywood Factor space. These surfaces are sufficiently distinct to discriminate between source solids. Therefore, a population of observed particles can be approximated by mixtures of model solids. Further research is needed to examine the effects of introducing concavity and pixilation into the 3D solids and how it affects the probability distribution surface.

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Nanoscience

Grad. 70

Subcategory: Biomedical Engineering

Nonlinear Spectroscopy and Computational Design of Nanoparticles for Light-activated Gene Delivery

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Noble metal nanoparticles have seen an increase in their use as delivery vehicles for various nucleic acids and biological molecules. While many of these applications only make use of permanently bound biomolecules, an increasing number of strategies use nanoparticles to deliver therapeutic biomolecules to a specific target in the body and then release them when activated by a programmed trigger such as light, heat, or pH. While systems like this have been demonstrated in the literature, the ability to precisely measure surface events on nanoparticle surfaces in solution has been lacking. However, the nonlinear phenomenon of second harmonic generation (SHG) acts to cancel out signals from the bulk media and nanoparticle by symmetry, preserving the surface signal for measurement. Nonlinear laser spectroscopy using SHG is able to detect surface specific events, allowing for the precise design of nanoparticle systems for programmed delivery. In this study, we demonstrate the use of SHG to measure photocleavage of a UV-activated nitrobenzyl linker attaching a microRNA to surface of gold nanoparticles and describe the wavelength, time, and energy dependence of this system.

In the design of light-activated nanoparticle release systems, the determination of wavelength, time, and energy dependence are key in developing more efficient generations of nanoparticle systems for microRNA delivery. Towards this end, we are using a variety of computational and experimental techniques that reduce the required amount of light energy, enhance the local electric field, and tune the activation wavelength of the system. The efficiency of these systems can also be increased by designing particles or arrays of particles that exploit the local heating, surface plasmon, or high intensity electric fields on the particle surface. Using Comsol Multiphysics, we are able to study particles, rods, and rod arrays in order to develop target particles for synthesis and further testing. We are also currently investigating the use of photosensitizers, which produce singlet oxygen when activated with in the clinically relevant near infrared, for the release of microRNA. These methods, along with key measurements from SHG studies will enable the development of more effective, clinically relevant nanoparticle delivery vehicles.

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Grad. 71

Subcategory: Chemistry (not Biochemistry)

Surface-Enhanced Raman Scattering on a Chemically Etched ZnSe Surface

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The proximity of a metal nanoparticle to a molecule has been found to considerably enhance the Raman intensity by factors in the range of 10^6 to 10^12. This phenomenon, known as surface-enhanced Raman spectroscopy (SERS), has been shown to be caused by several resonances in the molecule-metal system, including the surface plasmon of the metal conduction band, molecular resonances, as well as charge-transfer resonance between the molecule and nanoparticle. In semiconductors, according to Mie scattering theory, the plasmon resonance which lies in the visible region of the spectrum originates in the valence band when the particle size is adjusted to be on the order of 100-200 nm. This resonance in conjunction with charge transfer, molecular resonance and an additional exciton resonance are responsible for large enhancements observed in semicondutors.

We report the observation of surface-enhanced Raman scattering (SERS) from a chemically etched ZnSe surface using 4-mercaptopyridine (4-MPy) as probe molecules. A thin film of ZnSe is grown by molecular beam epitaxy (MBE) and then etched using a strong acid. A layer of hemi-ellipsoidal nanoparticles is obtained on the surface. Using the results of the Mie theory, we controlled the size of the nanoparticles to overlap significantly with maximum efficiency of near-field plasmon enhancement. Our Raman spectra show an enhancement factor of (2×10^6) of the intensity of 4-MPy normal modes when 4-Mpy molecules are adsorbed on the surface using a 514.5 nm laser for excitation. We believe this large enhancement factor is an indication of the coupled contribution of several resonances. We propose that some combination of surface plasmon, charge transfer, band gap resonances are most likely the contributing factors in the observed Raman signal enhancement, since all three of these resonances lie close to the excitation wavelength. Future research involves designing different type semiconductor nanoparticles using the Mie theory and exploring the application of surface plasmons in semiconductor SERS.

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Grad. 72

Subcategory: Environmental Engineering

Photo-degradation of Atrazine with Recycled Glass Filter Functionalized with TiO2

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Soil pollution is a major problem typically caused by agricultural activities of the release of toxic pesticide chemicals to control pests in. The residuals of these pollutants are found in ground water sources and drinking water supplies. The main goal of this research was to study the feasibility of the fabrication of porous glass sheets embedded with photocatalytic TiO2 for the degradation of atrazine as soil pollutant. The porous filter was fabricated by sintering recycled clear glass powder (MG-30 grade) with TiO2 nanoparticles between 750ºC to 800ºC for 25 and 30 minutes. Water percolation behavior was measured by recording the elapsed time to obtain a given water volume change. Although the composite is influenced by sintering parameters, it was found necessary to determine whether the sintering temperature and time had an effect in the TiO2 phase transformation and photoactivity. X-ray diffraction analysis allowed determining the TiO2 polymorph i.e. anatase or rutile, after the TiO2-glass composite was sintered. Preliminary results demonstrate a reduction of percolation rate when the temperature and the time increase. Also, the anatase polimorph remains for the sintering temperature used. Ongoing experiments seek to study the possible interaction between the TiO2 and SiO2. Moreover, the composite material is being photoactivated with ultraviolet light lamp sources and the degradation of atrazine is being carried out. An HPLC analysis is being used to evaluate the degradation and viability of applying the material in soil treatment technologies.

Funder Acknowledgement(s): CREST Program

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Grad. 73

Subcategory: Materials Science

Development of Biosensors for the Early Detection of Prostate Cancer

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Prostate cancer is the most commonly diagnosed cancer and the second leading cost of male death in the United States. The current screening test used, the PSA immunoassay, determines the concentration of prostate specific antigen (PSA). This screening method, however, lacks specificity and sensitivity, which leads to over-diagnosis and over treatment of clinically insignificant prostate cancers. New methods and devices must therefore be investigated for improved accuracy. This study is focused on developing a Nanoelectromechanical systems (NEMS) immunosensor that utilizes antibody conjugated nanoparticles for the early detection of prostate cancer.

Gold nanoparticles (GNPs) were synthesized using the Turkevich method. The GNPs were then reacted with cysteamine to produce cysteamine functionalized GNPs (cGNP). PSA was then covalently attached to cGNPs. These PSA conjugated gold nanoparticles were then immobilized onto gold electrodes. The electrodes were then characterized by Fourier Transform Infrared Spectroscopy (FT-IR), Atomic Force Microscopy (AFM), and Scanning Electron Microscopy (SEM). A piezoelectric transducer was then used to measure the antibody-antigen binding activity that occurred on the electrode surface. The functionalized electrodes were exposed to a mixture of analytes. This caused a decrease in resonance frequency due to the antibody-antigen binding activity occurring on the electrode surface. These results were compared to the enzyme-linked immunosorbent assay (ELISA), the commonly used assay for PSA concentration determination. It was found that the functionalized electrode was more sensitive than the commonly used ELISA.

Exposure of the functionalized electrode to a mixture of analytes showed that the antibody-antigen piezoelectric sensor is highly sensitive and specific and thus, demonstrates its usefulness for the detection of prostate cancer. The next step will be to synthesize more antibody cGNP using novel prostate cancer biomarkers and then implementing them in a NEMS array immunosensor.

Funder Acknowledgement(s): NSF-CREST; NSF-RISE

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Grad. 74

Subcategory: Materials Science

Electrical and Magnetic Property Dependence on the Structural Mechanics of Multilayer Perovskite Multiferroics Films of BTO/ LSMO on LAO and STO Substrates

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Currently we explore multiferroics and dependence of their properties on thickness and growth conditions. These ferroelas-

tic layer combinations, which hold the unique capability of being piezoelectric, ferroelectric, and ferromagnetic, have the ability to be polarized by both electric and magnetic fields. Barium Titanate (BTO) and Lanthanum Strontium Manganite (LSMO) layers are utilized on Strontium Titanate (STO) and Lanthanum Aluminate (LAO) substrates grown by pulsed laser deposition (PLD) using two methods: traditional partial pressure oxygen and radio-frequency (RF) oxygen plasma. The films grown by both methods show epitaxial layers of both BTO and LSMO. Although LSMO thicknesses are constant for each sample, BTO thicknesses were varied for exploration of BTO effects on the magnetization of the LSMO as well as the ease of polarization of the BTO layer. Mechanical properties were explored using X-Ray reciprocal space residual stress measurements and X-Ray topography. Surface topography for structural differences of the two growth methods was explored using atomic force microscopy. A link between mechanical and electrical properties is drawn using ferroelectric measurements and is used to show the connection between growth conditions, structural properties, and electrical properties. Magnetization measurements were completed using the SQUID Magnetometer and compared for varying BTO thicknesses on LSMO grown on both STO and LAO substrates. SQUID Magnetization measurements show a noticeable difference in hysteresis which is attributed to not only the quality but also to the in-plane and out-of-plane difference in the substrates. Structural mechanics can be married with these results for theoretical explanation of SQUID measurements for substrate and top BTO layer thickness dependence. It is shown that, under the application of a magnetic field, electrical properties can be manipulated from that of as-grown samples under no magnetic influence.

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Grad. 75

Subcategory: Materials Science

Manipulating the Self-assembly of the Triblock Copolymer Poly (styrene-b-dimethylsiloxane-b-styrene)

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The tendency of linear block copolymers (BCP) in solution to undergo self-assembly into periodic nanoscopic patterns or well-ordered nanostructures is thermodynamically driven by the micro-phase separation of the covalently linked immiscible homopolymers. Since this autonomous organization ability makes BCPs attractive for the “bottom-up” nanofabrication of materials it is imperative to establish a convenient approach to control their size and shape. To investigate if the morphologies of BCPs can be controlled by varying the molecular weight of the individual blocks of the homopolymer and the type of solvent used for solution preparation, polystyrene (PS) and dimethylsiloxane (PDMS) of different molecular weights was synthesized and covalently linked via hydrosilylation. The PS-b-PDMS-b-PS triblock copolymers will be drop cast from selective solvents on silicon wafers to imaged and analyzed with Scanning Electron Microscopy.

Funder Acknowledgement(s): Center for Functional Nanoscale Materials

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Grad. 76

Subcategory: Microbiology/Immunology/Virology

Antimicrobial Effect of Silver Carbon Nanotubes Against Mucoid and Non-mucoid P. aeruginosa

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Michael Miller, Auburn University

Pseudomonas aeruginosa is a major opportunistic Gram-negative bacterium that causes a wide array of human infections particularly in immunocompromised patients. It frequently colonizes mops, waterlines and faucet heads in hospitals, and if not properly disinfected, they could become a reservoir for continuous re-colonization. Due to the high occurrence of P. aeruginosa resistance to commonly used antimicrobials, the identification of novel antimicrobials is needed. One area of rapidly growing interest and study is the use of antimicrobial nanoparticles including nanomaterials coupled with metals.

Silver particles coated carbon nanotubes (AgCNTs) are well known for their antimicrobial properties. In the present study we hypothesized that AgCNTs may have bactericidal activity against mucoid and non-mucoid P. aeruginosa. We determined the antimicrobial effect of AgCNT against the viability of both strains of P. aeruginosa, effect on bacterial growth in the presence of AgCNTs, its microbicidal mode of action and effect on the essential genes of P. aeruginosa. Our results demonstrated that antimicrobial activity was significant at minimum inhibitory concentration (MIC) of of 62.5 – 31.25 µg/mL for both strains. Scanning and transmission electron microscopy analysis showed disruption of cell membrane integrity and leaking of cytoplasmic content. The outer membrane porin gene, OprD, LasA protease gene, LasA, ClpX protease gene, ClpX and inner membrane protein gene, CreD were significantly down-regulated in the AgCNT-treated mucoid and non-mucoid strain. These results show that AgCNT possess antimicrobial activity against mucoid and non-mucoid strain of P. aeruginosa and it down regulated essential

genes of both strains of P. aeruginosa. This study indicates that AgCNT can be applicable to antimicrobial coating, disinfecting surfaces and for water treatment and purification due to its insolubility in water.

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Grad. 77

Subcategory: Nanoscience

Synthesis and Characterization Of β-Cyclodextrin-Poly (ethylene glycol)-Folic Acid: A Drug Delivery Vehicle for Anti-tumor Therapeutics

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Beta-Cyclodextrin (β-Cyclodextrin) has been widely used as a host molecule for encapsulating a variety of guest drugs. While the exterior of this molecule is hydrophilic because of the primary and secondary hydroxyl groups located on the upper and lower perimeter of the moiety, the interior of β-Cyclodextrin is hydrophobic. These unique characteristics enhance β-Cyclodextrin's solubility in aqueous media and make it an ideal carrier for hydrophobic drugs. Additionally, functionalization of β-Cyclodextrin with the appropriate groups permits site specific drug delivery to its desired location. Phytosterols are plant sterols that have been shown to exhibit anti-cancer properties. We hypothesize that the β-Cyclodextrin-Poly-(ethylene glycol)-Folic Acid (β-CD-PEG-FA)/β-Sitosterol bio-conjugate will be an efficient tumor-specific complex for drug delivery. Since most tumor cells over-express folate receptors, inclusion of folic acid in the construct of the vehicle will direct phytosterols to tumor sites. NMR studies confirm the preparation of the β-Cyclodextrin -Poly(ethylene glycol)-Folic Acid bioconjugate. To understand and determine the stability of the β-CD/ β-Sitosterol complex, detailed studies were undertaken with IR (Infrared Spectroscopy), NMR (Nuclear Magnetic Resonance Spectroscopy), SEM (Scanning Electron Microscopy) and DSC (Differential Scanning Calorimetry). This data confirms that the complexes formed are well-defined and stable. In conclusion, these initial studies suggest that this polymeric bio-conjugate has the potential to be utilized as a target specific anti-tumor drug delivery vehicle. Future plans consists of conducting drug release studies on the vehicle using a model drug and testing the bio-conjugate complex on a prostate cancer cell line.

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Grad. 78

Subcategory: Nanoscience

Herringbone Rippling of Graphene on Biaxially Prestrained Elastomers

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Graphene is an atomically thick membrane which can easily bend and buckle out of the plane. Distorting the lattice from its ordinary structure introduces changes to its material properties, for example enough strain can induce the opening of a band gap and other unique pseudo-magnetic effecs. Using strain engineering, we intend to control the morphology of the graphene in order to produce intended optical and electronic behavior. Here, by prestraining an elastic substrate prior to relaxation we are able to buckle the graphene into a periodic rippled structure. Strain engineering of graphene is modeled off of origami, the Japanese art of folding paper, where we keep the graphene intact and bend it rather than cut it into nanoribbon wires. The herringbone structure of the biaxially-prestrained substrate is representative of the "Miura-ori" pattern, translated as "leaf fold". Additionally, introducing a surface treatment of oxygen plasma while prestrained but before transferring the graphene allows for a tunable periodicity based on plasma dosage. The ripple wavelength varies from .5 to 3 microns. Using biaxial prestrain, ordered (by sequentially relaxing each axis) and non-ordered (simultaneous relaxation) ripples are formed. We use AFM and SEM to characterize the ripples, showing valley-to-peak heights up to a few hundred nanometers. In order to analyze the strain profile, we use Raman spectroscopy mapping along the surface. The G and 2D characteristic Raman peaks have a linear relationship with strain based on the Gruneisen parameter effects on the lattice vibrations, and is used to estimate the strain within the ripples. The compression of the graphene during substrate relaxation is actually reducing the amount of strain by buckling, which would not produce strong electronic effects on the graphene. However, using a higher prestrain will yield a larger amplitude and high strains. The longer wavelength ripples (using a high plasma dosage that makes a stiffer surface) were able to resolve a pattern within the maps, due to the almost micron spot size limitations of the confocal laser microscope. The G and 2D peak shifts along the surface spanned from 1590 to 1597 cm-1 and 2688 to 2694 cm-1 respectively. This corresponds to roughly 1% strain, however these values may underestimate the actual strain due to averaging within the lasers beam. With smaller wavelength ripples, the amount of distortion should theoretically increase, but a map cannot be resolved. SEM and AFM enhanced Raman spectroscopy could be implemented to improve the spatial resolution of the maps. These ripples can be used for super-elastic electronics

including strain sensors, transparent conductors for displays, thin film transistors, solar cells, and wearable devices.

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Grad. 79

Subcategory: Nanoscience

Biosynthesis of CdS Quantum Dots with Extrinsic Control over Particle Size

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Due to their size-dependent photoluminescent properties, semiconductor quantum dots (QDs) have potential applications in a number of devices, including display technologies, in-vivo or in-vitro biomedical imaging/detection and quantum-dot solar cells. QDs are typically manufactured using multi-step, batch processes that require multiple organic solvents and expensive precursors, resulting in high material, operating and environmental remediation costs; collectively, these high costs inhibit their widespread commercial adoption. To address this challenge, it is desirable to develop alternative methods to produce QDs under mild conditions with low costs. We describe a cell-based process using an engineered strain of Stenotrophomonas maltophilia (SMCD1) that produces high yields of extracellular, water-soluble cadmium sulfide (CdS) QDs from low-cost precursors in aqueous media. SMCD1 was chosen due to its intrinsically high resistance to a variety of heavy metals, including cadmium. Standard microbiology techniques were used for growth and cultivation of SMCD1 using Luria-Bertani broth and SMCD1 cells grown in the presence of both cadmium acetate and L-cysteine in M9 minimal media resulted in the formation of fluorescent CdS QDs. Strain SMCD1 enables controlled growth of CdS QDs over a period of 6 hours in culture, allowing precise, extrinsic control of QD size and optical properties with emission maxima ranging from 460 to 560 nm. The as-grown CdS QDs show both zinc-blende and wurtzite type structures with a quantum yield of up to 2.08 %. Our results demonstrate for the first time the feasibility of a scalable, biological process to produce low-cost CdS QDs. Future research will focus on understanding the mechanism of how SMCD1 cells interact with heavy metals and furthermore form CdS QDs. Based on the mechanism, further work will be introduced to control the growth and improve the properties of the as-grown QDs.

References: Sanderson, K. 2009. Quantum Dots Go Large. Nature, 459:760-761.
Pages, D., Rose, J., Conrod, S., Cuine, S., Carrier, P., Heulin, T., & Achouak, W. 2008. Heavy Metal Tolerance in Stenotrophomonas Maltophilia. PLoS One, 3:1539-1544.

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Physics

Grad. 80

Subcategory: Cancer Research

Texture Analysis of Conventional and Respiratory-Gated PET/CT Images in Lung Cancer

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Respiratory-gated (RG) PET scans are used for radiation treatment planning of mobile tumors because they provide a "snapshot" of the tumor within a phase along the breathing cycle. In contrast, conventional (3D) PET scans average (and smear) the absorbed activity distribution of a mobile ROI over the motion/deformation pattern the tumor experiences during multiple respiration cycles. Texture analysis of PET/CT images has demonstrated great potential for increased treatment individualization in radiotherapy. However, 3D PET scans, rather than RG PET scans, are most often used for texture analysis in lung cancer. Our aim was to assess the variability between texture features from 3D and RG PET/CT images of lung cancer patients and elucidate the impact of tumor motion (affine and deformation) on image texture. The ultimate goal of our research is to develop radiomics tools for application in radiotherapy.

Fifteen lung cancer patients with 3D and RG PET/CT scans were selected for retrospective analysis. Tumor volumes were segmented at 45% of the maximum PET intensity inside a volume of interest. Center of mass motion, tumor length and tumor rotation were calculated for all cases. In addition, a total of 56 texture features (shape descriptors, first order and second order features) were extracted from the images with internally-developed programs. Relative feature differences were calculated between 3D and RG PET and CT images as well as phases of the RG PET scans.

A weak dependency of all tested features on respiration phase was found for the RG PET data for all patients. Differences between features in RG versus 3D PET ranged from 0% to 180%. These differences ranged from 0% to 189% for CT. Overall, the

percent of total features demonstrating less than 5% difference between 3D and RG protocols were 16% for CT and 34% for PET. Between PET RG phases, 47% of the features demonstrated percent difference less than 5%. Features with least variability included: entropy (2nd order), sum entropy, and information measure of correlation 2 in PET; and maximum intensity, short run emphasis, long run emphasis and run percentage for CT.

Image texture analysis using a static conventional acquisition (3D) versus a respiratory-gated acquisition provides notably different texture feature values. Texture variations between 3D and RG scans are likely due to tumor motion and deformation.

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Grad. 81

Subcategory: Materials Science

Plasmonic Biosensors Based on Gratings

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Surface Plasmon Resonance (SPR) biosensors are in demand for the detection of chemical and biological species for many applications including environmental monitoring, food safety monitoring, and for the pharmaceutical and medical industries. Such applications require devices that are highly sensitive and provide real-time sensing. SPR biosensors incorporate surface electromagnetic waves (surface plasmon polaritons) which propagate on the boundary of a metal-dielectric interface. Changes to the boundary, such as binding of biomolecules on the metal surface, produce changes in the optical signals to be measured. Thus, SPR devices can detect small concentrations of an analyte, in real-time, making them favorable for these applications. SPR sensors use several methods of optical excitation and this work investigates grating-coupled surface plasmon resonance (GSPR) for bio-sensing applications.

This paper presents the optimal design of a GSPR device in order to realize a highly sensitive sensor. The fabrication process flow for this device is discussed and includes using interference lithography (IL) to create the periodic grating features. IL was used instead of electron beam lithography because it can expose bigger areas and does not need expensive photoresists. A metallic bi-layer of chrome and gold is deposited on the device using thermal deposition techniques. The final step of fabrication includes bio-functionalization of the device for biosensing capabilities. During processing, the materials are characterized using various techniques including atomic force microscopy (AFM) and a scanning electronic microscope (SEM).

References:
[1] J. Homola, Chem. Rev. 108 (2) (2008) 462-493.
[2] J. Homola, S.S. Yee, G. Gauglitz, Sens. Actuators B 54 (1999) 3 -15.
[3] G. Zacco, F. Romanato, A. Sonato, D. Sammito, G. Ruffato, M.
[4] Morpurgo, D. Silvestri, M. Carli, P. Schiavuta and G. Brusatin, “Sinusoidal Plasmonic Crystals for Bio-detection Sensors”, Microelectronic Engineering, 2011, in Press.

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Grad. 82

Subcategory: Materials Science

Development of Pyroelectric Paint Films for Energy Harvesting Application

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This research examines for the first time the functionality of modified Paint-PZT composite films for use in pyroelectric infrared (IR) sensors and thermal energy conversion devices. Pyroelectric Paint: Lead Zirconate Titanate (Paint: PZT) composite films have been fabricated by the conventional paint brushing technique. The pyroelectric and dielectric properties of the composite films were examined for their use in uncooled infrared detectors and thermal energy conversion devices. The properties measured include: (1) dielectric constants (2) pyroelectric coefficient as a function of temperature. From the foregoing parameters, the materials figure-of-merits for infrared detection and thermal energy conversion were calculated. The results indicated figure-of-merits of composite films were higher than well-known pristine polyvinylidene fluoride films.

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Grad. 83

Subcategory: Physics (not Nanoscience)

Growth Morphologies in Active Elastic Bilayers

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Biological systems exhibit elastic instabilities such as buckling, folding and wrinkling. Very often, these instabilities are brought about by the growth of the system. We explore the deformation properties of a growing elastic medium resting on a passive substrate. Unlike other models, which have used the well-known Rodriguez formulation of growth, we adopt an ``active'' description. This in turn corresponds to having an active component of the stress tensor due to the proliferation of active units in the layer. We hypothesize that depending on the choice of activity, our continuum model can lead to different morphologies observed in differering systems from cells resting on the extracellular matrix to the cerebral cortex.

Furthermore, we show that there exists a mapping between the two formulations. We support our claims with both analytical and numerical results. The former are carried out in the thin lubrication limit, where the lateral length scale dominates over the transverse length scale. Whereas, numerical results are obtained using a finite difference scheme to solve the coupled partial differential equations of linear elasticity.
Our interest is in understanding what causes the different morphologies observed in many biological systems.

Funder Acknowledgement(s): STEM fellowship

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Grad. 84

Subcategory: Physics (not Nanoscience)

Absorption Studies of Diamond Nanoparticles using Photothermal Lens Spectroscopy

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Co-Authors: Aristides Marcano, Gour S. Pati, and Renu Tripathi, Delaware State University, Dover, DE

Photothermal lens spectroscopy (PTLS) is an indirect method of determining optical absorption and thermal properties of a sample. Based on a pump-probe optical scheme, it relies on measuring the change in the refractive index in the sample due to heating from incident pump laser energy. PTLS measurements are independent of sample scattering properties, and hence, suitable to studying crystals and nanoparticles.

We are studying photothermal and absorption properties of diamond nanoparticles to characterize their optical properties. Experiments are conducted using a collinear pump-probe setup with a diode pump laser at 445 nm and a probe laser at 532 nm. Z-scan is performed to improve calibration of absorption, and to determine any possible presence of nonlinear absorption in the sample. In addition, we measure absorbance in samples using a conventional transmission-absorption measurement system.

In this presentation, I will discuss the experimental details, and compare the results obtained using both PTLS and conventional transmission measurement techniques. I will also provide numerical values for the extinction and quantum yield of scattering for the diamond nanoparticle samples.

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Science and Mathematics Education

Grad. 85

Subcategory: Cancer Research

Examination of Breast Cancer Risk Calculator

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In 2013, over 2 million women in the U.S had been diagnosed with breast cancer. Breast cancer, the result of abnormal growth of breast cells is a major public health concern. There are many factors associated with increased risk of breast cancer. However the mechanisms by which they act are complex. There have been many tools developed with the intent of predicting breast cancer. Personalized medicine, a new ideal in healthcare, includes a focus on understanding and incorporating risk to improve the healthcare of individuals. Risk factors for breast cancer include mutations in the BRCA1 or BRCA2 genes, and the amplification of a human epidermal growth factor receptor, HER2. Some of the other risk factors include age, race, breast density, age at menarche, and family history of breast cancer. The goal of this project was to assess the accuracy of a publicly available breast cancer risk calculator, which has never been validated. The breast cancer risk calculator is a tool on the National Cancer Institute website that considers only five variables (age, race, family history of breast cancer in a first degree relative, history of breast biopsies, and breast density) to predict breast cancer. An additional goal was to further assess the risk calculator on specific simulated US sub-populations. To do this, we first created a simulated population created from a publicly available data-set. Upon validation, we tested the accuracy of the calculator using R software. These results will provide evidence regarding the efficacy of a widely available tool in breast cancer prediction.

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Grad. 86

Subcategory: Education

An Investigation of GI Bill Recipients with Disabilities of STEM as a Viable Career Option

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Students with disabilities and student veterans are vastly underrepresented in STEM despite being a valuable talent source. Research on student veterans with and without disabilities is limited. To realize the potential for student veterans with disabilities to contribute to STEM, we must identify the underlying issues that impact recruitment, enrollment, participation, and retention of this population in higher education STEM programs and develop research based strategies to support their goals.

Using an anonymous online survey of 19,000 GI Bill recipients at Virginia 2 and 4- year public institutions, we test the hypotheses that GI Bill recipients with disabilities will exhibit significantly lower participation rates in postsecondary STEM programs than GI Bill recipients without a reported disability and GI Bill recipients with disabilities will report that universal design and recruitment strategies are key factors in their enrollment and persistence in STEM. Preliminary data to date (n=198) indicate that 23.4% of respondents with a disability are participating in STEM programs compared to 30.5% of respondents without a disability. Non-STEM major respondents with a disability reported top reasons for not choosing a STEM major included: career goals not aligned with STEM (63%), unappealing employment opportunities in STEM (34%), and little interest in STEM (23%). STEM major respondents with a disability indicated that top reasons for choosing STEM were personal interest (83%), contribution to society (67%), natural aptitude (67%) and employment opportunities (50%). Future research involves further examining emerging trends and organizational factors that promote recruitment and persistence of students with disabilities in STEM programs.

References: Burelli, J.S. & Falkenheim, J.C. (2011). Diversity in the federal science and engineering workforce. Washington, DC: National Science Foundation, Directorate for the Social, Behavioral, and Economic Sciences (NSF 11-303).
National Science Foundation (2009). Veterans' education for engineering and science: Report of the National Science Foundation workshop on enhancing the Post-9/11 veterans educational benefit. McLean, VA: Author.

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Grad. 87

Subcategory: Materials Science

Materials Science and Engineering Clubs: A Successful Intervention Strategy for Nanoscience Education Targeting Middle and High School Students

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Most students attending underrepresented, minority-serving public schools are not fully aware of the importance of studying a field related to science, technology, engineering, and mathematics (STEM). As a consequence, they fail to comprehend how STEM disciplines are the basis of the most important technological advances and the constant search of life quality improvement. Thus, present and future generations, regardless of their upbringing and economic conditions, must be well educated in STEM. One successful strategy is via direct intervention by universities through STEM education activities, where students can observe and interact with real life applications. The University of Puerto Rico at Mayagüez hosts the Nanotechnology Center for Biomedical, Environmental, and Sustainability Applications (an NSF-funded Center of Research Excellence in Science and Technology or CREST). One of the Center's main educational components focuses on motivating the student community in middle and high schools to pursue college studies in STEM, with special emphasis on Materials Science and Engineering (MSE). To accomplish this goal, MSE clubs were established in regional public schools to awake their interest in materials science and nanotechnology. During club meetings, basic concepts of nanotechnology and MSE are taught through interactive demonstrations that capture the attention of the participants, which are then evaluated using an automated portable classroom response system. Over the years, a total of sixteen clubs have been established in Lajas, San Sebastían, Isabela, Aguadilla, Cabo Rojo, Hormigueros, and Mayagüez, all municipalities within the Western region of Puerto Rico. Our analysis has clearly established how students' career path decisions have been positively influenced by our intervention through their participation in the clubs. Finally, our assessment has also revealed that the MSE club mentors, i.e. teachers affiliated to the Center, detected an increased interest of the MSE club members in their own education in the classroom. During the second phase of the Nanotechnology Center new clubs from other municipalities will be established.

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Grad. 88

Subcategory: Social Sciences/Psychology/Economics

Deaf STEM Community Alliance: Frequency of Posts

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Students who are Deaf and Hard of Hearing (D/HH) face several challenges when pursuing a major in Science, Technology, Engineering, and Math (STEM) fields. One of these challenges is social isolation (Burgstahler, 1997; Foster, 2009; Johnson, 1997; Marschark, Lang, & Albertini, 2001; Saur & Rasmussen, 2003; Walter, 2009). The Deaf STEM Community Alliance is addressing this challenge by creating a model virtual (online) academic community for the deaf and hard of hearing students in Science, Technology, Engineering, and Math (STEM) majors, their faculty, mentors, and staff. It is a collaborative effort including students, faculty, and staff from Rochester Institute of Technology (RIT), Camden County College (CCC), Cornell University (CU), and D/HH STEM professionals across the United States. One of the project's goals is to address the challenge of socialization by encouraging D/HH students in STEM majors to participate online by contributing to ongoing conversations and or post STEM articles that is of interest to the Deaf and Hard of Hearing Virtual Academic Community (DHHVAC) Google+ Private page. Based on research studies on social media (for example, Facebook or Google+), most activity on the social media sites tends to occur during Tuesdays and Fridays during the morning at nine o'clock in the morning, and noon, Eastern time. Posts that are made at these times get the most responses from readers (Ford, 2014). The frequency of postings should be at a minimum of three times a week and the maximum should be ten times a week (Ford, 2014; Rowee, 2014, Goins, 2014; Zimmerman, 2014). These studies have looked at social media sites for the general public. The DHHVAC Google+ Private Community page is for purposes of discussing STEM topics with specific groups of individuals.

This research project tests the follow hypotheses:

- H1: The posts that receive the most activity will have been posted on a Tuesday, Friday, Saturday or Sunday.
- H2: The posts that receive the most activity have been posted at 9:00 am or 12:00 noon Eastern time.
- H3: The weeks with the most activity will have between three and ten posts.
- H4: Posting days and times will not be different for students, tutors, staff, or mentors.

This project will use descriptive statistics to analyze the frequency of posts made to the DHHVAC since February, 2013. The DHHVAC is in the process of analyzing data. Results will be shared at the conference.

The data will be used to understand the activity in the DHHVAC. The outcomes of the research may impact the posting activity in the DHHVAC. Future research questions might include: (a) What are the topics that encourage the most activity? and, (b) Are there any other effective times for posting?

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Social, Behavioral, and Economic Sciences

Grad. 89

Subcategory: Education

The Impact of Transactional Distance Dialogic Interactions on Student Learning Outcomes in Online and Blended Courses

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Theories of learning show that interactions between, and among students and teachers, play a role in determining student learning outcomes. However, studies that are based on these theories often fail to account for the mechanisms by which these interactions are influenced by the media of interaction; and miss the opportunity to identify and isolate the myriads of interactions that distinguishes a traditional brick-and-mortar/face-to-face (F2F) learning environment from an Online Learning Environment (OLE).

This study used Transactional Distance theory (Moore, 1993) to capture and measure how student interactions (as measured by dialogue) in online and blended learning environments impacted student learning outcomes, as measured by student satisfaction and student grades. Dialogic interaction was measured as student interactions with other students/learners (student-student interaction), the technologies used (student-technology interaction), the instructors or teachers (student-teacher interaction), and the course contents (student-content interaction). In addition, moderating effects of media of interaction, dispositional factors such as student academic level, and contextual factors such as ethnicity, on student learning outcomes were also measured. Survey data was obtained from 342 graduate, undergraduate, certificate, non-degree, and alumni participants enrolled in part time or full time synchronous or asynchronous, online or

blended courses during Fall, Spring, Summer, and Winter semesters between 2010 and 2013. Regression analysis, ANOVA, and Structural Equation Modeling were used to assess the contribution of dialogic elements to student learning outcomes; including the relationship between the dialogic elements and differences between subgroups such as online and blended students; male and female students, and students from high context and low context cultures. It was hypothesized that student-teacher interaction was the most important form of dialogue. However, the findings suggest an overwhelming importance of student interactions with course contents above other forms of dialogue. Implications for educational policies that require teacher-presence (student-teacher) and student-student interactions in distance learning environments are also discussed. Finally, a model is proposed for assessing the impact of dialogue on student learning outcomes in online and blended learning environments.

Funder Acknowledgement(s): Stony Brook University Technology and Society Department

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Grad. 90

Subcategory: Geosciences and Earth Sciences

Integrating Native American Beliefs and Western Environmental Scientific Context of Sustainability in the Preliminary Storyline of the Sol Y Agua Project

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The nation's shortage of scientists and engineers requires the participation of diverse students, especially Latino students, in STEM fields. However, the conventional curriculum fails to make connections with students' existing knowledge and backgrounds. The claim is that students' experiences with traditional curriculum prevent them from pursuing advanced STEM courses in high school, which limits their knowledge and curiosity in STEM subjects and careers. Research has shown that students can learn more when a curriculum integrates the local context. The Sol Y Agua project at the University of Texas at El Paso aims to develop the a virtual role-playing adventure game focused on sustainability and watershed problems in the El Paso-Rio Grande area. The game, which extends from the Smithsonian Latino Center (SLC)'s virtual role playing adventure game Mi Tierra-Mi Mundo, has the potential to increase students' attitudes, awareness, interest, confidence, and process skills in STEM subjects related to environmental themes.

The goal of this study is to gather local environmental and cultural information to develop the content of the game. The research intends to examine and compare the diverse perspectives of environmental stewardship held by environmental researchers, water officials, and local Native Americans. The study hypothesizes that the environmental knowledge of the local Native American transmits into the Western scientific context of sustainability, and this knowledge can be interconnected with scientific data in the game plot.

The Sol Y Agua project is based on a participatory design approach with semi-structured interview questions being used to elicit information about watershed problems in from local Native Americans and experts in the fields of agriculture, urban systems, ground water systems, and desert ecology. The responses will be assessed using grounded theory. Follow-up interviews will be conducted as needed. The themes and insights extracted from the interviews are being used to conduct design sessions to produce drafts of the game plot. The team will conduct usability surveys with students as active participants in the game design process.

The preliminary results indicate that local Native American beliefs of stewardship concur with Western environmental scientific context of sustainability. Their notion of gratitude corresponds with the ideas of local environmental researchers who advocate for practices that conserve water and protect water resources. Considering these similarities, the study to date has led to a recommendation that the Sol Y Agua game plot bring the concept of gratitude into the scientific notion of environmental sustainability to help students gain a deeper understanding of water sustainability issues in the desert.

Funder Acknowledgement(s): This effort is being funded in part by the NSF-funded CREST Cyber-ShARE Center of Excellence (HRD-1242122) and the NSF-funded BPR: Increasing STEM Participation and Success Rates of Latino Youth Using Culturally Relevant Immersive Technologies.

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Grad. 91

Subcategory: Social Sciences/Psychology/Economics

Perennial Energy Crops on Small Farms in North Carolina

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The study assesses whether perennial energy crops such as switchgrass will fit as an alternative enterprise on small farms in North Carolina and explores the implications of producing such perennial energy crop on the allocation of farms' land, labor and capital. A mathematical programming model is used to ascertain the optimal combination of crops that could include perennial energy crops. Alternative business scenarios - with and without land constraint, and with and without constraints on the amount of financial resources the farms have access to - are compared and contrasted. Results indicate that the price of

switchgrass will have to increase by as much as 11 percent in order to successfully compete with conventional crops. This implies that any regulations that require growing perennial crops in North Carolina are likely to have high shadow price for small farms. Further studies should also be conducted in the production costs and yield of feedstock especially switchgrass. A biomass feedstock with more yields is better but may be less competitive if its cost of production is relatively higher than those of other feedstock.

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Grad. 92

Subcategory: Social Sciences/Psychology/Economics

Anticipated Disgust, Willingness to Use Recycled Water and the Impact of Information

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Water recycling is increasingly recognized as a critical strategy for maintaining sustainable water supplies. Despite technological advances, public acceptance of these policies lags behind. Disgust reactions at the idea of using recycled water (RW) have been highlighted repeatedly in the literature as an important factor contributing to a lack of public acceptance. It remains unclear how aware individuals are of the role of disgust in their decisions about RW, how important anticipated disgust is to willingness to use RW when controlling for other factors, and how effective messaging would be in changing these attitudes. To this end, we used a three-pronged approach, including examination of qualitative data, multivariate analyses, and experimental methods, in a large representative US sample (N=500). In open-ended responses, only 2% of participants explicitly mention disgust as an important factor to decisions about RW. In contrast, when measured using a psychometric scale and entered simultaneously with other important individual difference factors, anticipated disgust (β=-.68, t(362)=-16.34, p<.001) became the single best predictors of willingness to use (F(14, 362)=31.83, p<.001, R2=.55). Attitudes about the environment (β=.10, t(362)=-2.29, p<.05) and risky behavior (β=.09, t (362)=2,40, p<.05) also emerged as important predictors. Finally, participants were exposed to one of three treatment conditions: one of two brochures framing the same information using cognitive or affective words and images, or a control group which only read a definition of recycled water. Condition did not impact willingness to use RW (F(2, 384)= 2.237, p=.108), however participants given information about RW (regardless of frame) reported less anticipated disgust than the control group (F(2, 384)=4.307, p<.05). Our findings have implications for how disgust is measured, as individuals may not be aware of the role their emotions play in decisions. These results also indicate that disgust reactions toward RW are not fixed, but that increased information about RW can help shift these quick, automatic judgments. Future research will focus on stronger messaging mediums that may be used to further influence willingness to use.

References: Rodriguez, et al. (2009). Indirect Potable Reuse: A Sustainable Water Supply Alternative. Int J of Env Res & Pub H., 6, 1174-1209; Po, et al. (2003). Literature review of factors influencing public perceptions of water reuse. CSIRO Land and Water, 1-39

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Technology and Engineering

Grad. 93

Subcategory: Chemistry (not Biochemistry)

A Study of Nickel and Iron Based Catalysts in the Heterogeneous Reaction of Tar Reforming and Ammonia Decomposition of Hot Syngas

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Syngas, which is the product of the gasification of biomass, is used in many applications, such as power production and in Fischer Tropsch Technology. The production of syngas is accompanied with several impurities. These impurities are mainly chlorine, sulfur, nitrogen and tar. For advanced applications such as Fischer Tropsch, syngas needs to be clean enough and tar should extensively be removed, Also in power production application, The tar in the syngas gas will condense at reduced temperature and will cause blocking and fouling of engines. In this research, different nickel and iron based catalysts are synthesized using the incipient impregnation method. Several catalyst characterizations and screening techniques are used. The measurement of total surface area and porosimetric analysis of the catalysts are conducted in a BET analyzer. The temperature programmed reduction as well as desorption analyses of the catalysts are carried out using a chemisorption unit. The physiothermal behavior of these catalysts is investigated to determine their thermal stability using a TGA unit. The crystallographic analysis of the synthesized catalysts is carried out using XRD to characterize the metallic distribution on the support. The BET results showed

high surface area around 400 to 480 m2/g ranged between monometallic and bimetallic catalysts. The TPR analysis has detected the reduction behavior of iron to be around 400˚C, whereas that of nickel is around 600˚C. The TPD results have approved the distribution of the adsorption as well as the desorption sites which further confirms the capability of the catalysts towards tar conversion into many commdity chemicals. The TGA results have shown that the optimum synthesization conditions of these catalysts to be around 450˚C. These results can show the capability of these catalysts in the catalytic conversion of tar as well as ammonia which will further produce a high quality syngas for downstream applications. Also, these results would lead to increase the hydrogen content in the syngas which is a beneficial factor in advanced Fischer Tropsch technology.

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Grad. 94

Subcategory: Civil/Mechanical/Manufacturing Engineering

Comparison of Computational Fluid Dynamic Simulation and Experimental Convective Heat Transfer Parameters Over Asymmetric Airfoil With Varying Angles of Attack

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The problem of ice accretion on an airfoil has been well chronicled. The hazards associated with ice formation on wings and engine inlets are well studied. Ice accretion can be extremely dangerous to an aircraft; as the built-up ice changes the aerodynamics of the airfoil surface, which can increase the risk of a subsequent stalling and loss of airfoil stability. Heat transfer characterization at various locations along the top and bottom surfaces of an airfoil is vital to creating an effective heat transfer model for an asymmetric airfoil. Empirical data can be used to obtain convective heat transfer parameters, i.e., Nusselt (Nu) and Reynolds (Re) Numbers.

Convective heat transfer parameters were studied for NACA 0010 airfoil section with chord and span lengths of 15 and 10 inches and a circumference profile of 30 inches. KH Kapton flexible heaters applied constant heat flux of (5W/in2) to the airfoil. Film sensors measured surface temperatures at various positions along the circumference of the airfoil. Tests were conducted using an Eiffel type wind tunnel powered by a 37 kW electrical motor that is able to generate subsonic air velocities up to 41 m/s in the 24 square-inch test section. While the airfoil was in the test section, its angle of attack was varied from 0 to 20 degrees. CFD modeling of the airfoil geometry was conducted using ANSYS FLUENT software analyzing laminar and turbulent flow. Temperature readings were used to calculate Nusselt and Reynolds numbers for laminar and turbulent flow. Results were in agreement with accepted correlations for Nusselt and Reynolds numbers for given airfoil. In the future, visualization of the forced convection will be conducted to further investigate turbulence.

References: Yusuf Dag, Stephen Akwaboa, and Patrick F. Mensah. “Determination of Forced Convective Heat Transfer Coefficients for Subsonic Flows Over Heated Asymmetric Airfoil”, 15th International Heat Transfer Conference, Kyoto Japan; 08/2014.
Michael Benissan, Stephen Akwaboa, and Patrick Mensah. “Experimental Measurement of Nusselt Number Correlations on Flat Plate and NACA 0010 Section Surfaces”, ASME 2012 Heat Transfer Summer Conference Rio Grande, Puerto Rico, USA, July 8-12, 2012.
Phillip E. Poinsatte, G. James Van Fossen, and Kenneth J. Dewitt. “Convective Heat Transfer Measurements from a NACA 0012 Airfoil in Flight and in the NASA Lewis Icing Research Tunnel, 28th Aerospace Sciences Meeting “ sponsored by the American Institute of Aeronautics and Astronautics Reno, Nevada, January 8-11, 1990.
M. B. Bragg, G. M. Gregorek, and J. D. Lee. “Airfoil aerodynamics in icing conditions”, Journal of Aircraft, Vol. 23, No. 1 (1986), pp. 76-81.

Funder Acknowledgement(s): CREST LaSPACE Consortium

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Grad. 95

Subcategory: Civil/Mechanical/Manufacturing Engineering

Modeling the Effects of Median Selection on Roadway Efficiency

Mikhail Gordon, Auburn University

Access management techniques affect the safety and efficiency of roadways. These efficiency impacts (travel time and delay) are investigated using microscopic traffic simulation. The simulation is completed using a segment of Opelika Rd in Auburn, AL. The roadway currently has a two-way lane turn lane (TWLTL) to control access to businesses and roadways. This TWLTL baseline is compared to using a raised median (RM) to control locations where left turns are permitted. Currently the 2.7-mile roadway averages 64 access points per mile; controlling these points is investigated to see its effects traffic movement.

To simulate this control the software package VISSIM is used. The TWLTL condition is made to have 46 access points where left turns are allowed. In the RM condition the number of access points is constricted to 20. The travel time and delay are recorded for all turning movements and for vehicles that travel the full roadway. This is completed for the baseline and two additional cases. Turning movements are increased by 50% and 100% in the cases two and three respectively. The dominant

movement traffic volume is increased by 20% in both of these cases.

Preliminary findings indicate that a RM increases the efficiency of the roadway by reducing the amount of delay. Turning movements are defined as left turns both onto and off of the mainline roadway. The delay experienced by turning movements is 10% higher with raised median. The delay experienced on the dominant roadway movement is 30% higher with TWLTL. The travel time is not significantly different between TWLTL and RM. These results are from the case with baseline traffic volumes. The effects of these results are expected to increase as the traffic volumes are increased for the other simulation cases.

It is seen from these results that both the TWLTL and RM have advantages and disadvantages. Future research will involve simulation of roadways with higher traffic volumes and using both TWLTL and RM interchangeably on a roadway. Roadways with different geometries will also be investigated to see if the geometry can have a significant effect on results.

References: Eisele, William. (2004). Estimating The Impacts of Access Management with Micro-Simulation: Lessons Learned. Paper presened at 6th National Conference on Access Management.
Foresite Group. (2012). Opelika Road Corridor Study: Existing Conditions Report.
Planung Transport Verkehr Traffic Mobility Logistics. (2012). VISSIM 5.40-03 User Manual.

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Grad. 96

Subcategory: Civil/Mechanical/Manufacturing Engineering

Simulation of Hurricane Induced Storm Surge Using an Implicit Solver Model

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In this paper a parallel storm surge model based on hybrid finite element and finite volume techniques to solve hurricane induced storm surge flow problem is presented. Hurricanes bring storm surges to the land, causing wide spread destruction. The technology is not matured yet to stop a hurricane from occurring. However, if the hurricane and storm surge can be predicted ahead of time, the people can be evacuated to safety. Storm surge models do the prediction through computer simulation of the problem. Storm surge models solve shallow water equations to predict the hurricane induced floods. In present study a segregated implicit projection method is used to solve the 2D shallow water equations on staggered unstructured meshes. The governing equations are written in non-conservation form. An intermediate velocity field is first obtained by solving the momentum equations with the matrix-free implicit cell-centered finite volume method. The nonlinear wave equation is solved by the node-based Galerkin finite element method. This staggered-mesh scheme is distinct from other conventional approaches in that the velocity components and auxiliary variables are stored at cell centers and vertices, respectively. The hurricane induced wind stress and pressure, bottom friction, Coriolis Effect, and tidal forcing conditions are used as inputs to this model.

The developed storm surge model is used to hindcast Hurricane Katrina (2005). The simulated Maximum Envelope of Water (MEOW) and High Water Marks (HWM) are compared with published data. The comparison is reasonably good. The Hurricane Gustav, 2008 storm surge will be simulated to further demonstrate the robustness and applicability of the model. The results will be used to compare parallel performance of the model to the sequential version of the model. The future research includes increasing the speed and accuracy of the developed storm surge model.

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Grad. 97

Subcategory: Civil/Mechanical/Manufacturing Engineering

Solar Photocatalytic Water Treatment on an Inclined Plate

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The energy-water nexus, combined with rapid high-density growth in cities, demands solutions to water scarcity that are sensitive to both energy intensity and the urban environment. Current water treatment systems are typically energy and capital intensive, but solar photocatalysis, the generation of hydroxyl radicals via UV-sunlight irradiation of titanium dioxide, offers a promising and cost-effective solution to water treatment. In this work, we explore optimization of an inclined plate photocatalytic reactor under solar conditions. Specifically, we relate inclined plate angle, solar incidence angle, and reaction rate to determine whether if, at scale, inclined plate photocatalytic systems could provide viable water treatment performance.

In this work, we construct a bench-scale inclined plate reactor coated with nanostructured titanium dioxide photocatalyst (catalyst area: 150cm2). Titanium dioxide nanostructures are grown on glass substrates using a modified sol-gel process applied by dipcoating with a 3d-printer and calcination treatment. Catalyst light capture and mass transfer in the reactor is analytically described using the Beer-Lambert law and first principles, and then experimentally verified via UV/Vis/IR spectroradiometry and observation. Together, these studies bracket a range of angle inclinations that offer optimal light capture and mass transfer. Water treatment is explored by the degradation of probe compound methylene blue in the reactor under a xenon arc-lamp solar simulator; photocatalytic decolorization of dye is quantified using a UV-Vis spectrophotometer. Under realistic solar irradiation for two hours, up to 62% reduction in dye concentrations is demonstrated, and supported with dark and no-photocatalyst control experiments. Our study indicates that laminar flow, achievable in plate angles 5-25 degrees at bench-scale flowrates, and high intensity UV have greatest influence on treatment performance, while angle relative to the incident light source is of secondary importance. We conclude that the inclined plate system, when operated with correct design parameters, has strong relevance for niche applications such as decentralized water treatment in sunny urban locations. Future research will involve extending these inclined plate studies to develop viable reactor designs to address niche needs, and quantifying reactor performance for treatment of realistic water pollutants (e.g. E. coli bacteria, organic pollutants, and heterogeneous wastewater matrices).

Funder Acknowledgement(s): NSF-EFRI

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Grad. 98

Subcategory: Computer Engineering

A Testbed for Modeling and Detecting Attacks on NFC Enabled Phones

Kimberly Gold, Tennessee State University

Modern mobile computing devices have enabled a wide array of applications in commercial and government sectors. The integration of sensors and communication interfaces have paved the way for emerging applications and services. In particular, the integration of Near Field Communication (NFC) in smartphones and tablets has benefitted payment and ticketing based services. These services typically process personal information stored on mobile devices which makes them an easy target for adversaries to steal or modify information. Due to the recent attacks on mobile payment and payment systems, there is a need for an experimental testbed to evaluate approaches to model and detect threats to normal operation of NFC enabled devices. The testbed comprises of 3 NFC enabled Android cell phones, RFID credit card, NFC tags, Frontier Comprobe Antenna, and associated software to generate attack vectors and monitor operations. The testbed is applicable for indoor and outdoor settings. We present experiments to generate and analyze the impacts of Replay attacks and Denial of Service attacks on NFC enabled phones. In our experiment, we install proxy software, NFCProxy, on two NFC enabled Android phones to implement a Replay attack. In the attack scenario the attacker holds the NFC enabled phone (Relay phone) near the victim's credit card and relays the data over the WiFi to the second phone. The second phone serves as the Proxy phone that will emulate the victim's card. The information is then sent multiple times in an effort to flood the Point of Sales terminal. Data related to the success of the Denial of Service attacks is currently being collected. However, the relay attacks were successfully performed in 75% of cases. These results show that the testbed architecture facilitates generation of the relay attack, which allows the victims data to be compromised. Future research involves the design and implementation of a cloud based classifier system to aid the testbed in further validation and evaluation of attack models and resilient control strategies under various attack scenarios.

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Grad. 99

Subcategory: Computer Science & Information Systems

A Hybrid Approach to Detecting Android Mobile Cloud Malware

Paul McNeil, Tennessee State University

Recently, the smartphone industry has seen tremendous growth due to the widespread adoption of devices based on Google's Android and Apple's IOS platforms. According to a recent study, both platforms constitute 64 percent of the market share, with Android and iOS share being 37 and 27 percent respectively. The worldwide market penetration of Android based smartphone and lack of a secure platform has attracted attention of malware developers. For instance, a recent DHS bulletin released in July 2013 has reported that 79% of all mobile malware affects Android devices. The ability to detect malicious applications developed for Android devices is crucial as the volume of such applications increases. A large number of detection tools focus only on attacks affecting the Android device. Yet, these tools have difficulty detecting malware that uses or attacks the clouds synced to the Android device. We propose a new model for detection based on a hybrid approach to Android malware analysis.

ANANAS and Mobile Sandbox (MS) are two tools which use both methods of Android malware analysis. MS at the time this is being written, provides only the static analysis report to the

public. ANANAS is not publicly available. Both ANANAS and Mobile Sandbox have tested known live malware samples with a successful identification average of over 90%. Yet, simulations including "unknown" malware samples remain in the mid-80s. While both systems retain information regarding malware network usage, neither performs further analysis to detect sensitive information offloading, secondary payload deployment, or other cloud-based attacks on Android systems. Our system is novel since it aims to perform this further analysis.

In our hybrid approach, we conduct static and dynamic analysis to extract features which represent the malware's typical activities on the smartphone system and network. The static reports from both MS and ANANAS combined with ANANAS' dynamic results reveal patterns. To determine the critical features that indicate malicious behavior, we analyzed 11 variations of the Plankton family. As a result of this analysis, we are able to identify 12 features, 3 feature sets, to use as input to known machine learning models. We expect our experiments, using the identified key features as input, to reveal a highly effective model for detecting malware that is using the cloud to propagate or avoid detection. These results will lay the foundation to the first-time detection of unknown, next generation, Android malware.

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Grad. 100

Subcategory: Education

Game Theme-Based Educational Modules for Introductory Programming Courses

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There has been an increasing interest in the use of game theme-based educational modules as an educational tool. The objective of this project is to help novice students understand object-oriented programming (OOP) concepts, namely encapsulation and polymorphism. The hypothesis is that the use of the game theme-based educational modules will lead to a better understanding of encapsulation and polymorphism than with traditional instructional approaches. Two game-themed instructional modules were developed as a supplementary way of teaching encapsulation and polymorphism to students in early programming courses.

The modules were developed in three phases. In the first phase, the environments for both modules was created using Vizard, a virtual reality development toolkit. In the second phase, three-dimensional models were incorporated into the environments. Using 3ds Max 2014, a 3D modeling and animation software application, we were able to convert the models into a format compliant with Vizard and added textures to them. Once the 3D models were integrated into Vizard, we scaled them to suit the environments. In the third phase, we implemented the modules using the Python programming language. We created user interface elements, such as drop-down menus and radio buttons, and functionalities such as a scoring system.

The results of previously developed modules showed a marked improvement in learning concepts after students used them. In conclusion, the encapsulation module and polymorphism module function properly and the user is able to learn encapsulation and polymorphism. Our future work involves evaluating the modules in introductory programming courses.

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Grad. 101

Subcategory: Electrical Engineering

Lensfree 3D Imaging of Sperms

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Dynamic tracking of spermatozoon is critical for medical sciences and animal husbandry, where motility and swimming trajectories are important indicators of sperm fertility. Three-dimensional (3D) swimming patterns of microswimmers have been underexplored mostly due to limitations of conventional lens-based optical microscopes, like poor depth resolution and the trade-off between field-of-view (FOV) vs. lateral resolution. Lensfree on-chip imaging offers a unique solution with ultra-large throughput in recording the 3D trajectories of sperms in large volumes (e.g.,8-17 mm3) with sub-micrometer 3D localization accuracy [1,2]. This computational imaging platform only requires a CMOS image sensor and two partially coherent light sources (e.g., two fiber-coupled LEDs at 625 nm and 470 nm wavelengths) at different incident angles (0° and ~45° respectively). The sample is placed close to the sensor (<1 mm), which records the interference patterns created by light that is scattered and transmitted by the specimen. Working under unit-magnification, this on-chip imaging geometry utilizes the full sensor active area (>17 mm2) as its imaging FOV.

Oblique and vertical reconstructions of the specimen are obtained separately by back-propagating the sensor output to multiple heights with the corresponding wavelengths, scanning the

specimen in depth. Each sperm within the specimen is associated with a vertical and oblique reconstruction pair separated by a distance proportional to its depth. The sperm head is localized in 3D with submicron accuracy from the centroids of these two reconstructions. Operating this on-chip imaging platform at high frame rates (>90-140 frames/second), detailed 3D trajectories are recorded. Using this platform, we reconstructed >24,000 individual 3D trajectories of human sperms. Such large statistics, for the first time, reveal that 4-5% of human sperms follow well-defined helical patterns [1]. Over 9,600 horse sperm trajectories were also reconstructed using the same platform and a chiral ribbon pattern has been discovered [2], also for the first time in the literature, among <30% of the trajectories; this chiral ribbon pattern is extremely rare in human sperm (<2%).

In summary, lensfree on-chip microscopy is a powerful method to image and track sperms over large volumes in 3D. The large throughput and sub-micrometer 3D localization accuracy of this platform has enabled us to reveal and quantify rare swimming patterns of human and horse sperms.

References: 1. Su, T.W., Xue, L. & Ozcan, A. 2012. High-Throughput Lensfree 3D Tracking of Human Sperms Reveals Rare Statistics of Helical Trajectories. Proceedings of the National Academy of Sciences. 109(40):16018-16022.
2. Su, T.W., Choi, I., Feng, J., Huang, K., McLeod, E. & Ozcan, A. 2013. Sperm Trajectories Form Chiral Ribbons. Scientific Reports. 3(1664):1-8.

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Grad. 102

Subcategory: Environmental Engineering

Experimental Determination of the Structural Evolution of Biomass Particles During Pyrolysis and Gasification

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Biomass pyrolysis and gasification (P&G) processes involve complicated structural evolution of solid biomass particles when volatiles are released. These changes exert some influence on the products. The structure of biomass particles is critical in determining the mass transport of the volatile species and physical properties of the particle. However, little comprehensive data about the structural evolution of biomass particles during P&G exists. We hypothesize to uncover the structural evolution of biomass particles during P&G using different experimental techniques.

A 100 ml tubular reactor and a thermogravimetric analyzer (TGA) were used to pyrolyze or gasify prepared sawdust samples. The effect of the P&G on the structure of biomass particles was studied at temperatures from 100˚C to 800˚C. The dynamic temperature-mass profiles of the char during P&G were studied using the TGA. Direct observation of the particle size and topography was performed with scanning electron microscopy (SEM). The crystallography of the evolving carbon structure was studied with X-ray diffraction analysis (XRD) while the surface chemistry and carbon-based organic molecules were determined with Fourier Transform Infrared Spectrometry (FTIR). The morphology, i.e. porous structure, pore size distribution and pore volume, together with the surface area, were analyzed with the Brunauer-Emmett-Teller (BET) method using N2 at 75K.

The TGA profiles indicated that char yield decreased with increase of the temperature. The decrease was more pronounced at temperatures above 400˚C, where more volatiles were released. The devolatilization resulted in more char pore openings, rough surfaces and irregular shapes, as observed with the SEM. The porosity and surface area increased significantly as shown by the BET study. However, above 600˚C, the structural ordering and micropore coalescence resulted in a decrease in surface area. The FTIR profiles indicated that as temperature increased, the char became increasingly more carbonaceous. Concurrently, the hydroxyl, carbonyl, aliphatic C-H and olefinic C=C groups gradually disappeared. Our findings show that the structures of sawdust particles evolve when subjected to different P&G temperatures. Future on-going research in our lab involves studying the effect of the structural changes on biomass gasification kinetics.

Reference: Dilek Angin, Effect of pyrolysis and heating rate on biochar obtained from pyrolysis of safflower seed press cake, 2012.

Funder Acknowledgement(s): This study was supported by a grant from National Scientific Foundation (Grant # HRD 1242152) awarded to the CREST Bioenergy Center at North Carolina A&T State University.

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Grad. 103

Subcategory: Environmental Engineering

Numerical Modelling for Assessing Alternative Energy Potential in Landfills

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Heat and gas are significant byproducts of landfilling processes. Both byproducts are generated due to various biochemical reactions and decomposition processes. Landfills typically utilize methane to provide a significant source of energy and to avoid introducing harmful greenhouse gases to the atmosphere. Heat, however, has not been utilized and excess heat can create engineering performance problems in landfills (Onnen, 2014). Heat extraction using a network of ground source heat pumps may provide a novel alternative energy source and potentially mitigate the elevated temperatures (greater than 45oC) in landfills. Temperature control may result in increased gas production as well as improved engineering performance of landfills.

A heat extraction system (HES) was modelled using finite element analysis. An axisymmetric model using quadrilateral elements was used to simulate heat generation in various landfills from around the world. Heat generation was simulated using an exponential growth/decay model developed from empirical data. A heat flux boundary was placed vertically at the origin of the model to simulate heat extraction. The flux was determined by empirically-based fourth order polynomials that predict heat exchange between the fluid media in pipes extending vertically into the landfill and the waste mass.

Numerical results indicated that more than 250,000 MJ could be extracted over a 40 year period and a potential 13% increase in methane production could be obtained under optimal temperature (35oC to 40oC). The zone of influence for a HES was established providing optimal spacing for a system of multiple wells.

A prototype HES was recently installed at Cold Canyon landfill in San Luis Obispo. This system was designed using the data obtained from the numerical investigation. Future research will advance the numerical model to include convective flow (i.e. leachate and gas), an energy expended (instead of exponential growth/decay) formulation, and application of daily n-factors. The HES at Cold Canyon is currently being tested to determine operational performance. The data collected from this site will be used to validate the previous models, confirm the hypothesis for heat extraction, and provide a framework for design of future installations. The ultimate goals of this research are to provide an entirely new source of alternative energy that has not been previously utilized and to optimize landfill performance through temperature control.

References: Onnen, Michael. (2014), Thermal Numerical Analysis of Vertical Heat Extraction Systems in Landfills, M.S. Thesis, California Polytechnic State University, San Luis Obispo.

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Grad. 104

Subcategory: Materials Science

Morphological Study of Polymer Solar Cells

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Organic photovoltaics (OPVs) are a promising candidate for future solar power generation with the possibility for very inexpensive continuous processing. OPV panels can be manufactured very quickly like a coating because the organics are deposited from solution. The current highest efficiency OPVs rely on Phenyl-C61-butyric acid methyl ester (PCBM) and Poly(3-hexylthiophene-2,5-diyl) (P3HT) which have been heavily studied and optimized. Likely new, more effective materials are necessary to make further advances in the efficiency of OPVs. Additives alter the drying time or provide crystal nucleation sites to better order the bulk heterojunction (BHJ) and thus improve performance. In PCBM/P3HT BHJ OPVs, the effect of various additives is largely well understood. The interaction of additives and conducting polymers apart from P3HT remains largely unknown. A better understanding of these interactions could enable smarter, quicker testing of the multitude of possible conducting polymers when applied to OPVs to find the next highest efficiency combination.

By prolonging film drying time with a high boiling point additive (specifically chloronaphthalene) and providing additional nucleation sites with a nucleating agent, we were able to control film morphology of all-polymer bulk heterojunction (BHJ) organic photovoltaic (OPV) devices. Additionally a nucleation agent was used to the same effect and both aided in increasing device performance. BHJ OPV devices were produced from intermixed solutions of donor polymer (PBDTTT-C-T) and acceptor polymer (P-NDI2OD-T2). The active layer of the devices was blade coated from solution to simulate the large area slot-die coating technique utilized in continuous roll-to-roll processing. Various blading speeds were attempted from 5 to 40 mm/s to obtain active layer films of around 100 nm, as measured by variable angle ellipsometry. Films deposited with 20% v/v CN and 1% w/w DMDBS were used in synchrotron grazing incidence X-ray diffraction measurements along with control films with no additives. The diffraction results displayed a shift from primarily face-on orientation to edge-on orientation for the acceptor polymer (P-NDI2OD-T2) in the BHJ. Power conversion efficiencies (PCEs) of the devices were measured to be as high as 1.4% for conventional architecture and 1.7% for inverted architec-

ture, nearly 40% higher than control devices. The electrical properties of the highest performing OPV device were an open circuit voltage (Voc) of 820 mV, a short circuit current density (Jsc) of 4.6 mA/cm2, and a fill factor (FF) of 46%. Future research will analyze in-situ BHJ formation to better understand how the additives affect the morphology. The results will be utilized to correlate performance-processing relationships able to inform future formulations for devices.

Funder Acknowledgement(s): NSF, NIST

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Grad. 105

Subcategory: Materials Science

Surface Redistribution Kinetics of H/Li on Graphene for Advanced Energy Storage

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The motivation for this project is to create advanced materials for energy storage in battery electric and fuel cell electric vehicles, which show great promise as future energy solutions. One of the best candidate materials for enabling this technology is high surface area carbon. In order to leverage the high surface area in batteries and hydrogen storage tanks, investigations on how hydrogen and lithium interact with carbon substrates are required. Thus, in this study, we use first principles calculations to determine the kinetics and thermodynamics of the redistribution of hydrogen and lithium on graphene. We find that hydrogen and lithium move and pattern differently on the surface which we are able to explain in terms of fundamental differences in bonding mechanisms. For future research, we plan to investigate the homogeneity, concentration, and voltage dependency of hydrogen and lithium on graphene.

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Grad. 106

Subcategory: Materials Science

Platinum-free Cathode Catalysts for Solid Acid Fuel Cell Applications

Vanessa Evoen, California Institue of Technology

Fuel cells are efficient converters of chemical energy to electrical energy, with the potential to meet substantial energy demands with a small carbon footprint. Intermediate temperature fuel cells (200-300°C) are attractive fuel cell types, as they combine kinetic benefits of higher operating temperatures, with the flexibility in fuel and material choices that lower operating temperatures allow. A SAFC comprises of a solid acid electrolyte, in this case cesium di-hydrogen phosphate (CDP), an anode where the fuel (commonly hydrogen) is oxidized, and a cathode where oxygen is reduced. The major set back in bringing SAFCs to market is the high platinum catalyst loading at the cathode where the oxygen reduction reaction (ORR) takes place. State of the art SAFC cathodes have a catalyst loading of about 8 mg/cm^2 and area specific resistance (ASR) of about 0.4 ohms cm^2.

This work focuses on the development of highly defective multi-walled CNTs as potential alternative ORR catalysts at the cathode. CNTs were grown by metal organic chemical vapor deposition (MOCVD) using nickel as the seed catalyst and acetylene as the carbon source. It was found that growth temperature scales inversely with the density of defect sites in the MWCNTS as characterized by Raman spectroscopy. Composites were prepared by milling the CNT material with micron-sized CDP electrolyte to obtain a composite electrode with pores for oxygen access. A symmetric cell comprised of two porous electrodes and a dense CDP electrolyte was prepared and tested by AC Impedance Spectroscopy in humidified oxygen. It was found that electrochemical activity increased with increase in defect density as characterized by Raman spectroscopy. Area specific resistances (ASR) as low as 400 ohms cm^2 have been measured for CNT/CDP composite electrodes.

Furthermore, additional active sites in the form of –COOH functional groups, characterized by Fourier Transform Infrared Spectroscopy (FTIR), can be incorporated by an acid treatment of CNTs. Electrodes made with these functionalized CNTs show increased activity by an order of magnitude, corresponding to a decrease in ASR to ~45 ohms cm^2. A promising route to further decrease the ASR to get comparable activity with platinum, is the additional doping of the CNTs with nitrogen. Nitrogen-doped CNTs are the most active form of MWCNTs shown in the literature for lower temperature applications. In addition, it has been shown in our research group that using electro-spray to make porous composite electrodes can increase the electrolyte surface area and increase catalyst utilization. We plan to use this method to make electrodes with our active CNT material, to get ASRs that are comparable to state-of the art platinum electrodes. In conclusion, we plan to present at the conference novel platinum-free cathodes with high activity and stability.

Funder Acknowledgement(s): NSF, ARPA-E , DOW

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Grad. 107

Subcategory: Materials Science

Influence of Different Peroxide Initiators on the Cure Behavior of Bio-Based and Recycled Unsaturated Polyester Resins

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Many unsaturated polyester resins are produced from petroleum based by-products as synthetic polymers, and the movement to save the world and its natural resources are all but pressing. By controlling the cure reactions of these polyester resins may lead to less energy consumption during curing. Hence, the objective of this research was to study the effects of four different peroxide initiators on the cure behavior, thermal properties and subsequent development of material properties of unsaturated bio-based Envirez™ 70301 and recycled Envirez™ 50380 polyester resins provided by Ashland Incorporated. These resins are widely used in pultrusion of composite parts which require less time to cure. The peroxide initiators used in the study were Methyl Ethyl Ketone Peroxide (MEKP), Tert-butyperoxy benzoate (TBPB), Luperox® CU80 and Luperox® IS-300 measured at one part per hundred for initiation of polymerization process during curing. To determine the initiator (s) with the most controllable reaction kinetics based on each resin system, dynamic differential scanning calorimetry (DSC) was utilized and results analyzed using Flynn-Wall-Ozawa and Kissinger models of kinetic analysis. Results from the study indicated that MEKP and TBPB had the highest enthalpy, while Luperox® CU80 and Luperox® IS-300 showed the lowest values. Also, samples with MEKP showed a much broader and less intense exothermic peak, while TBPB showed the highest and narrow exothermic peak compared to the other initiators considered under the study. These results indicate the potential use of Luperox® CU80 to achieve a fast reaction time necessary for fast speed line during pultrusion applications. Future work would involve utilizing varying amount of appropriate initiator concentration for material property optimization.

Funder Acknowledgement(s): NSF-EPSCoR, NSF-CREST

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Grad. 108

Subcategory: Materials Science

Development of Functional Nanomaterials from Waste Avian Eggshells

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The United States produced about 95 billion avian eggs, equivalent to 704 million kg of eggshell as waste in 2013. The landfill is the final abode for the eggshell due to unidentified potential alternative use. The eggshell is rich in calcite crystals and other minor inorganics which are deposited in layers of organic moieties, giving it a well-defined structure and good properties to support the egg. A critical consideration of this shell being regarded as waste suggests that resources can be derived from it to benefit our society. The predominance of calcite makes it a sustainable and cheap source of calcium carbonate for drug delivery, tissue regeneration, polymer fillers, and food supplements among other uses. Calcium based materials like hydroxyapatite, calcium silicates and calcium silicate hydrates (bio ceramics) and composites can also be made from eggshell precursor, avoiding the use of toxic chemicals precursors. We proposed that the avian eggshell can be converted into useful and sustainable materials capable of replacing current ones that are obtained using unsustainable and toxic precursors. Therefore, we studied eggshell nanopowder (ENP) synthesized through mechanical attrition and ultrasound irradiation for the reinforcement of green composite structures and its hybrid, calcium silicate (CS) for tissue regeneration and structural engineering purposes. Both ENP and CS significantly improved the thermal decomposition temperatures, storage moduli, coefficient of thermal expansion (CTE) and flexure properties of Super Sap 100/1000, a high plant based content epoxy formulation. In vitro cell cytotoxicity studies of CS on ATCC CRL 11372 human osteoblast cell line showed nontoxicity and biocompatibility. Also, taking advantage of the inherent porosity of the eggshell crystals and the antimicrobial activity of stable silver metal, we synthesized ENP/Ag filter/antimicrobial nanocomposite material and investigated its antimicrobial and water filtration suitability. The results showed great promise and is being further experimented. These outcomes suggest that copious amounts of eggshell being dumped into landfills can be turned into resources.

References: V.H Walton, J.O. Cotteril, M.J. Vandepop. Composition of shell waste from egg breaking plants. Poult Sci 1973; 52 (5):1836.
T.J. Boniface, V.K. Rangari, S. Jeelani. Effect of Reinforcement of Sustainable β-$CaSiO_3$ Nanoparticles in Bio-based Epoxy Resin System. J Appl Polym Sci 2014; 131, 40867. Doi:10.1002/app.40867.

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Grad. 109

Subcategory: Mathematics and Statistics

Influence of Halloysite Nanoclay on Curing, Mechanical and Thermal Properties of Bio-Based Epoxy Resin System

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The field of nanotechnology is a popular area for current research and development for all technology applications. Polymer science and technology includes a broad range topics including studies into the effect of nanoparticles on polymer matrix. Research has shown the addition of nanoparticles will increase toughness and Young's modulus of the polymer samples. However the extent of improvement depends on several factors such as chemical interaction between the epoxy and nanoclay, method of dispersion and rate of curing. In the present research project, the curing, mechanical and thermal properties of a bio-based epoxy polymer containing 0, 1, 2, 3, and 4 wt. % of dispersed halloysite nanoparticles were investigated. Firstly, the cure kinetics of the epoxy resin with and without nanoparticle was determined by dynamic testing using DSC. In literature, "nano-effect" has been recorded to change the glass transition and the Tg of the polymer matrix. This effect can both increase and decrease the glass transition, depending upon the interaction between matrix and nanoparticle. Secondly, thermal properties were evaluated to determine the weight loss, coefficient of thermal expansion (CTE), storage and loss modulus. The introduction of nanoclay to the bio-based epoxy system decreases the flammability therefore increasing applications for the final composite panel. Thirdly, flexural analysis was used to define the impact of the halloysite on the strength and modulus of the cured samples. Replacing components of the epoxy system with recycled material may reduce the overall strength so adding the nanoparticles replenished and improved the mechanical properties. The halloysite nanoclay effected Tg and heat of reaction contributes to the curing process. Gradual weight loss of the nanoclay infused epoxy samples compared to the neat epoxy samples over a wide range of temperature shows a barrier was formed by the nanoparticles during curing. The halloysite nanotubes showed an overall improvement in properties. The next step is to introduce other nanoparticles to this polymer system. Once characterization is complete, a comparison of data will determine the best nanoclay percentage to infuse into epoxy resin which will lead to producing fiber reinforce bionanocomposites using woven flax fabric as reinforcement.

Funder Acknowledgement(s): NSF-CREST, NSF-EPSCoR & NSF-IGERT

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Grad. 110

Subcategory: Nanoscience

A Study of Glassy Carbon and Carbon Nanofiber Electrodes for Glucose Detection in Homogeneous Solution

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Glassy carbon (GC) and carbon nanofiber (CNF) electrodes were used for the electrochemical detection of glucose in homogenous solution. Glassy carbon is a standard electrode material for biosensing due to its low electric resistance, wide potentiometric window, and good biocompatibility. Carbon nanofibers (CNFs) were vertically aligned with a diameter range of 25-100 nm and height ranging between hundreds of nanometers and one micron. CNFs possess the additional advantage of relatively simple integration into a silicon-based device. The objectives in this study are: (1) to perform electrochemical characterization of both the glassy carbon and the CNF electrodes, and (2) to detect glucose in homogenous solution. It was hypothesized that the CNFs electrode would have a faster response time to the addition of glucose in comparison with the GC. Characterization of both electrodes was done using electrochemical techniques cyclic voltammetry and amperometric. The amperometric studies were conducted with both electrodes using dilute concentrations of hydrogen peroxide (H_2O_2) solution to observe the current response of both electrodes of oxidation of H_2O_2. The results showed a faster current response for both the CNFs electrode with a stair step curve in comparison with the GC electrode, which had a gradual increase, with the addition of the H_2O_2. An enzymatic kinetics was conducted to determine the activity of the glucose oxidase using UV-Vis spectrum. In this study, a cocktail mixture was used, which included the following: 1) 10mM phosphate buffer saline solution, 2) 1.56mM 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS)/horse radish peroxidase (HRP), 3) 1M glucose and 4) different concentration (0.100mg/ml, 0.050 mg/mL and 0.025mg/mL). The ABTS is a dye substrate that turns the cocktail a bright dark aqua blue-green color when oxidized. This color was changed with the addition of the glucose oxidase to the cocktail. For the homogenous glucose detection investigation, electrochemical technique performed was amperometric. The results showed current response for the GC electrode with the addition of 1M glucose solution. In the immediate future, further testing will be performed with the CNFs electrode using the same setup as the GC electrode and heterogeneous testing using both electrodes.

References: Bateman, R. C., & Evans, J. A. (1995). Using the Glucose Oxidase/Peroxidase System in Enzyme Kinetics. *Journal of Chemical Education*, *72*(12), A240. doi:10.1021/ed072pA240.

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Grad. 111

Subcategory: Pollution/Toxic Substances/Waste

Characterizing VSP Distribution of Heavy-Duty Diesel Trucks in Port of Houston Area

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The purpose of this study was to characterize the VSP distribution of trucks in port of Houston area in order to give recommendations on how to mitigate pollution. The Bayport terminal was selected for the study.

With respect to the considerable amount of emission created by the trucks and significant air pollution impacts on living in communities, it causes adverse health effects, particularly for children, the elderly, and those with compromised health. The easiest and fastest way to make changes to decrease the amount of emission is through making changes in the truck circle. The purpose of this study is designed to investigate the amount of emission created by trucks.

Instantaneous speeds of vehicles were collected on a second-by-second basis using GPS device. Then, for each second-by-second data, acceleration rate and Vehicle Specific Power (VSP) value were calculated. There were 5 heavy duty diesel trucks chosen for 6 weeks, 5 days a week. The area of the study was limited to a specified area with the areas covering 11 zip codes. VSP were used to obtain the operating mode distribution bins according to the standard provided by the MOVES. The vehicle emissions were calculated based on the operating mode binning approach. Emission factors analyzed in this study are Carbon Dioxide (CO2), Oxides of Nitrogen (NOx), Hydrocarbons (HC) and particulate matter (PM).

As a result, the frequency of bin 1 (idling mode) has the highest approximate percentage equal to 59% that represents the amount of time that trucks had been moving at less than one mph, which shows the amount of time the truck had been in a long line for entering and leaving the gates, inspection of the vehicle or inspection of the truck load or any other reason that truck is stopped but the driver did not turn off the vehicle. With respect to the information given in the introduction and the review of literature (Background), the highest percentage of operating mode ID and as a result the highest emission distributed, is related to the idling mode.

To figure out the unexpected amount of bin 1 (idling mode), it's suggested that we prepare a survey about drivers behavior. Also, it's recommended checking the location of the truck when it's stopped for more than 2 minutes. Also for future research, it's suggested that the the efficiency of the current application of Port of Houston Authority and the current truck circle be improved in order to avoid idling by managing time as much as possible.

Funder Acknowledgement(s): NSF CREST.

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Grad. 112

Subcategory: Water

Impacts of Conventional Uranium Mining on Groundwater in the San Juan Basin

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With few exceptions, all conventional sources of electric power are associated with large volumes of water to produce the fuel and/or generate the electricity. Growing electric power demands thus result in increasing impacts on water resources, especially in the arid southwest. Electricity production from nuclear power provides 19% of total US energy demand, but more than 83% of the required uranium is currently imported. It is estimated that uranium reserves in the San Juan Basin in northwestern New Mexico contains nearly 600 million pounds of ore, primarily in the Morrison Formation, leading to renewed interest in uranium mining in the basin. However, most of these reserves are located in high quality and productive aquifers consequently future underground development would have large impacts on an already limited resource.

This paper describes a modeling study to explore the relationship between uranium development and water resources in the region. The basin was divided into nearly 300 interconnected cells to account for geologic and hydrologic variability and a spatial-compartmental (Roach and Tidwell, 2009) or mixing cell approach within a system dynamics framework was applied to model groundwater flow and the impacts of uranium mining on groundwater resources in the Morrison Formation. Results from the model simulations show storage loss in cells in the vicinity of potential mines, very large cones of depression and extraction of large volumes of water associated with mining. The model suggests that the impacts of uranium mining on groundwater vary largely as a function of sub-regional geology and groundwater hydrology.

In addition to uranium resources, it is estimated that the San Juan Basin contains large amounts of undiscovered oil (19.10 billion barrels), gas (50,584.6 billion cubic feet), and liquid natural gas (148.37 million barrels) resources (USGS, 2013), all of which to varying degrees require water in the extraction proc-

ess. The aforementioned uranium model is the first step in developing a model of all energy resources within the basin and their potential impacts on groundwater, driven by increasing interest in development within the basin. The final product will incorporate all resources in a system dynamics framework in order to analyze tradeoffs associated with each resource and extractive technology, potential groundwater impacts, and aid decision makers regarding future development in the basin. Additionally, the final product will be transferable to other hydrologic basins with sufficient data to support analysis of energy development and groundwater interactions.

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Undergraduate Abstracts for Oral Presentation

Biological Sciences

OA #1

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

NMR Monitoring of Metabolic Conversions of Substrates Important in Glycosaminoglycan Synthesis

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Co-Author(s): You Zhuo and James Prestegard, University of Georgia Complex Carbohydrate Research Center, Athens, Georgia

Sugar nucleotides are important building blocks for the cell surfaced carbohydrates that mediate communication between mammalian cells and their environment. The intracellular concentrations of sugar nucleotides are, therefore, closely regulated. One possible regulation point is the inter-conversion of UDP-GalNAc and UDP-GlcNAc by an epimerase enzyme. Our goal is to monitor the inter-conversion by NMR and assess its importance as a regulatory element. To facilitate observation we introduce an NMR active isotope that can be observed in complex biological systems; for example, 13C. We have begun by producing 13C GalNAc labeled at the C1 carbon of the acetyl group and monitoring production by NMR methods. This will be followed by monitoring the phosphorylation of UDP-GalNAc production and enzymatic epimerization. The results may provide a basis for the development of new therapeutics to control disorders related to glycosaminoglycan synthesis. We will report on progress in this research.

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OA #2

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Genetics Impact on Generational Taste Preferences: It Runs in the Family

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The objective of this study is to test if genetics and ethnic backgrounds play a role in taste preferences. General surveys and interviews will be conducted to determine these factors. The surveys and interviews will act as a means to determine each test subject's taste preferences without triggering or putting anyone at risk of food allergies or other dietary matters. Conducting interviews and surveys will also provide a more profound look into cultural influences on taste preferences. Specified shared gene(s) among different cultural backgrounds will play a role in determining if genetics have an impact on generational taste preferences. The question of children in a specific background or certain gene pool and being a picky eater will be researched in the near future.

Research will also be conducted to determine if environmental changes and peer pressure play a role in a child being more receptive to trying new foods (even if the new food was rejected in previous settings). The contribution to this research will be a method of tracking of what has been introduced in different families' taste preferences and correlating what can be removed or introduced in order to provide a child with a better reception to trying new foods.

Funder Acknowledgement(s): LSAMP

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OA #3

Subcategory: Biomedical Engineering

Effects of Fetal Bovine Serum Proteins on Bacterial Biofilm Formation

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Biofilms are sessile microbial communities that are highly tolerant to antibiotics. Thus, biofilm-associated infections are difficult to control, leading to high motility and morbidity. In this study, we hypothesized that certain protein factors in the blood can inhibit biofilm formation. To test this hypothesis, we studied the effect of fetal bovine serum (FBS) on Pseudomonas aeruginosa PAO1 biofilm formation. The bacteria were treated with FBS and protease-inactivated FBS to determine if any proteins in the FBS have biofilm inhibitory activities. Our results showed that the active FBS inhibited biofilm formation of P. aeruginosa PAO1 for 24 h with no major effects on planktonic growth of this bacterium. Further research to identify the active factors will help develop more effective biofilm control methods.

Funder Acknowledgement(s): This study was supported by the NSF EFRI-REM program (1431222).

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OA #4

Subcategory: Biomedical Engineering

Optogenetic Spinal Stimulation Evokes Forelimb Movements

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Spinal cord injuries (SCIs) occur in ~20,000 patients/year in the United States. If a procedure for stimulating the spinal cord could be developed, researchers may be able to restore functionality to these patients. Intraspinal microstimulation (ISMS) has been shown to evoke a broad pattern of movements prior to injury and up to 9 weeks after injury (Sunshine, 2013). To target specific populations in the spinal cord we attempted to repeat this protocol using optogenetics. Optogenetics involves the transfection of light-sensitive channels (Chr2) into neurons allowing for the targeted activation when stimulated with blue (473nm) light (Alilain, 2008).

Rats were instraspinally injected with AAV-CamKIIa-Chr2-mcherry virus in 6 sites spanning spinal segments C3-T1. After an 8 week transfection period rats underwent an optogenetic mapping procedure that assessed forelimb movements elicited by epidural light stimulation. Photostimulation was applied at 24 sites and ten different intensities. Forelimb movements were analyzed using electromyography (EMG) and videography. Additionally, we performed histological examinations on the transfected tissue in order to correlate the results from the EMG and video footage with the efficiency of the Chr2-viral spread at the different stimulation sites.

Similar to the ISMS study, we were able to elicit observable forelimb movements at a majority of the sites tested. Histological images verified that the sites where we could not elicit observable movements had diminished viral transfection. Interestingly, we did observe that increasing the intensity of the photostimulation tended to cause a graded increase in EMG response within a muscle and a significant shift in number of coactivated muscles ($p<0.001$).

We intend to repeat this study with more targeted transfection as well as moving toward red-shifted optogentic channels to combat difficulties with light diffusion. We also plan to use the information gained in this study to use implanted LEDs for targeted regeneration studies.

References: Sunshine MD, Cho FS, Lockwood DR, Fechko AS, Kasten MR, Moritz CT (2013) Cervical intraspinal microstimulation evokes robust forelimb movements before and after contusion injury. J. Neural Eng.
Alilain WJ, Li X, Horn KP, Dhingra R, Dick TE, Herlitze S, Silver J (2008) Use of Channelrhodopsin to Restore Function after SCI. Journal of Neuroscience.

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OA #5

Subcategory: Cancer Research

The Comorbidity of Ovarian and Colorectal Cancer

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Colorectal cancer patients with family history of breast cancer, have higher risk of developing ovarian cancer. Ovarian cancer is the fifth leading cause of death in women. It is often described as a “silent killer” due to a lack of early diagnostic strategies. There are over 300,000 diagnosis of colorectal cancer a year. Both ovarian and colorectal cancer can be treated if detected in their early stages. The hypothesis is Colorectal cancer can promote the growth and migration of ovarian cancer as much as LPA. If ovarian cells are treated with conditioned medium or fluid from colorectal cancer cells, then they will respond similarly as when treated with LPA. Lysophosphatidic acid (LPA) is a bioactive phospholipid found in abnormal concentrations of the ascitic fluids of ovarian cancer patients as well as in plasma of colorectal cancer patients. LPA promotes tumor cell proliferation, survival, adhesion, migration, invasion, and metastases. Our objective is to investigate the influence of colorectal cancer on the development of ovarian cancer. To execute the objective the growth rates of ovarian cancer cell

line, Caov-3 and colorectal cell line, HT-29 will be assessed with or without LPA stimulation. LPA-mediated biological processes such as wound closure assay will also be evaluated in both cell lines. Caov-3 ovarian cancer cell line will be stimulated with conditioned medium from HT-29 colorectal cancer cell line to assess the ability of colorectal cancer to mediate aggressive cancer behaviors in ovarian cancer. The results demonstrate that Lysophosphatidic acid is indeed a growth factor for colorectal cancer patients. In future experimentation it has to be confirmed that LPA is a growth factor ovarian cancer. Ovarian cancer cells will be treated with colorectal conditioned medium. The growth will be compared to the cells that were treated with LPA. The findings will assist in answering the question does colorectal cancer drive ovarian cancer.

Funder Acknowledgement(s): HBCU-UP

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OA #6

Subcategory: Cancer Research

Mefloquine Decreases the Proliferation of Triple Negative Breast Cancer Cells

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Triple negative breast cancer is the most aggressive subtype of breast cancer and disproportionately affects African-American women. The increasing incidence and mortality rate of TNBC in patients along with no known pharmacological targets emphasizes the importance of novel therapies for effective drug treatment. Recent studies have revealed that anti-malarial compounds play an antagonist role in the proliferation in prostate cancer cells. In this study, we explored the effect of mefloquine, an antimalarial compound and its effect on triple negative breast cancer cell lines MDA-MB-231 and MDA-MB-468. Mefloquine is a prophylactic, anti-malarial compound that triggers oxidative stress in vitro. We hypothesized that mefloquine would cause an anti-proliferative effect on the cancerous cell lines, MDA-MB- 231 and MDA-MB-468. Alamar Blue assay was used to assess cell proliferation and crystal violet was used to assess cell death. There was an IC50 of in MDA-MB-231 and MDA-MB-468 cells of 30% and 40% at the 10-4 and 10-5M concentrations, respectively. The crystal violet data indicated that mefloquine caused only 39% viability at the nanomolar concentration and 25% viability at the micromolor concentration. No viability was detected at the millimolar concentration. Taken together, mefloquine demonstrated to have a significant antiproliferative effect on both TNBC cell lines and significantly decreased cell viability. Given the activity of mefloquoine, there is potential in evaluating analogs of this agent as a potential anticancer drug. These findings indicate that further investigation of mefloqine and its analogs should be further investigated as potential anticancer therapeutic agents.

Refrences: Anders, Carey K., and Lisa A. Carey. 'Biology, Metastatic Patterns, and Treatment of Patients with Triple-Negative Breast Cancer.' Clinical breast cancer 9 (2009): S73-S81. Print.
Kuo, Wen-Hung, Yao-Yin Chang, Liang-Chuan Lai, Mong-Hsun Tsai, Chuhsing Kate Hsiao, King-Jen Chang, Eric Y. Chuang, and Ju -Seog Lee. 'Molecular Characteristics and Metastasis Predictor Genes of Triple-Negative Breast Cancer: A Clinical Study of Triple -Negative Breast Carcinomas.' PLoS ONE 7.9 (2012): e45831. Print.
Lee, Liang-Ming. 'Mefloquine exerts anticancer activity in prostate cancer cells via ROS-mediated modulation of Akt, ERK, JNK and AMPK signaling.' Oncology Letters 5 (2013): 1567-1571. Print.

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OA #7

Subcategory: Cancer Research

Addressing Primary Resistance of ERBB2 Mutant Cancer Cells with Combination Therapy

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Lung cancer, accounting for over 150,000 deaths annually, is the leading cause of cancer death in the United States. Targeted therapies such as gefitinib (ZD1839) and erlotinib (OSI-744) are effective in non-small cell lung cancers (NSCLC) harboring mutations in the EGFR receptor tyrosine kinase pathway; however, currently available targeted agents are inadequate as monotherapies as treatment for individuals with oncogenic mutations in the related ERBB2 pathway. We hypothesized that cancer cells harboring these mutations display a type of primary resistance in which oncogenic lesions respond to relevant inhibitors but additional driver events allow for continued proliferation. Using data generated by the Cancer Target Discovery and Development (CTDD) project, we calculated the IC50s of cancer cell lines harboring ERBB2 mutations to relevant inhibitors, focusing our subsequent analysis on the FDA-approved irreversible inhibitor, afatinib (BIBW2992). We used a novel algorithm, REVEALER, developed at the Broad Institute by Dr. Pablo Tamayo, to identify genomic features that segregate with sensitivity and resistance to monotherapy with afatinib. We identified five pathways that are upregulated in the afatinib-resistant cells: Rho, PI3K/MTOR, Notch, Mek, and a series of anti -apoptotic proteins. Once the upregulated pathways were identified, we targeted these pathways with seven small

molecule inhibitors, dactolisib (BEZ235), trametinib (GSK1120212), selumetinib (AZD6244), navitoclax, (ABT263), Cl-1040, Y-27632, and RO4929097 in a series of ERBB2 mutant cell lines and measured cell viability in response to treatment.We identified the maximum non-cytotoxic dose of these inhibitors and initiated testing of the cell lines with combinations of afatinib and the other inhibitors to determine effects on cancer cell viability. Further analysis of which combination therapies are most effective against ERBB2 mutant cell lines may enhance our ability to treat these cancers.

Funder Acknowledgement(s): Summer Research Program in Genomics

Faculty Advisor: Heidi Greulich, heidig@broadinstitute.org

OA #8

Subcategory: Cancer Research

The In Vitro Evaluation of Pediatric Brain Cancer Cell Lines

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Brain malignancies are the most common form of solid tumors found in children. Treatment for these malignant growths typically requires a combination of surgery, radiation therapy, and chemotherapy. Chemotherapy specifically can have undesired toxic effects. Cabazitaxel was recently approved for the second line treatment of hormone refractory prostate cancer. This compound also possesses the ability to pass through the blood brain barrier making it a promising chemotherapy agent for brain malignancies. However, to date, no studies have been conducted investigating the efficacy of this compound in pediatric brain tumors. To address this problem, we designed a series of studies to determine the anticancer efficacy of cabazitaxel in medulloblastoma (D341Med) and fibroblast (IMR-90) cell lines. The initial investigations involved the growth and observation of the cell lines being used. Standard cell culture techniques were used to establish the D341Med suspension cell and the IMR-90 adherent fibroblast cell lines. D341Med cells exhibited a spherical structure with growth occurring in clusters; whereas, the IMR-90 fibroblasts grew with an elongated bipolar/multipolar structure. The aim of future in vitro mechanistic studies will be to determine the anticancer potency of cabazitaxel and to establish the underlying mechanisms of action for any observed anticancer activity. The effects of this compound are to be tested by, but not limited to, a cytotoxicity assay to measure how toxic the compound is, a proliferation assay to determine the number of cells that are growing in the absence or presence of certain proliferation affecting agents, an assay for apoptosis to distinguish live cells from apoptotic cells and necrotic cells, and finally a cell cycle assay to distinguish cells in different phases of the cell cycle. These findings will further establish the rationale of cabazitaxel as a chemotherapeutic agent in the pediatric population.

References: Tarbell, Nancy J., Henry Friedman, William R. Polkinghorn, Torunn Yock, Tianni Zhou, Zhengjia Chen, Peter Burger, Patrick Barnes, and Larry Kun. 'High-Risk Medulloblastoma: A Pediatric Oncology Group Randomized Trial of Chemotherapy Before or After Radiation Therapy (POG 9031).' Journal of Clinical Oncology 31.23 (2013): n. pag. Web. http://jco.ascopubs.org/content/31/23/2936.long.
Paller, Channing J., and Emmanuel S. Antonarakis. 'Cabazitaxel: A Novel Second-line Treatment for Metastatic Castration-resistant Prostate Cancer.' Drug Des Devel Ther. 5 (n.d.): 117-24. Web. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3063116/.

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OA #9

Subcategory: Cancer Research

Preclinical Studies Using Bioactive Compounds to Develop Novel Chemoprevention Strategies for Breast Cancer

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Breast cancer is the most common type of cancer among women in the United States. Despite the impressive progression of therapies and advanced treatments, there is still a great need for novel therapeutic discoveries. Cellular studies have provided insights into the benefits of using bioactive compounds to combat breast cancer. The treatment regimens using these compounds are known to demonstrate higher efficacy and lower side effects. One bioactive compound that is of interest is cruciferous vegetable constituent benzyl isothiocyanate (BITC), which our lab has previously shown to present substantial protection against mammary carcinogenesis in a transgenic mouse model through its inhibition of the effects of adipocytokine leptin. Leptin is overexpressed in obese breast cancer patients and is known to increase tumorigenesis via multiple signaling pathways. BITC treatment circumvented the leptin-stimulated growth and migration of human cell lines MDA -MB-231 and MCF-7. The present study provides evidence that BITC not only inhibits oncogenic adipocyte-derived hormone, leptin, but it also upregulates a protective hormone, adiponectin, and inhibits stemness markers (eg. KLF4 and SOX2)

to minimize the oncogenic progression of the cells. Increased adiponectin impairs adipocyte differentiation, which impairs leptin's function in cell proliferation. The results of this study serve to show that BITC treatment in the human breast cancer cell lines MDA-MB-231 and MCF-7 elevate the expression of adiponectin. BITC also decreases the expressions of stemness biomarkers SOX2, NANOG, KLF4, and OCT4. The methods used to observe these results include treating the cultured cell lines with 1.0µM, 2.0µM, and 5.0µM concentrations of BITC and analyzing the translation of the adiponectin with western blot analysis, analyzing the transcription of adiponectin through PCR analysis, and observing the differences in mammosphere formation between the normal cells and those treated with BITC with a mammosphere assay. Taken together, these results may provide evidence that BITC could develop into a novel chemoprevention strategy for breast cancer. In the future, this study will be done in transgenic mice models to observe the effects of BITC on tumors in obese mice.

Funder Acknowledgement(s): The Leadership Alliance

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OA #10

Subcategory: Cell and Molecular Biology

Neural Signaling in the Olfactory Bulb Through Activation of Metabotropic Glutamate and Endocannabinoid Receptors

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Protecting neurons in the brain against excitotoxicity and neuronal death is critical during traumatic experiences such as stroke. Brain-produced endogenous cannabinoids (eCBs) are prime candidates for a self-defense mechanism because of the known neuroprotective effects of exogenously applied cannabinoids. Δ9-tetrahydrocannabinol (THC), the bioactive ingredient of marijuana, activates cannabinoid receptors (CB1R) in the brain in the same manner as eCBs. Main olfactory bulb (MOB) neurons express high levels of CB1R. Glutamate acts on ionotropic as well as metabotropic glutamate receptors (mGluRs) in the brain. In the MOB, mGluRs (mGluR1) are expressed at high levels by mitral cells. We study how these two neuromodulator systems interact to regulate activity of mitral cells by potentially exerting neuroprotective or neurotoxic effects.

In mouse brain slices, we used whole-cell patch-clamp recordings to study how CB1R and mGluRs regulate mitral cell activity.

Mitral cells respond with potent membrane potential depolarization and increased action potential firing in response to activation by group I mGluR agonists. mGluR1 antagonists block this effect and reduce the firing activity. CB1R agonists evoke increased action potential firing, while a CB1R antagonist reduces firing. Novel effects are observed when receptor blockers for both CB1 and mGlu1 are combined. Rather than reducing mitral cell activity as observed individually, the combination of both antagonists results in excessive action potential firing leading to cell death.

CB1Rs and mGluRs regulate mitral cell activity. Inhibition of both receptor systems leads to neuronal overstimulation of mitral cells, but could have neuroprotective effects when both systems are activated.

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OA #11

Subcategory: Cell and Molecular Biology

Analysis of Gene Regulation of the Estradiol Receptor in Schistosoma Mansoni Castrated Biomphalaria Glabrata Snails

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Parasitic castration is a well-known phenomenon in which the parasitic trematode, Schistosoma mansoni infection blocks egg clutch production in its intermediate snail host. For example, when this parasite infects a susceptible snail host, such as the NMRI strain of Biomphalaria glabrata, it may either produce no eggs, or fecundity might be delayed. The molecular basis of parasitic castration is unknown. Similar to humans, hormone receptors which affect estradiol expression in Biomphalaria glabrata, influencing egg production, also affects women, by triggering breast cancer, infertility, ovarian cancer, and endometrial cancer. We hypothesize that the snail schistosome interaction will provide a good animal model system towards a better understanding of gene regulation of the estradiol receptor and fecundity, leading to controlling the expression or suppression of these hormonal receptors in important human diseases.

Parasite infected Biomphalaria glabrata no longer produced egg clutches. Differences in the transcription of the estradiol receptor was examined by both end point qualitative RT-PCR and qPCR in normal snails, pre-patent, and patent- castrated snails. The temporal expression of the receptor was also

examined at early time points (30 minutes, 2 hours, and 16 hours, 72 hours) post-infection. Differential expression of the receptor between early and late stage infection was determined. Lack of fecundity in Biomphalaria glabrata post infection is caused by suppression of estradiol expression.

Funder Acknowledgement(s): I'd like to thank the NSF HBCU-UP and HRD-0928444 for providing funding for this project.

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OA #12

Subcategory: Cell and Molecular Biology

High Pressure Liquid Chromatography Analysis of Curcuminoids in Turmeric, Curcuma Longa.

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The objective of this research was to use High Pressure liquid chromatography (HPLC) to analyze curcuminoids in Turmeric, Curcuma longa. Turmeric is a mild spice that enhances the flavor of other spices and foods. Numerous constituents have been identified in turmeric. The main constituent group is poly-phenolic curcuminoids which include curcumin (diferuloyl-methan), demethoxycurcumin, bisdemethoxy-curcumin, and cyclocurcumin. Curcumin has demonstrated a wide range of cancer preventive (chemopreventive) actions, antioxidant and anto-inflamitory activities. Two liquid turmeric supplements, 17 capsule supplements, one tablet supplement, and one turmeric powder were analyzed in this research. The chemical differences between the samples were profiled.

Funder Acknowledgement(s): USDA Beltsville.

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OA #13

Subcategory: Cell and Molecular Biology

The Yeast Endocytic Proteins Epsin (Ent2) and the Huntingtin-Interacting Protein 1-homolog (Sla2) Cooperate for the Regulation of Cell Division

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Huntington's disease is one of the several neurodegenerative disorders caused by expansion of the number of glutamines (Q) present in the protein huntingtin. Research has extensively focused on the toxic gain-of-function phenotypes acquired by the Q-expanded huntingtin. However, loss-of-function effects (inability to fulfill biological functions) that also result from Q expansion lead to neurodegeneration.

The purpose of this project is to address the question of how the polyQ in huntingtin function to mediate protein-protein interactions. Although yeast does not have a huntingtin homolog, Q-rich regions are present in the endocytic protein epsin and the Ent2 paralog is crucial for the regulation of cell division. Importantly, the yeast homolog of the huntingtin binding partner HIP1 (Huntingtin Interacting Protein 1), known as Sla2, binds epsin. This further supports the idea that epsin's Q -rich regions may functionally replace huntingtin Q stretches in yeast.

Using microscopy and extensive image analysis, here we show that Ent2 dominant negative (E2DN) constructs (lacking C-terminal determinants) induce cell division defects in a Sla2-dependent manner. Conversely, truncations of the C-terminus of Sla2 suppress the E2DN-dependent phenotype. Further, our data suggest that Q-rich regions of Ent2 and the second coiled coil domain (CC2) of Sla2 is necessary for this regulation of cell division.

To summarize, we have discovered the first physiological function of Q regions in endocytic proteins. We believe that this research will provide important insights into the function of Q that are disrupted upon expansion.

Funder Acknowledgement(s): National Science Foundation (NSF)

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OA #14

Subcategory: Cell and Molecular Biology

Swine Production Style Influences Histological Morphology, Proteomic Dynamics and Superoxide Dismutase Expression in the Tracheal Epithelium

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In North Carolina, the majority of pigs are reared in swine confinement facility units (SCF). The issue of diminished air quality in confinement facilities has resulted in chronic inhalation of SCF dust particles, which have been shown to elicit and exacerbate respiratory abnormalities and diseases in farm workers and potentially in pigs. SCF dust may cause inflammation, goblet cell metaplasia, protein infiltration into the

airway and oxidative stress. The cells of the immune system use superoxide dismutase (SOD), an endogenous enzymatic antioxidant, as a main line of defense against oxidative stress. Therefore, we hypothesized that there are proteomic, goblet cell, and SOD expression differences within the airway of pigs reared indoors compared to those reared outdoors. Porcine tracheal portions were fixed, sectioned at six microns, stained, and visualized for mucus-secreting goblet cells. Proteomic analysis and western blotting was used to characterize airway protein expression changes in response to production environment. Tracheal sections were also probed for SOD via immunohistochemistry (IHC) and visualized. Statistical investigations were employed to evaluate significant differences among means followed by Bonferroni post-test corrections. Histological evaluation of airway sections revealed tracheal epithelia of pigs reared indoors are densely packed with goblet cells versus outdoors. Proteins that play key roles in airway inflammation and cellular stress were identified. The IHC showed more expression of SOD antioxidant within the airways of outdoor reared pigs versus pigs reared indoors. These observations indicate animals reared indoors may have distinct airway physiology compared to their outdoor counterparts.

Funder Acknowledgement(s): USDA-NIFA Evans-Allen; NC-LSAMP

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OA #15

Subcategory: Cell and Molecular Biology

Study of Neurogenesis and Gsk3B Protein Expression in a PTLS Mouse Model

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Dp (11)17/+ mice possess a duplication mutation on chromosome 11 which negatively affects the learning and memory among other funtions. This mutation is equivalent to the mutation that is found in patients with Potocki-Lupski Syndrome which has autistic-like symptoms along with low muscle tone, feeding disabilities, developmental delay, and possibly congenital heart defects. The question then arose if mice with this mutation had the same amount of neurogenesis present in their hippocampus compared to a mouse without this mutation. We then inquired if wild type and duplication mice had the same amount of Gsk3B protein expression since this protein is involved in neuronal development. Eight mice were used in this study. Four were wild type and the other four were the Dp(11)17/+ mice. Each mouse was injected with BrdU intraperitoneally and brain sections were utilized for immuno-fluorescence with an antibody against BrdU. Using a microscope, the hippocampus was located and the newborn cells were counted and recorded. Four one month old mice were used for the second part of this study. Two wild type and two Dp(11)17/+ mice. Protein extracts from the hippocampus were run in a SDS-PAGE. Western blot against the Gsk3B protein was performed. No significant difference in the amount of neurogenesis occurring in Dp(11)17/+ and wild type mice was found. The Gsk3B protein expression was slightly higher in the Dp(11)17/+ mice than it was in the wild type mice. For future studies when measuring neurogenesis between duplication and wild type mice, we will measure neurogenesis while the mice are undergoing development and observe if there will be a difference. In the future when measuring Gsk3B protein expression between these two mice, more mice will be used to determine if there really is a difference between the two.

Funder Acknowledgement(s): South Florida Chapter of NCCU Alumni,NCCU LS-AMP

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OA #16

Subcategory: Cell and Molecular Biology

Cellular Targets of HVC Projection Neurons in the Zebra Finch Telencephalon Using Anterograde Tracing

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FoxP2 is a speech related gene that is associated with auditory feedback. In order to understand how FoxP2 is linked to auditory feedback, which is important for song acquisition and maintenance, we used the zebra finch as a model in song learning. The purpose of this study was to determine if HVC projections (known to precisely fire at specific points in the motif during singing or playback providing auditory information to Area X) to Area X connect to FoxP2+ cells. It was important to map out the circuitry responsible for song production and learning in the zebra finch model. In addition, song learning and production regions of the zebra finch brain are similar to those found in humans. Our study focuses on the auditory connection between FoxP2+ cells and auditory projections from HVC. FoxP2 expression in the brain is linked to auditory experience therefore we believe that this expression is because the FoxP2+ neurons are receiving auditory signal from HVC. Using an anterograde tracer, we were able to trace the projections of neurons from HVC (song-dedicated brain region necessary for learning and projection of song) and the neurons with which they synapse in Area X, a basal ganglia brain region critical for song learning and modification.

We hypothesize that FoxP2+ cells in Area X of the avian brain will receive input from HVC projections. Evidence that Area X receives these projections will further support previous studies on how FoxP2 plays a significant role in speech development by

providing us with direct evidence that FoxP2+ neurons receive auditory information.

Funder Acknowledgement(s): NSF

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OA #17

Subcategory: Ecology

Contrasting Social Organization in Day and Night Roosts of the Proboscis Bat (Rhynchonycteris naso)

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Our understanding on how roosting habits of bats influence their social organization and mating systems is scarce. Here we attempted to fill in some of these gaps by examining the social organization of the Proboscis bat at La Selva Biological Station, Costa Rica, both during the day and at night. Day roosts of these bats are very exposed and bats are visually and behaviorally cryptic during the day but not at night. We thus predicted that the social organization would differ between the day and the night roost of this species. Behavioral observations of individually banded bats show that there were 2 social groups in Cabina 5 during the day using only a small part of the potential roosting space and that virtually all members showed high fidelity to the day roost. In contrast, we found bats to be using a much larger part of the potential roosting space at night and to have much lower fidelity; only 38% of the males present in the day were regularly present at the night roost and our results provide evidence of five male territories in the night roost. Our study suggests that R. naso might have a resource-defense polygyny rather than a female-defense polygyny as previously thought. Our finding thus indicates that female choice probably plays a much larger role in Proboscis bats than previously anticipated. Observing the social structure at night allowed us to understand a major feature of the social organization of this bat species that had been missed before and has essential consequences for interpreting the mating system.

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OA #18

Subcategory: Ecology

Does Social Behavior Influence Disease Transmission in House Finches?

David Vasquez Jr., Virginia Tech
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In this experiment, we test the relationships between social behavior or dominance, intraspecific feeder interactions, and disease transmission by using inert microspheres as a less invasive model for pathogen deposition and uptake to and from bird feeders. Understanding this relationship will give us insight to disease transmission in wild birds with this naturally occurring host-pathogen system. The goal of this experiment is to test the hypothesis that socially-dominant birds, which often have greater access to feeders, will deposit higher numbers of microspheres onto the bird feeder than socially-subordinate birds.

Mycoplasma gallisepticum (MG) is a conjunctival pathogen spread through short term, indirect contact on fomites (bird-feeders). I used inert microspheres in the conjunctiva as a non-infectious model for MG spread on feeders. For six flocks of five House Finches (Haemorhous mexicanus), the most dominant and subordinate bird in each flock were given different colored microspheres and feeders were swabbed to detect deposition. The control birds for each flock were the 4 “middle birds.” Passive integrated transport (PIT) tag were placed on the legs of a each house finch. PIT tag encodes 10-digit code allowing a radio-frequency identification (RFID) device to record identity and duration of each bird at the feeder. I recorded intraspecific interactions at food to assess flock hierarchy. I then calculated dominance status as the total # of wins / total interactions.

We found that dominant birds spent significantly more time on the bird feeder than subordinate birds ($t=-6.12$, $n=111$, $p < 0.0001$). Subordinate birds made significantly more feeding bouts per day than dominant birds ($t=2.33$, $n=111$, $p=0.0215$). Finally, on average, dominant birds deposited more microspheres but the result is not statistically significant. (One-tailed t-test, $t=-1.09$, $n=24$, $p=0.14$.)

Dominant birds, on average, deposited more microspheres than subordinates. This was likely because dominant birds spent more overall time on the bird feeder. Although subordinates had higher numbers of total feeding bouts, most of these bouts may have been too short to result in microsphere deposition. Overall, time on feeder appears to be more important than number of feeding bouts for microsphere deposition. We plan to run more flocks to increase our sample size for the experiment. I have two more flocks to finish this semester and we will continue with the project next semester.

Funder Acknowledgement(s): Thank you Sahnzi Moyers, Jim Adelman, and Laila Kirkpatrick for your help with my experiment. This project was funded by the Robert Jones Undergraduate Research Excellence Award.

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OA #19

Subcategory: Genetics

Identifying Candidate Reproductive Genes from Apomictic Pistils of Cenchrus Ciliaris (Buffelgrass) Using Genomic Methods

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Apomixis is a mechanism of clonal reproduction through seeds which occurs in a wide variety of plant species. From a practical perspective, researchers are interested in apomixis in order to utilize it to rapidly fix desirable genetic characters in cultivated plants. From the perspective of evolutionary biology, apomixis is of interest because it is an unusual mode of reproduction considered by some to be an evolutionary dead end, despite the fact that it is a not uncommon process in several species of plants. C. ciliaris is valuable as a forage grass and the existence of sexual and apomictic genotypes makes this species an important resource for investigating the genetics and mechanisms determining modes of reproduction. Apomictic reproduction in C. ciliaris is through aposporus apomeiosis. BLASTx to the Uniprot database was performed using 10318 sequences previously derived by the assembly of an EST library constructed from young ovaries of obligate apomictic buffelgrass plants. C. ciliaris candidate genes involved in general reproduction and apomixes were identified by Gene Ontology (GO) results in combination with a syntenic cross species in silico mapping strategy. Thirty-two of a GO based selected subset of ESTs mapped within the rice chromosome 12 region known to be syntenic with the apomictic region of Paspalum simplex. Among these were genes involved in auxin signaling pathways, methionine biosynthesis, endoreduplication, and programmed cell death. Significant BLASTn hits to a Panicum maximum apomictic pistil cDNA library has provided additional candidates for consideration. Future studies will include comparative expression assays of the identified candidate genes and tBLASTx analysis of ESTs that failed to match known proteins in the Uniprot database

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OA #20

Subcategory: Genetics

Reduced Virulence and Diversification in Natural and Digital Host-Parasite Populations

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Viruses are a major threat to global health. Some viruses have highly virulent effects on their hosts when first introduced into a population, but this may attenuate over time. As a coevolutionary outcome, levels of virulence can be affected by multiple phylogeographic factors. We hypothesize that attenuation of virulence will result in reduced levels of genetic diversification within viral populations. We further hypothesize that attenuation of virulence is a low frequency event as it may be monitored for across a set of comparable subpopulations. The magnitude of a virus' ability to infect a host depends on how the virus changes over time. We did a systematic survey of well-studied viruses that have entered human and animal populations: canine distemper virus, HIV, influenza virus, and myxoma virus. We have found attenuation to be a low frequency event as it may occur for different subpopulations with different ecological and host genetic backgrounds. Rates by which coevolution has occurred for infectious viruses in natural host populations were compared to digitally modeled rates of coevolution through the use of the digital evolution software AVIDA. AVIDA currently has a host-parasite implementation that allows for positive and negative co-evolutionary scenarios to take place between infectious digital organisms and their host digital organisms. We have inferred a similar low frequency effect of attenuation to occur in AVIDA where only a fraction (<10%) of host-parasite subpopulations have reduced their "arms race" of increased virulence and diversification. We conclude that phylogeographic evidence of viruses can be effectively used to model parameters of host-parasite coevolution within AVIDA. This digital modeling specifically predicts how rates of mutation impact the differential potential for attenuation observed for DNA and RNA viruses that have respectively low and high rates of mutation.

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OA #21

Subcategory: Genetics

Localization and Early Upregulation of Hsp 70 Stress Protein in Susceptible Biomphalaria Glabrata Snails After Infection of Schistosoma Mansoni

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The stress protein, Heat shock protein 70 (Hsp 70), is a conserved protein that is expressed in the S. mansoni intermediate snail host, Biomphalaria glabrata. In the parasite-resistant juvenile snail, BS90, invading parasites are encapsulated and killed not long after penetration. NMRI, the susceptible strain of B. glabrata, allows miracidia to freely develop after penetrating the head-foot region of the snail host. Upon shedding its cilia plates, the miracidium develop in the susceptible NMRI snail from the mother to daughter sporocyst stages, permitting asexual reproduction of the free- swimming cercarial stage. Mechanisms shaping these outcomes involve the parasite's ability to evade the snail's innate defenses. We hypothesize that Hsp 70 protein in the susceptible snail will be upregulated throughout the snail early but not late after infection. Using immuno-histochemistry, we examined the location of the Hsp 70 protein after infection of the susceptible NMRI snail. In addition to immuno-histochemistry, we also used immuno-precipitation technology to capture the proteins associated with Hsp 70 in the susceptible snail after infection. Western blot analysis was also done using anti - snail recombinant Hsp 70 antiserum, soluble protein extracts from NMRI and BS-90 snails exposed to S. mansoni for different time intervals were examined. Results showed early and strong expression of Hsp70 protein in susceptible but not resistant snails. These data will aid in understanding how a parasite - mediated stress response involving transcriptional regulation of Hsp 70, and juvenile snail susceptibility, helps with the development of intra-molluscan stages of S. mansoni.

Funder Acknowledgement(s): MARC U*STAR

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OA #22

Subcategory: Genetics

Suppression of Cathepsin B Gene in Normally Resistant Biomphalaria Glabrata Snails Causes Susceptibility

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Biomphalaria glabrata is the intermediate snail host of the trematode parasite Schistosoma mansoni that causes schistosomiasis also known as bilharzia which infects 200 million people a year, mainly in sub-Saharan Africa. There are many varieties of B.glabrata, with some being susceptible while others are resistant to the parasite. The snail stock, BS-90 is one that is resistant to all strains of the parasite. Thus, when S. mansoni miracidia penetrates the BS-90 snail, the parasite is encapsulated and killed, thereby blocking the parasite's life cycle. The NMRI snail is a susceptible strain of B. glabrata which allows the parasite to develop into a mother (also known as a primary) sporocyst and then into the daugher sporocyst stage producing by asexual reproduction thousands of cercariae which later emerge and infect the primary human host. Previous studies showed that by using double stranded RNA (dsRNA) with a non-viral inert cationic delivery agent, poleyethyleneiminse (PEI) successful gene silencing in the snail host can be achieved. Because high levels and early expression of Cathepsin B were found to correlate with resistance to S. mansoni in the resistant BS-90 snail host. We hypothesized that the knock down of Cathepsin B gene in the BS-90 snail using Cath B dsRNA and PEI delivery method would reduce/prevent the encapsulation of the parasite allowing the parasite to complete its transformation into a cercariae in the dsRNA treated BS-90 snail. To achieve this objective, BS-90 snails were soaked in Cath B dsRNA and PEI for 48 hours before being exposed to the parasite. At six weeks post exposure, experimental and control (infected- dsRNA untreated) snails were monitored for cercariae shedding. RT-PCR with Cath B specific primers were used to validate the successful knock down of the Cathepsin B gene in dsRNA/PEI transfected snails, done in parallel using control mock myoglobin dsRNA/PEI transfected snails. Change in qualitative expression of Cath B was determined relative to the house keeping actin gene. In conclusion, the BS-90 snails treated with the dsRNA/PEI all shed cercariae proving that early expression and high concentration of the Cathepsin B gene corresponds to the resistance of the BS-90 snail.

Funder Acknowledgement(s): MARC

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OA #23

Subcategory: Microbiology/Immunology/Virology

Does HIV Manipulate Cellular Stress Responses?

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Many different kinds of viruses induce a cellular stress response. Other viruses come up with methods to circumvent the response, such as poliovirus and human rhinovirus. By cleaving the eIF4G protein complex, the host cell allows the mRNA from

the virus to avoid mRNA cap recognition. (Lloyd, 2013) Whether or not HIV (Human Immunodeficiency Virus) can manipulate cellular stress responses is unknown. Our hypothesis is that since poliovirus and human rhinovirus manipulate cellular responses, we believe that HIV can induce stress granules (SG) as well as manipulate them for its own viral gene expression. This is important because if we are able to gain a better understanding of host-viral interactions, then the result could aid in combating the virus with effective treatments that could prevent HIV from forming the structural proteins that it needs to make multiple viruses. To address this hypothesis, we tested to see if HIV-1 can induce or repress stress granule formation by infecting HeLa cell lines expressing fluorescent markers for stress granules and observe the result via fluorescent microscopy over the course of 24 hours. During the experiment, we observed YFP-APOBEC3G, a marker for stress granules and processing bodies (PB), accumulate in PBs which remained prevalent during infection. Another SG marker, YFP-TIA1, showed a transient localization to stress granules during infection. Subsequently, we used the stress inducer, sodium arsenite, in the presence of infection to see if the virus would suppress SG formation. From numerous observations, HIV infection did appear to block SG formation in response to sodium arsenite. This result is consistent with our hypothesis of suppression of SGs by HIV.

Due to this result, this could possibly mean that in order for the virus to continue its life cycle, it has to prevent the TIA-1 protein from initiating apoptosis whenever the cell is infected. If this is true, then further research can be done on a biochemistry level to determine how those interactions occur and how can they be prevented for the benefit of effective vaccinations/treatments against HIV.

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OA #24

Subcategory: Microbiology/Immunology/Virology

Bacillus Cereus Group Biofilm Formation in Response to Iron and Temperature

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Biofilm formation in bacteria causes substantial losses as it relates to the economy and is responsible for the high percentage of mortality and morbidity that is seen in medical settings. Biofilms are defined as aggregates of bacteria held together by a mucus-like matrix of carbohydrate that adheres to a surface. Because biofilms are highly resistant to treatments and normal sanitation techniques and allow bacteria to bypass the immune's defense system, it is of top priority that new methods be created to prevent biofilm formation. In this study, 3 bacterial strains were observed and screened for biofilm formations at different temperatures and concentrations. Those strains included genetically close pathogenic members of the Bacillus species: Bacillus anthracis, Bacillus cereus, and Bacillus thuringiensis. Evidence shows that these three species could possibly represent one species. The aim of this study was to observe biofilm formation in order to identify the causes of the formation as well as the strain of bacteria that was more susceptible to forming biofilms at given temperatures and time periods of incubation. B. cereus and B. thuringiensis were cultured under iron-replete and iron-deplete conditions at various temperatures. Biofilm was observed for all strains tested. Biofilm formation was greatest at 30˚C in B. thuringiensis. The addition of iron resulted in a decrease in biofilm formation. These are the first reports that mark the production of biofilm in response to iron in Bacillus species.

Funder Acknowledgement(s): Jackson Heart Study: RUI

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OA #25

Subcategory: Microbiology/Immunology/Virology

Assessment of the Anti-bacterial and Anti-Biofilm Potency of Psidium Guajava on Escherichia Coli and Salmonella Typhimurium, and Two Strains of Pseudomonas Ffluorescens

Sherlene Brown, Claflin University

Psidium guajava, more commonly known as Guava is an evergreen plant of the family Myrtaceae. It is a traditional plant used to treat various gastrointestinal infections such as typhoid fever and dysentery. Most diarrheal diseases are caused from bacterial strains including Salmonella typhimurium and Escherichia coli. Salmonella is a widespread gram negative bacteria that is highly pathogenic. Escherichia coli is also a gram negative bacteria that is rod-shaped. Both can be found in the intestine of living organisms. Pseudomonas fluorescens is an organism capable of surviving in chromium rich soils. It can convert the toxic chromium (VI) to chromium (III) due to its ability to form Biofilm. For years researches have been conducted to determine new and naturally synthesized drugs that are efficient, have little or no side effects, and are inexpensive. We hypothesized that the phytochemicals produced by Psidium guajava leaves can inhibit the growth of both bacterial species, and that chloroform extracts will have greater inhibitory effects against the bacteria than methanolic extracts. We also hypothesized that the guava extract will

decrease the rate of biofilm formation by the Pseudomonas fluorescens strains. To determine the antimicrobial effects of the plant extracts, sensitivity assays (disk and spot diffusion) were conducted using chloroform and methanolic extracts of the Guava. Kanamycin and water were used as the positive and negative control respectively. Results showed that contrary to our hypothesis the methanolic extracts exhibited greater antimicrobial effect than the chloroform extracts against Salmonella typhimurium and Escherichia coli. Additionally, to determine the antibiofilm potential of the Psidium guajava leaves, static biofilm assays were done using methanolic and chloroform extracts. Preliminary findings indicated that the methanolic and chloroform extracts of Psidium guajava did not inhibit biofilm formation in the two Pseudomonas fluorescens strains. However, more data is currently being collected. For future works, the synergistic effects of Psidium guajava and other plant extracts as antimicrobial and antibiofilm agents will be evaluated. Also, Nuclear Magnetic Resonance (NMR) analysis of the compounds from the plant extracts will be done.

Bipul Biswas, Kimberly Rogers, Fredrick McLaughlin, Dwayne Daniels, Anand Yadav. 2013. *Antimicrobial Activities of Leaf Extracts of Guava (Psidium guajava L.) on Two Gram-Negative and Gram-Positive Bacteria*. Pages 1-16.

Y. V. Nancharaiah, C. Dodge, V. P. Venugopalan, S. V. Narasimhan, and A. J. Francis. 2010. *Immobilization of Cr (VI) and Its Reduction to Cr (III) Phosphate by Granular Biofilms Comprising a Mixture of Microbes*. Pages 1-15.

Funder Acknowledgement(s): Claflin University School of Natural Science and Mathematics- Department of Biology

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OA #26

Subcategory: Microbiology/Immunology/Virology

Characterizing the Binding of GM-CSF to FliC in Pseudomonas Aeruginosa

Katelyn Buchanan, Syracuse University

Persisters are variants of microbial cells that exhibit an increased tolerance to essentially all antibiotics. This characteristic causes antimicrobial therapies ineffective leading to chronic infections with reoccurring symptoms. This study focuses on the persisters of Pseudomonas aeruginosa, a bacterium that causes infections to those with a compromised immune system and cystic fibrosis patients. Previous research in our group has identified a synergistic effect between the cytokine GM-CSF and antibiotics resulting in the sensitization of P. aeruginosa persisters to antibiotics. Identifying the specific protein responsible for this phenomenon would lead to a better understanding of bacterial persistence and aid in the development of better control methods to eliminate persister cells.

Previous research in our group using a co-immunoprecipitation technique identified FliC of P. aeruginosa PAO1 as a potential target of GM-CSF. In this study, we use Western blotting and yeast two-hybrid system to verify if FliC interacts with GM-CSF. Three samples derived from P. aeruginosa (wild-type PAO1, fliC mutant, and complemented fliC mutant) were cross-linked with GM-CSF and analyzed by Western blotting. Our findings demonstrate GM-CSF binding to the flagella samples of the wild-type PAO1 and complemented mutant, but not the fliC mutant. These results were corroborated by our yeast two-hybrid assay. Future research involves identifying the specific domain and amino acid sequence of FliC for binding and the subsequent effects on bacterial gene expression. This information will help understand host-bacteria interaction and develop better control methods.

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OA #27

Subcategory: Microbiology/Immunology/Virology

Anti-Clostridium Difficile Activity of Paired Rifaximin-based Antibiotic Combinations

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Clostridium difficile is an opportunistic intestinal bacterium that causes severe recurrent diarrhea, resulting in over 250,000 hospitalizations and 14,000 deaths annually in the US alone. The emergence of epidemic strains of C. difficile, such as BI/NAP1/027, has increased the severity and rates of recurrence of C. difficile infection (CDI) following monotherapy with current treatment options: metronidazole or vancomycin. Recently, use of the rifamycin antibiotic rifaximin (RFX) as a chaser following vancomycin therapy was shown to be promising in reducing the incidence of CDI recurrence. However, the clinical use of rifaximin is plagued by resistance emerging during therapy. Historically, antibiotic combination therapy has been employed to treat persistent bacterial infections and reduce the risk of resistance emerging during therapy. However, multi-drug therapy remains under-examined in treating CDI. Therefore, we explored whether combining various anti-difficile antibiotics with RFX could enhance its efficacy against C. difficile. Minimum inhibitory concentrations (MICs) singly and in combination with RFX were assessed against ten clinical isolates of C. difficile. Antibiotics tested were: ramoplanin (RAM), fusidic acid (FUS),

vancomycin (VAN), linezolid (LNZ), metronidazole (MTZ) and daptomycin (DAP). From these MICs, fractional inhibitory concentrations (FICs) were evaluated as synergy FIC < 0.5; partial synergy FIC ≤ 0.75; additive synergy 0.75 ≤ FIC ≤ 1.0; indifference 1.0 ≤ FIC ≤ 2.0; antagonism FIC > 2.0. FUS-RFX combinations showed full to additive synergy in 55% of tests and 45% indifference. DAP-RFX showed full to additive synergy in 35% of tests, 65% indifference and no antagonism. RAM-RFX showed full to additive synergy in 30% of tests, 65% indifference with possible antagonism. MTZ-RFX showed 30% full to additive synergy and 70% indifference, whereas VAN-RFX showed 15% partial synergy and 80% indifference, with possible antagonism. Our studies demonstrate that FUS-RFX combinations are highly active against C. difficile. Majorly synergistic antibiotic combinations such as FUS-RFX enhance the antibacterial activity of either component antibiotic, permitting lower doses to inhibit the growth of C. difficile; these combinations could show improved efficacy and reduce drug toxicity to C. difficile-infected patients. Ongoing studies are examining if FUS-RFX combinations could mitigate resistance emergence in recurrent CDI.

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OA #28

Subcategory: Microbiology/Immunology/Virology

Functional Loss of Thymic Nurse Cells Induces Disease in Lupus-prone Mice

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Systemic lupus erythematosus (SLE) is a chronic, inflammatory, multisystem disorder that predominantly affects women, particularly those of color, during their child bearing years. SLE is an autoimmune disease which results from aberrant immune responses to self-antigens and is mediated by B and T lymphocytes. These autoreactive lymphocytes are believed to have escaped elimination by mechanisms of central and peripheral tolerance. Thymic nurse cells (TNCs) are cortical epithelial cells that play a major role in central T cell tolerance. TNCs specifically interact with and internalize CD4+ CD8+ TCRlo triple positive (TP) thymocytes undergoing restriction to major histocompatibility complex (MHC) proteins in the thymus. Greater than 95% of TP thymocytes interacting with TNCs become apoptotic and are removed through lysosomal activity within TNC vacuoles. The remaining 5% of TP thymocytes up-regulate maturation markers such as CD69 and Bcl-2. In the diseased state all SLE mouse models were found to have significant depletions of TNCs in the thymi. We hypothesized that loss of TNCs and/or their function contribute to SLE disease onset and progression. To test this hypothesis, seroconversion, measured as a change in serum levels of anti-DNA IgM to anti-DNA IgG, was compared over time with TNC numbers in normal C57BL/6 and SLE-prone NZBWF1 mice. Additionally, normal TNCs were transplanted into the thymi of pre-diseased NZBWF1 mice and recipient animals were monitored for the onset of SLE disease symptoms over a period of 16 weeks. Initial data collected showed a direct correlation between significant decrease in TNC numbers and seroconversion, which is an indicator of disease onset in SLE. It was also noted that intrathymic transplantation of normal TNCs delayed onset of disease symptoms in NZBWF1 mice. These findings suggest that TNC function may be defective in NZBWF1 mice. Therefore, current work focuses on the creation and characterization of TNCs from SLE-prone mice to identify functional defects in these thymic epithelial cells.

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OA #29

Subcategory: Microbiology/Immunology/Virology

Adapting Chromosome Conformation Capture to Assay Human Gut Samples

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The human gut microbiome is a diverse community composed of thousands of bacterial species, plasmids, and bacteriophages. It is hypothesized that horizontal gene transfer mediated by plasmids and other mobile elements is responsible for the rapid evolution of bacteria observed under acute stress such as antibiotic treatment. However, a system-wide technique to assay the dynamic associations between mobile elements and their specific hosts is lacking. Here, we describe the adaptation of Chromosome Conformation Capture (3C) to assay human fecal samples. In 3C, cells are fixed and lysed to obtain cross-linked DNA fragments, which are digested and ligated under dilute conditions. Cross-links are then removed and paired-end sequencing allows for identification of the cellular origin of DNA fragments. Initial attempts to apply 3C to fecal samples produced only partially digested DNA, prompting investigation of the digestion step. We found that increasing formaldehyde concentration generates larger cross- linked molecules with little inhibitory effect on digestion. Additionally, reduced lysate concentration enhanced digestion efficiency and reproducibility, likely due to digestion inhibitory factors in stool. This work sets the foundation for the application of 3C to study complex

microbial communities. Assembly of a 3C library from these methods will complement metagenomic data and provide greater understanding of horizontal gene transfer within the human gut microbiome.

Funder Acknowledgement(s): Amgen Foundation

Faculty Advisor: Eitan Yaffe, eitan.yaffe@gmail.com

OA #30

Subcategory: Nanoscience

Dealing with Obstacles: Microbial Biofilm Development Through Physical Obstructions

Steven Ceron, University of Florida
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Microbial biofilms of the species Bacillus Subtilis were grown so that the changes in the expression of several important genes (matrix, motility, and sporulation) could be observed with fluorescence microscopy. Biofilms grow in all kinds of environments; instead of acting as independent swimmers, the cells act cooperatively, which in turn may result in a number of benefits for the colony, making it the preferred living state for bacteria. However, this ability of biofilms to survive in harsh environments can cause serious problems in the medical and industrial fields, leading to the spread of infection and degradation of components. Understanding the factors that lead the bacteria to change from one phenotype to another in a set environment can provide insight to the best approach in solving these issues.

Our set environment was composed of two laser-cut acrylic barriers separated by varying widths, fixed in an agar plate with biofilm inducing minimal medium, leaving a channel that disrupted the normal growth of a biofilm inoculated away from its entrance. Thus, one half of the biofilm grew towards the obstruction while the other half grew on the open agar substrate, serving as the control of the experiment. Nutrients cannot transport across the barrier, which allowed us to test our hypothesis that a difference in the nutrient diffusion, caused by the barriers, would drastically affect a biofilm's overall growth pattern and phenotype expression.

When the size of the channel was varied to smaller widths, matrix was expressed at a higher intensity on the second side of the barriers. We believe this was caused by the matrix cells at the edge of the colony forming higher stacks of cells on a smaller surface area of agar inside the channel. The marked differences in the growth rate and phenotype composition along both sides of the walls may be due to changes in nutrient availability and condensation caused by the barriers, and could be studied more extensively through the varying of the shape and size of the barriers. Thus, these experiments could serve as a simple assay for studying phenomena that have previously only been investigated using more complicated microfluidic devices.

References: Rubinstein, S.M., Kolodkin-Gal, I., Mcloon, A., Chai, L., Kolter, R., Losick, R. & Weitz, D.A. 2012. *Osmotic pressure can regulate matrix gene expression in Bacillus subtilis.*

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OA #31

Subcategory: Physiology and Health

Social Isolation During Adolescence has Differential Effects on Apical Dendritic Branching of Pyramidal Neurons in Dorsal and Ventral Hippocampal CA1

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Adolescence is a stage of development that is monumental in the development of the brain. Stress during the onset of puberty has been shown to alter the behavioral, physical, and biochemical processes of the brain because of the introduction of gonadal hormones. Previous studies have shown that stress during critical periods of development is linked to many pathological disorders, such as schizophrenia, depression and anxiety-like behaviors. The effects of stress could be gender specific. For example, females are more susceptible to stress-increased anxiety-related behaviors. However, females have been insufficiently studied in animal models. Social Isolation(SI) is a stressor that has been shown to affect individual behaviors. Previous studies also indicate that there may be a critical period for the effects of SI before and during puberty. The hippocampus is a component in the limbic system that plays a role in spatial learning, memory, anxiety and the regulation of stress. An introduction to stress before or around puberty can cause changes in the dendritic remodeling of the apical CA1 pyramidal neurons in the hippocampus. Interestingly, previous studies indicate the differential response of hippocampal subregions to stress. For example, ventral region of the hippocampus is more susceptible than the dorsal region to changes in response to stress hormones. The goal of this study

was to understand if SI alone during puberty in females could cause changes in the dendritic remodeling of the pyramidal neurons in the CA1 of ventral hippocampus. We also tested whether SI had a different effect on dendritic branching of the pyramidal neurons in the dorsal compared to the ventral hippocampal CA1. Sixteen Sprague-Dawley female rats were delivered at P28, and assigned to 2 experimental groups (socially isolated and paired housed) from P36 to P44, where animals were euthanized. We traced and measured the dendritic arborization of the pyramidal neurons by Sholl analysis after the Golgi procedure in the CA1 region of the dorsal and ventral hippocampus, then calculated the difference in the dendritic characteristics between socially isolated animals and paired-housed controls.

Our preliminary data indicated that in the ventral hippocampus, which preferentially regulates anxiety, SI evoked an increase in dendritic branching in the CA1 pyramidal neurons. On the other hand, in the dorsal hippocampus, which preferentially mediates spatial learning and memory, cells of animals under SI had fewer dendritic branches in stratum radiatum than in paired controls. Taken these results together, our data indicate that SI of adolescent females elicits pathway-specific changes in the hippocampus that may cause an increase in anxiety in the ventral hippocampus and a reduction in spatial memory performance in the dorsal hippocampus. In the future, we would like to measure the spine density of the pyramidal neurons in CA1 under social isolation.

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OA #32

Subcategory: Physiology and Health

Chronic Exposure to a Cannabinoid Agonist Inhibits Tissue Regeneration in Girardia Tigrina

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Due to the lack of cannabinoid receptors in most invertebrate species, the endocannabinoid system has not been as well characterized in this group of animals as it has been in vertebrates, which do possess cannabinoid receptors. Other components of the system have been identified in invertebrates, including the endogenous ligand anandamide. This suggests that the endocannabinoid system also has a function in these animals. Cannabinoid agonists have been shown to inhibit proliferation in certain cancer cell lines. Using an invertebrate model of cellular/tissue regeneration, the planarian Girardia tigrina, we examined the effect of the synthetic cannabinoid agonist, WIN 55,212-2 (WIN) on the ability of this planarian species to regenerate lost tissues and to test the following hypothesis: prolonged exposure to a cannabinoid agonist will inhibit the regeneration of the amputated body parts. Decapitated G. tigrina were treated with either 1 mM WIN, 10 mM WIN or an appropriate control (media only or a dimethyl sulfoxide solvent control). The development of ocelli (eyespots) by day 5 served as the marker for successful cephalic regeneration. Compared to controls and the lower concentration of WIN, animals maintained at a concentration of 10 mM WIN had a significantly lower rate of ocelli formation as determined by one-way ANOVA and Tukey's method. These data indicate the WIN does have an effect on planarian regeneration in a dose-dependent manner. In future studies, the ability of a cannabinoid antagonist, rimonabant (SR 141716) to counter the inhibitory effect of WIN on planarian tissue regeneration will be determined.

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Faculty Advisor: Rosie Sneed, rsneed@udc.edu

OA #33

Subcategory: Physiology and Health

Carcass Yield and Quality Traits in Kids Under Mixed and Sequential Grazing System

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In a 2x2 factorial arrangement, 50 kids that were born and weaned under the mixed-species system were randomly assigned to confinement vs. semi-confinement housing and fed rations with 13% or 16% crude protein (CP) levels. After an adjustment period of 2 weeks, live weights (LW) and body condition scores (BCS), (1 = thin, 5 = fat) were taken every 14 d for 8 wk. At the end of the study, 24 male kids were humanely harvested and deboned for carcass study. Hot (HCW) and cold carcass weights (CCW), dressing percentages, cold carcass yield, live grades (LG), conference grade (CG), fat score, etc. were recorded. Ribs, shoulder, shank, leg, back, and neck were cut from each carcass, weighed and deboned to determine percent of lean meat (PLM) and weight of lean meat yield (WLM). Data were analyzed using SAS MIXED procedure and stepwise

regression. No differences in carcass weights were observed due to housing effect or level of CP in the diet. BCS was the best predictor for PLM followed by LW and CG. LW was the best indicator for WLM followed by BCS, CG and LG. WLM yield was positively correlated with LW, HCW, BCS, CG, and LG. Similar relationships were observed for PLM. Ribs, legs, shoulder, shank, back and neck cuts represented 29.4%, 25.2%, 15.1%, 10.1%, 8.6% and 5.6% of the total carcass weight, respectively. Based on these results, one can feed a lower CP level without negative effect on carcass traits and lean meat yield.

Funder Acknowledgement(s): Southern University Ag Center

Faculty Advisor: Sebhatu Gebrelul, sebhatu_gebrelul@suagcenter.com

OA #34

Subcategory: Physiology and Health

Understanding the Role of Pyroglutamate-3 Amyloid Beta in Alzheimer's Disease

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Alzheimer's disease (AD) is a common form of dementia characterized by impaired cognitive function and memory loss. The pathological hallmarks of AD include neurofibrillary tangles comprised of hyperphosphorylated tau and plaques comprised of amyloid-beta (Aβ). Pyroglutamate-3 Aβ (pGlu-3 Aβ) is a modified Aβ species that is formed following degradation at the N-terminus of Aβ. The remaining exposed glutamate residue 3 is then cyclized by glutaminyl cyclase (QC) resulting in a post-translationally modified Aβ species commonly found in Aβ plaques. In comparison to unmodified Aβ, pGlu-3 Aβ has a higher propensity for aggregation, increased resistance to degradation and increased toxicity, especially in neurons. In this study, we sought to determine whether pGlu-3 Aβ could act as a seed for Aβ aggregation and neuroinflammation. An APP/PS1ΔE9 transgenic (Tg) mouse was selected as a model for AD because unlike normal mice, these mice develop human Aβ plaques. Young (~3.8 mo-old), female APP/PS1ΔE9 Tg mice (C57BL/6J) received bilateral intrahippocampal stereotaxic injections with 2µL of either of brain extract (10% w/v protein) from aged mice that overexpress pGlu-3 Aβ (APP-NLQ Tg) (n=7), brain extract from aged wildtype mice (WT) (n=7) or phospho-buffered saline (PBS) (n=7) as a control. The mice were sacrificed 9 months following injection (~13 mo of age). Brain tissue was fixed in 4% PFA, cryo-protected in graded solutions of sucrose and embedded in OCT. Staining was performed on 3 equidistant planes with 82E1, 07/1, Aβ40, R1282, Aβ 42, Thioflavin S and GFAP. These stains target Aβ 1-x, pGlu-3 Aβ, Aβ x-40, general Aβ plaques, Aβ x-42, fibrillar Aβ and astrocytes, respectively. Quantitative analysis of immunostaining in the hippocampus and cortex was performed using BIOQUANT imaging software. Analysis demonstrated a decrease in Aβ1-x immunoreactivity in the hippocampus of NLQ extract-injected mice compared to PBS injected mice ($p<0.05$). Although not significant, NLQ extract-injected mice demonstrated higher pGlu-3 Aβ and Aβ42 immunoreactivity than WT extract and PBS-injected mice in the hippocampus. Analysis of cortex revealed similar increasing trends as previously measured in the hippocampus. NLQ extract-injected mice had higher general Aβ, Aβ42 and pGlu-3 Aβ immunoreactivity than mice injected with WT extracts or PBS. NLQ extract-injected mice also showed a trend for increased Thioflavin S fibrillar Aβ, Aβ40 and Aβ 1-x immunoreactivity in cortex compared to WT extract-injected mice.

In summary, our results indicate that pGlu-3 Aβ may enhance AD-like pathogenesis in APP/PS1ΔE9 Tg mice and suggest that pGlu-3 Aβ may be a good therapeutic target to block Aβ aggregation and reduce subsequent neuroinflammation and neurodegeneration. Future studies will test the effects of injecting more highly concentrated pGlu-3 Aβ "seeds".

Funder Acknowledgement(s): National Institutes of Health, WBHR-LSAMP NSF Grant Number HRD-1000286

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OA #35

Subcategory: Physiology and Health

The Effects of Pediatric SIV on the Blood Brain Barrier

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Pediatric HIV infection remains a global health crisis with an estimated 1,500 children under the age of 15 years becoming infected with HIV-1 each day in the developing world. Children are much more susceptible to HIV-1 neurological impairments than adults, possibly due to a viral/blood brain barrier interaction. Neuron-glial antigen 2 (NG2), is responsible for protein kinase binding, cell proliferation as well as the basement membrane of the blood brain barrier. We have previously shown that pediatric simian immunodeficiency virus (SIV) infection results in significant demyelination, loss of hippocampal and immature neurons. Here we test the hypothesis that perinatal HIV infection down regulates the pericyte population leading to a compromised blood brain barrier. Newborn rhesus macaques (Macaca mulatta) were inoculation with SIVmac251 (n=4) or vehicle (control n=4) within 72 hours of birth. After a 6-18 week survival time, the animals were sacrificed and the brains prepared for quantitative histopathological analysis. Matched sections for control and

SIV+ subjects were immunostained with mouse anti-NG2 with an Alexa fluorophore 555 secondary antibody. Sections were then counterstained with Tomato Lectin to identify blood vessels. The NG2 antibody is currently being optimized for primate tissue. Data from these experiments will identify the role that the blood brain barrier plays in the pathogenesis of pediatric HIV infection.

Funder Acknowledgement(s): This work is funded by the District of Columbia Developmental Center for AIDS Research (DC D-CFAR), an NIH-funded program (P30AI087714).

Faculty Advisor: Mark W. Burke, Assistant Professor, Howard University Medical School Physiology Department, Mark.burke@howard.edu.

OA #36

Subcategory: Plant Research

The Identification of Volatiles and Their Interactions with Sugar Content Correlated to Optimal Flavor

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Solanum lycopersicum, most commonly known as the tomato, is widely consumed throughout the world. The demand for tomatoes is steadily increasing, with consumers spending roughly 2 billion dollars annually in the U.S. alone. Through the years, farmers have specifically bred commercial tomatoes to increase yield, shelf-life and fruit firmness; however, largely through neglect, the flavor quality has dropped over the years. The fruit's flavor is derived from specific biochemical compounds, including sugars, acids and volatile compounds that contribute to sweetness, acidity and aroma, respectively. Volatiles, in particular, are what define the unique flavor of a tomato. Discovering the ideal volatile composition for good flavor will allow breeders to develop tomatoes with better flavor. Using the heirloom variety "Maglia Rosa Cherry" as the control for our experiments, we examined the development of fruit quality in a segregating population from the fourth generation after crossing Maglia Rosa Cherry and a commercial tomato variety. We identified lines from this cross that were most desired and further examined based on their properties to ensure they had the specific genes needed for crossbreeding and back-breeding. We conducted taste panels of fruit from these lines. To identify the flavor volatiles, we used a method called "Absorption Solvent Desorption" which traps the volatiles to further analyze them using gas chromatography. We quantitated 20 volatiles plus glucose and fructose, and then correlated that data with the taste panel ratings. This method enables us to strategically select varieties based on their biochemical composition. Ultimately, these methods of analysis will allow production costs to stay at a minimum while still ensuring optimal fruit quality for the consumer.

Funder Acknowledgement(s): This study was supported, in part, by grants from NSF HRD HBCU-UP Targeted #1238789 and DBI REU-Site Programs awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #37

Subcategory: Plant Research

High Frequency Plant Regeneration from Axillary Shoot in Moringa Oleifera

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Moringa oleifera Lam., commonly known as drumstick, has potential as a commercial medicinal and nutritional supplement. This plant has long been recognized in folk medicine and is extensively used in the treatment of rheumatism, venomous bites and as a cardiac and circulatory stimulant. The present study was aimed to establish an efficient and rapid protocol for in vitro plant propagation of Moringa oleifera through axillary shoot explants. Axillary shoot growth was induced by supplementing Murashige and Skoog's (MS) medium with cytokinins. Of the three cytokinins tested, namely benzylaminopurine (BAP), kinetin (KN), and thidiazuron (TDZ), BAP at 0.5 mg/l showed a maximum of 92% of shoot proliferation with 15.2±0.87 number of shoots per explant with 2.26±0.05 cm mean height of individual shoots after 4 weeks. The combination of BAP (0.5 mg/l) and NAA (0.5 mg/l) showed 95% of shooting response with 17.4±0.36 number of shoots per explant with 3.62±0.03 cm means height of individual shoots. The combination of BAP (0.5 mg/l) and IAA (0.1 mg/l) produced 71% of shooting response with 7.4±0.46 number of shoots per explants with a mean shoot height of 1.50±0.2 cm. After standardization of PGRs for shoot multiplication, the multiplied shoots were subjected for root formation using various concentrations of PGRs. IAA and NAA were tested in varying concentrations from 0.1-1.00 mg/l. IAA in a concentration of 0.5 mg/l recorded 92% of rooting response with a maximum number of 15.0±0.89 root hairs in a mean root length of 8.3±0.23 cm. NAA in a concentration of 0.1 mg/l responded 93% of root formation with 14.6±1.19 number of roots per explants with a mean root length of 11.1±0.38 cm. The rooted plants were transferred to soil and vermiculture in the ratio of 1:1 and were kept in the humidity chamber for acclimatization. The established system is efficient enough to be used for mass production of healthy plants in a short period of time. Fast growing embryogenic callus were also established from leaf segments of in vitro raised plants on MS medium supplemented with 4.52 μM 2,4-D and 11.09 μM BAP. The highest induction frequencies of somatic embryos were obtained on MS medium

containing 13.31 μM BAP and 3% sucrose with an average of 28 embryos per gram of callus. The continuous production of Moringa regenerated plants via somatic embryogenesis could be used as a possible micropropagation and plant transformation system.

Funder Acknowledgement(s): This study was supported, in part, by grants from NSF HRD HBCU-UP Targeted #1238789 and DBI REU-Site Programs awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA.

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OA #38

Subcategory: Plant Research

Muscadine Grape Leaf Proteomic Analysis

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Muscadine (Vitis rotundifolia) is widely cultivated for fruit and wine production. This study focuses on grape characteristics that play a role in wide-spread cultivation of grapes in SE U.S. Muscadine grapes are unique in their sugar content, photosynthetic efficiency, and tolerance to Pierce's disease. Muscadine grapes tend to have lower relative sugar content and are highly resistant to Pierce's disease when compared to the native species Bunch grapes (Vitis vinifera). With the unique traits of this species in mind, a proteomics study was conducted to understand how proteins play a role in the particular physiological characteristics of the Muscadine Grape and to improve disease tolerance characteristics of other grape species. The proteomic study determined identity and function of the Muscadine leaf proteome, identified differentially expressed proteins during leaf development, deciphered a protein interaction network, and determined genetic variation in photosynthesis and defense related leaf proteins among Vitis genotypes. A high throughput two-dimensional gel electrophoresis (2-DE) was conducted on developing and developed Muscadine leaf proteins. The differentially expressed proteins were excised from 2-DE gels, subjected to in-gel trypsin digestion, and analyzed in MALDI/TOF mass spectrometer. The mass spectra were collected and protein identification was performed by searching against Viridiplantae database using Matrix Science algorithm. Proteins were mapped to universal protein resource to study gene ontology. This study revealed identities of 285 proteins. Of these, 68 proteins were found related to photosynthesis. Several photosynthesis and defense related proteins are among the differentially expressed proteins during leaf development. Protein interaction studies indicate that CR88, a heat shock protein has seven interactors. Comparative leaf proteome analysis of three Vitis species showed that 54 of these proteins varied among muscadine, bunch and Florida hybrid bunch grape species. Two defense related proteins were found unique to muscadines. In addition, photosynthesis-related proteins were found to be more abundant in Vitis vinifera grape compared to other Vitis species. The differences in leaf protein content and composition found among these species appear to contribute to their unique physiological characteristics. Future research includes isolation of resistant gene and proteins involved in Pierce's disease tolerance in order to improve tolerance in other species.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF awarded to Ramesh Katam, Plant Biotechnology Lab, Florida A&M University, Tallahassee, FL.

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OA #39

Subcategory: Plant Research

Morphometric Analysis of the Asian Citrus Psyllid with Respect to Collection Date, Method, and Location Within the State of Florida and Within the Grove

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Sandra Allan and Richard Mankin, USDA-ARS-CMAVE

Greening or Huanglongbing (HLB) is considered to be the most important disease of citrus worldwide. It is vectored by Diaphorina citri Kuwayama. After the introduction into Florida, D. citri spread rapidly to all the major citrus growing areas in the United States. Currently,the size and shape of characteristic of D. citri dispersing is unknown. Both morphometric and geometric morphometric analysis were conducted on D. citri collected in two locations (Immokalee, FL and Gainesville, FL) with several different collection methods (aspirator, suction trap, modified leaf blower (vacuum)). The collections took place over the course of one year. Our analysis provides researchers data concerning their ability to identify dispersing D. citri in the field.

Funder Acknowledgement(s): USDA-ARS-CMAVE, NSF Graduate Fellowship to BR, Citrus Research Development Fund, University of Florida SouthWest Florida Research & Education Center.

Faculty Advisor: Richard Mankin, richard.mankin@ars.usda.gov

OA #40

Subcategory: Plant Research

A First-Generation Device to Mimic the Vibrational Mating Behavior of the Asian Citrus Psyllid

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Florida is known for its citrus industry, which is under threat by Huanglongbing (HLB), commonly known as citrus greening disease. HLB is caused by a bacterium transmitted by the Asian citrus psyllid Diaphorina citri (ACP), and has caused over $4.5 billion in damage to Floridian citrus in the past 8 years.
Asian citrus psyllid conspecifics use vibrational communication to locate partners of the opposite sex and reproduce. Male ACP transmit a call through the plant, felt by the female psyllid, who calls back. A duet of call-and-response buzzes ensues, which is used by the male to find the female for mating. We believe that a synthetic female insect can be created that mimics the behavior of the live psyllid female, attracting males for trapping. We created a device that recognizes the call of some male psyllids under noise-proof conditions. This device utilizes a genetic algorithm to generate a template for the recognition of male psyllid calls. Female calls have been electronically reconstructed as synthetic mating calls using the Arduino micro controller system, instigating male ACP to respond. The insects, manipulated into searching for the potential mate, locate the technology creating the call, provided the environment is in ideal conditions. These bugs could then be captured through this mechanism, preventing further damage to the citrus trees they feed upon.

The device has successfully detected the mating calls of a small percentage (ca. 10%) of unmated male psyllids in a noise-proof room. Through a synthetic call-and-response mechanism, it has managed to elicit movement from some of those psyllids up the length of a test plant.

This is a start toward the trapping of all male ACP. The device only uses a single template, while there is a diversity among psyllid calls that prevents this device from recognizing the calls of more than 10% of male psyllids. In the outside world, though, background noise interferes with the device's recognition of psyllid calls, to the extent that this device does not work in the field. But progress is continually being made to create new generations of devices toward our goal; devices that will eventually be able to recognize and attract most male ACP in field conditions. By manipulating the Psyllid mating call to our advantage, we aim to kill these insects, and prevent the collapse of a $9 billion industry if successful.

Funder Acknowledgement(s): USDA-ARS-CMAVE, NSF Graduate Research Fellowship Program, Citrus Research Development Fund, King Abdulaziz City of Science and Technology.

Faculty Advisor: Richard Mankin, richard.mankin@ars.usda.gov

OA #41

Subcategory: Plant Research

Expression of Suppresor Of Sessile Spikelet-like (SOS1-like) in Setaria Viridis

Geralle Powell, Wellesley College

According to the U.S. Environmental Protection Agency, the U.S. exports more than 30% of the world's maize, wheat, and rice. With increased climate and weather events crop yield could decrease significantly in the near future. Through plant biotechnology methods to increase crop yield have been are continuing to be identified. In our study we investigated the expression of the suppressor of sessile spikelets gene1-like, SOS1-like, gene in Setaria viridis (tribe Paniceae, subtribe Cenchrinae). Setaria viridis is small, fast growing model grass species that shares major flower morphology and genetic homology with maize, found in its sister tribe, Andropogoneae. The significance of the SOS-like gene has been identified in maize and is shown to reduce yield by decreasing the total number of spikelets.We have isolated and confirmed the presence of the Sos1-like gene from Setaria viridis through the use of polymerase chain reaction (PCR) Our sequencing have also confirmed the isolated SOS1-like gene is an ortholog of FON2/4, a CLAVATA-like gene in rice.

Through RNA extraction and RT-PCR we expect to determine if Sos1-like expression is restricted only in young inflorescence meristem of Setaria, providing support of its role in the development of the spikelet pair meristem. Our project will provide increased insight of the Sos1-like gene in the inflorescence meristem of grass species other than maize or rice, and will give increase insight into Setaria viridis as a model grass species in other genetic studies.

Funder Acknowledgement(s): The funder of my project was the National Science Foundation and other expenses paid by endowments of the Donald Danforth Plant Science Center.

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Chemistry and Chemical Sciences

OA #42

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Nitric Oxide and its Role in Photodynamic Therapy

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Porphyrinic pigments are used as photosensitizers (PS) in photodynamic detection (PDD) and therapy (PDT) that is a minimally invasive modality in the fight against cancer. When the PS is activated by visible light at a given wavelength, reactive oxygen species (ROS) are generated, which cause cancer cells to undergo cell death. Despite significant advances, drawbacks of the PSs in clinical use include their non-selectivity in cellular-targeting causing cell death by necrosis leading to tissue inflammation. Nitric oxide (NO) has been shown to play a key role in modulating apoptotic cell death pathways and to react with reactive oxygen species to form additional lethal reactive nitrogen species (RNS). In our efforts to enhance the effectiveness of PDT, we set out to investigate the role of NO in PDT. We hypothesized that NO delivered to cancer cells at the time that the PS was administered would enhance the efficacy of PDT by promoting mitochondria-mediated apoptosis. To this end, we incubated androgen-sensitive human prostate adenocarcinoma (LNCaP) cells with both a PS and an NO releasing agent that was most effective in NO release as was spectrophotometrically determined by its oxidation of hemoglobin. Phototoxicity experiments were carried out at 37C with a noncoherent light source. Cell viability, damage and death were assessed in both illuminated and non-illuminated cells and were quantified by MTT staining as well as trypan blue and propidium iodide exclusion. To corroborate the cell viability results, we assayed clonogenic recovery in response to PDT in pigmented cells both in the presence and absence of NO. Our results indicate that the effectiveness of PDT in causing cell death depends on the NO concentration. PDT with NO alone was toxic to the cancer cells at high concentration of NO, whereas at low NO concentration no significant cell damage was observed after light illumination. PDT with the PS alone was not as effective in promoting cell death as PDT in the presence of both NO and the PS. Depending on the concentrations of the PS and NO, we observed that either necrosis or apoptosis were the prevailing modes of cell death after PDT. Our results indicate that the phototoxicity of the compounds is mainly determined by their intracellular concentration. Thus, understanding the combined effects of NO and the PSs in enhancing cell phototoxicity will aid in determining the roles that NO plays in improving the efficacy of PDT and may provide an alternate regimen to enhance PDT efficacy.

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OA #43

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Polyamine-anthracene Conjugates as Anti-Cancer Agents: Is DNA a Potential Biological Target?

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The uptake of polyamine-anthracene conjugates into cells is facilitated by the polyamine transport system (PTS). As a result, polyamine-anthracene conjugates have been utilized to selectively target cancer cells that display high PTS activity. While cellular uptake is an essential first step, the cytotoxic effects of the polyamine-anthracenes are likely to involve interactions with macromolecules inside of the cell. The planar aromatic ring system of anthracene coupled with the high positive charge of the polyamine component makes the conjugates potentially excellent DNA ligands. To test this hypothesis, here we have examined the DNA interactions of five polyamine conjugates that share a common anthracene core. Data from UV-visible absorption experiments, thermal melting analyses, and gel shift assays suggest that charged polyamine amino groups contribute to binding. The anthracenes with two polyamine chains were accordingly found to display the highest DNA affinity. Possible correlations to PTS activity and cytotoxicity will be discussed.

Funder Acknowledgement(s): CHE - 0718634

Faculty Advisor: Kathryn B. Grant, kbgrant@gsu.edu

OA #44

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Chemical Characterization of Phytoliths with Raman Spectroscopy: What is Inside?

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Phytoliths are silica bodies formed by biomineralization in plants where soluble monosilicic acid is assimilated by the plant and precipitated within the cells and intracellular spaces as amorphous silica. After the plant dies and decays, phytoliths remain in the soil until they are slowly released to soil solution through chemical weathering. Phytoliths contain a small amount of carbon (phytC) embedded in the silica bodies. Morphology and distribution patterns of phytoliths in soils have been used for paleoenvironmental reconstructions, when the assumption that the embedded carbon (C) has a photosynthetic origin led to several isotopic studies. However, systematic offsets of the radiocarbon (^{14}C) age of phytC relative to the ^{14}C age of the plant tissue prompted the investigation of its C source (Santos et al. 2012). This study uses Raman spectroscopy to examine the nature of phytC obtained from a previous isotope study (Santos et al. 2014, abstract presentation). The phytoliths were isolated from modern plants, Sorghum bicolor, growing in six different experimental conditions, attempting to see if phytC changes with different growing conditions. Differences in organic matter (OM) type and distribution between these treatments could give information about the OM source. Samples of bilobate phytoliths were analyzed in the C-H stretching region (2700-3200 cm^{-1})and the fingerprint region (1300-1800 cm^{-1}) of the vibrational spectrum. Results show that the average spectra for each treatment exhibit consistent common vibrational bands; however there are slight differences between the spectra of phytoliths from each treatment. The data suggest the presence of carbohydrates, lignin, and possibly lipids. Moreover, the OM is heterogeneously distributed throughout the phytoliths, corroborating the finds of Alexandre et al. (2014). Further research will focus on spectral imaging and a Raman based survey of other silica structures. Information on the nature of OM in phytoliths may aid in determining a mechanism of entrapment.

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Faculty Advisor: Eric Potma, epotma@uci.edu

OA #45

Subcategory: Chemistry (NOT Biochemistry)

Synthesis, Structural Elucidation and Antimicrobial Activities of Some Dialkyl and Alkylene Dithiophosphate Derivatives of Macrocyclic Complexes of Tin (IV) Phythalocyanine Dichloride

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Co-Author(s): Adnan El-Khaldy, Alabama Agricultural & Mechanical University, Alabama

Dialkyl and alkylene dithiophosphate derivatives of macrocyclic complexes of C32H16Cl2N8Sn have been synthesized from the reactions of C32H16Cl2N8Sn with Na and K salts of dialkyl and alkylene dithiophosphates in 1:2 molar ratios in benzene. These complexes have been characterized by elemental analysis such as molecular weight determination, IR spectroscopy, 31P NMR and 1H NMR spectroscopy. Molecular weight determination of these complexes indicates their monomeric nature. Octahedral structure has been proposed on the basis of 1H and 31P NMR, Two sulfur atoms of the ligand coordinate to the central Sn ion in the ring. Antimicrobial activities of these derivatives have been studied by screening them against bacteria, such as *Salmonella typhi* and *Bacillus subtilis*. Future research will involve a further study and synthesis of similar dialkyl and alkylene dithiophosphate derivates that might serve as pharmacological probes in the treatment of certain cancers.

Funder Acknowledgement(s): HBCU-UP

Faculty Advisor: Adnan El-Khaldy, adnan.elkhaldy@aamu.edu

OA #46

Subcategory: Chemistry (NOT Biochemistry)

Extraction and Application of Cellulose from Hibiscus Plants as Fillers in Polymer Composite Products

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Interest in the extraction of cellulose from natural products and their use in the fabrication of bio-friendly electronics have increased over the years. Furthermore, due to the abundance of cellulose and its great strength and biodegradability, it is an ideal candidate for potential use as reinforcement fillers in the formation of plastics for electronics. However, previous literature reports have shown that the properties of extracted cellulose are strongly dependent upon the biomass extraction source and extraction methodology. Thus, in this study, we investigate the extraction of crystalline cellulose from Hibiscus via a strong acid hydrolysis technique. Using X-ray diffraction, the percent crystallinity and structure of the extracted cellulose was determined and compared to cellulose structural data from previous studies reported in the literature. Subsequently, the extracted cellulose is applied as fillers in varying ratios in the formation of a biodegradable plastic polymer composite, such as acrylonitrile butadiene styrene (ABS). Additionally, the impact of the cellulose fillers on the thermal stability of the composites was investigated.

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OA #47

Subcategory: Chemistry (NOT Biochemistry)

Synthesis of Beta-Nitrostyrenes

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β-Nitrostyrenes have been synthesized and used for a variety of medicinal purposes. They have been shown to be anti-angiogenic, anti-mutagenic, kinase inhibitors, antiplatelet compounds and capable of inducing apoptosis in cancer cells. Their anti-angiogenesis ability has been greatly desired in the field of cancer chemoprevention. As anti-angiogenesis agents, these compounds starve blood flow to cancerous tumor cells through varied mechanism which causes the tumor growth to be arrested. We are synthesizing β-nitrostyrenes and several analogous derivatives to determine their structure to activity relationship. All β-nitrostyrenes compounds from this project will be submitted to the National Cancer Institute Developmental Therapeutics Program (NCI DTP) for biological evaluation. We will utilize molecular modeling to evaluate the structure to activity relationship and predict more effective compounds for cancer chemoprevention.

Funder Acknowledgement(s): Marion Franks Lab; NSF

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OA #48

Subcategory: Chemistry (NOT Biochemistry)

Optimizing Synthetic HDL for Atherosclerosis

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Co-Author(s): Hiren Patel and Anna Schwendeman, University of Michigan, Ann Arbor, MI

High Blood Cholesterol is a major risk factor for Coronary Heart Disease (CHD). The current approach of pharmacologically raising High Density Lipoprotein (HDL), for its cholesterol removing ability from arteries, has not been approved as a therapeutic drug. ApoA-I is the protein component of HDL that is responsible for cholesterol removal. Purified ApoA-I has been clinically tested and has a short half-life that requires a higher (i.e. toxic) dose. Studies have shown that ApoA-I mimetic peptides in HDL exhibit many biologically useful functions, such as having a strong lipid-associating ability and activating enzymes (LCAT) involved in HDL remodeling. In this study, the interaction of mimetic peptide (22A) with two naturally occurring lipids (POPC and eSM) has been studied to optimize the formulation of synthetic HDL as a therapeutic drug. The interaction of these peptides and lipids was studied using isothermal titration calorimetry, dynamic light scattering, uv-absorbance, and transmission electron microscopy. Our data illustrates that a higher temperature is required for strong lipid-peptide binding, rapid solubilization of lipids, and formation of stable HDL. Based on the above criteria, eSM is a better candidate for synthetic HDL formation than POPC.

Funder Acknowledgement(s): This research experience was funded by the National Science Foundation through the Interdisciplinary REU Program in the Structure and Function of Proteins at the University of Michigan - College of Pharmacy.

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OA #49

Subcategory: Chemistry (NOT Biochemistry)

Photothermal Ablation Therapy for Oral Cancer by Using Bio-Conjugated Hollow Gold Nanospheres

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Oral cancer is diagnosed in approximately 42,000 Americans every year; which kills 21,000 Americans within 5 years. In recent years, photo-thermal ablation therapy (PTA) based on metal nano-materials has been actively explored for treating cancer cells with successful outcomes. The key factor to achieve high performance of PTA is the bio-conjugation of the Hollow gold nanospheres (HGNs) to create specific affinity toward oral cancer cells, as well as destroy the cell by heat generation from surface plasma resonance. In this study, we developed a conjugation method to modify monoclonal antibody directed at epidermal growth factor receptor (EGFR) on the surface of the HGN, which represent selective target ability to oral cancer cells, A431. This was done by linking the HGNs with anti-EGFR-FITC by using SVA-PEG-OPSS as the linker. Different ratios were tested, which demonstrated their affinity towards A431 cells. The ratio that had the strongest affinity for the cells was 5µg/1mg/10 OD per mL for anti-EGFR/OPSS-PEG-NHS/HGN. To determine death rate for the A431 cells, we examined bio-conjugated HGNs to cells that were not conjugated with HGNs. The ratio of A431 cells with and without Anti-EGFR_FITC-HGN that survived the NIR laser treatment was around 43% and 84%, respectively. With the research and data acquire from present study it was demonstrated that a highly potential of optimized bio-conjugate HGNs in the application of PTA for oral cancer cells. The bio-conjugated of HGNs represented their PTA efficiency by eliminating more than half A431 cells, compared with the other HGNs that were not conjugated. Future work may include attaching a peptide to the HGNs, to facilitate delivery of HGNs into the nuclei of cancer cells, for improving the PTA efficiency, and also check the affinity towards normal cells using the bio-conjugates to assure affinity towards the A431 cells.

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Faculty Advisor: Jin Zhang, zhang@ucsc.edu

OA #50

Subcategory: Chemistry (NOT Biochemistry)

Synthesis, Characterization, and Biocidal Activity of Organotin Complexes of Picolinic Acid N-Oxide

Adewola Osunsade, University of the District of Columbia

The formation of tetracoordinated triorganotin esters in which the oxygen atom of a deprotonated carboxyl group bonds to the tin atom via a substitution mechanism has been extensively reported. Previous work in our laboratory involving reactions of Triphenyltin Chloride with picoline N-oxides established that pentacoordinated addition products were formed via bonding between the tin atom and oxygen atom of the ligand. A reaction of Picolinic Acid N-Oxide with a triorganotin would result in a competition between the oxygen atom from the carboxyl group and the one bonded to the nitrogen atom for the tin atom. We predict the tin will bond preferentially to the oxygen from the carboxyl group, and that this reaction will proceed via substitution. Picolinic Acid N-oxide was reacted with a series of triorganotin compounds in a 1:1 molar ratio and refluxed in ethanol for two hours. The products were then filtered and recrystallized in ethanol. Elemental analysis and spectroscopic data of a Triphenyltin Hydroxide complex indicated that it is a pentacoordianted polymer in the solid state. NMR data shows that it dissociates into a tetracoordinated free complex in solution with the predicted structure. The X-ray crystallographic results will be discussed. A resazurin based assay was used to assess the toxicity of the complexes against both a gram-positive (Bacillus subtilis) and a gram-negative (Escherichia coli) bacteria. Preliminary results indicate Bacillus subtilis is more tolerant to the Triphenyltin Hydroxide complex.

Funder Acknowledgement(s): Financial support from the UDC MARC Program is gratefully acknowledged.

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OA #51

Subcategory: Pollution/Toxic Substances/Waste

Biogas Production from Kitchen and Human Waste Products

Jasmine Gordon, Howard University

Developing countries energy demands continue to increase with their growing populations. Traditional, or conventional, methods of energy are oftentimes not as available for developing countries. As a country, Ethiopia has to continue to meet its energy demands. The country also has a waste management problem. This creates a viable field for biofuel from waste in Ethiopia. Using human waste and left over food waste would reduce the waste management problem while allowing for the creation of biofuel. With the creation of biogas plants, Ethiopia could supply the country with its energy needs. This experiment explored the production of biofuel from a 90% human waste and 10% kitchen waste input and what is the best ratio in providing a viable energy source. Fresh human and kitchen waste was collected and digested in an anerobic biodigester for 41 days. After 10 days, gas started to form and a substantial amount was formed. Methane gas was formed but other ratios can be determined to supply Ethiopia with more energy in the future.

Funder Acknowledgement(s): National Science Foundation

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Computer Sciences and Information Management

OA #52

Subcategory: Computer Science & Information Systems

Eating and Drinking Gesture Recognition Through Pebble Smart -Watch Accelerometer and Wrist-Worn Accelerometers

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Co-Author(s): Gert Lanckriet and Katherine Ellis, University of California, San Diego, La Jolla, CA

Activity recognition through body worn sensors holds promising uses in future applications. Specifically, in the field of health, there has been research in the usage of devices to measure one's physical activity levels. Although, there has not been much research in the usage of devices to measure one's eating habits. Our lab seeks to predict when a user is eating solely through wrist worn accelerometers. To gather a range of data, we will run multiple interventions where we have participants eat various foods (such as pasta, steak, cereal). After, we will annotate the data based on a set protocol. Then we will design a classification of the data and perform experiments to see how correct our algorithms are. We hope to come up with machine learning algorithms that correctly predict when a user is eating with at least 90% accuracy. For current research purposes, we are gathering our own repetitive eating data to analyze. We would like to see if we can predict repetitive eating, before we move on to large scale eating data collection. We have extracted features at the second time interval from 2-3 minute long eating data. We have used SVM and random forest classifier to predict when a user is eating. These classifiers have not given the

desired accuracy. We will still be experimenting with other classifiers such as the k-nearest neighbor. We hope to develop algorithms with a desired accuracy with our own experiments before we move on to the participant data collection and experimentation. After creating a successful algorithm, we hope to create a non-invasive application, which will be able to monitor and hopefully better people's eating habits.

Funder Acknowledgement(s): Funding was provided by the National Science Foundation for the Temporal Dynamic Learning Center REU at UCSD.

Faculty Advisor: Gert Lanckriet, gert@ece.ucsd.edu

OA #53

Subcategory: Computer Science & Information Systems

Exergame for the Blind

Jiayi An, Borough of Manhattan Community College
Co-Author(s): Hao Tang, Borough of Manhattan Community College, CUNY, NY

In this study, we developed an accessible game Finding Survivors in the Dark, for the blind and visually impaired. Using a Microsoft Kinect motion sensor, we designed and implemented a game that is both played and controlled using voice or physical hand gestures. Game instructions and feedback are provided by audio and speech synthesis. Our goal is to investigate the accessibility challenges in exergame for the blind using motion sensors.

In the game, a player tries to recognize the survivor's location in a 2D maze by utilizing stereo sound from earphone/headphone and approaches the target to win the game. The moves are controlled by voice commands, such as "front", "move front", "right", "go back". This game can help people improve their direction sense and practice map memorization ability. While playing the game, the player can construct a map in his/her head by walking in the maze, but how many steps he/she can remember depends on the player's memorization ability. The game also has an interesting and challenging feature, a zombie mechanism. After a few easy levels, players will be told that a zombie is coming, at the same time the player is able to hear the noisy sound from the moving zombie, and the player can swing his/her fist to defeat it. However, it only works when players punch in the correct direction and the zombie is within the player's attacking range. The game has multiple levels, in the first two levels the maze is easy and there is no zombie at all. The difficulty of the game increases, including both the complexity of the maze and the speed of zombies' motion.
We have performed preliminary testing on both visually impaired and blind-folded sighted person. The testing has revealed that the logic of game is interesting, the voice and gesture recognition components work as expected, but tutoring and calibration phases at the beginning of the game are suggested by users in order to let visually impaired people correctly play the game. The calibration step will ensure the alignment of the player within the sensor's field of view as well as teaching users how to play the game; this will be future work. In addition, we plan to perform more testing, with the collaboration of CUNY Baruch College Computer Center for Visually Impaired People.

Funder Acknowledgement(s): This work is supported by NSF EFRI-REM under Award # EFRI-1137172, to the City College of New York, and a PSC-CUNY Award to Borough of Manhattan Community College.

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OA #54

Subcategory: Computer Science & Information Systems

Developing a Web-Based Interface to Evaluate Downscaled GFS Products

Joshua Bailey, Mississippi Valley State University

At the National Centers for Environmental Prediction (NCEP) Environmental Modeling Center (EMC) in College Park, MD coding languages are heavily used for numerical weather prediction, product dissemination, and product evaluation. However, the python programming language is foreign to many of the model developers and model evaluators as a viable resource that is useful for displaying model output. This project involved the introduction of python to EMC as a useful tool for evaluating Global Forecast System (GFS) model output. It is the goal of EMC to improve weather prediction models so that forecasters have the ability to make accurate predictions. These predictions are improved if forecasters have multiple sources of data to make their predictions. The National Digital Forecast Database (NDFD) is the primary method used by forecasters at NWS offices to create and disseminate gridded forecasts of sensible weather elements such as temperature, precipitation, and cloud cover. One of the most commonly used tools to create NDFD gridded forecasts is the GFS. Currently, the course resolution GFS model is input into a downscaling code called "smartinit" to produce downscaled 2.5-km weather products over Guam. In this project we add the capability to produce downscaled products over Hawaii, Puerto Rico, Alaska, and the Continental United States (CONUS) in the hope of adding this new feature to the operational GFS production suite. Before these products become operational the output must be evaluated against downscaled products from the North American Mesoscale (NAM) as well as verified against observations to check the validity of this new product. Python is used to achieve this goal of evaluation and verification by developing a web-based interface that will serve as a gateway to

python produced GFS and NAM products. Visual interpretations of gridded forecast products from both the GFS and NAM covering Alaska, Hawaii, Puerto Rico, and CONUS is evaluated.

Funder Acknowledgement(s): National Oceanic Atmospheric Administration Educational Partnership Program

Faculty Advisor: Timothy Holston, thost@mvsu.edu

OA #55

Subcategory: Computer Science & Information Systems

Augmented Reality Application for Campus Navigation and Learning

Dexter Ballerda, Bowie State University

The goal of the Augmented Reality (AR) mobile application is to develop a learning and navigation tool to maneuver the campus. We hypothesize that this real-time AR mobile application will help users navigate through the campus and learn about the university's departments such as majors available, department chair, etc. The process of making this application was fun, interacting, and challenging. The methods involved the following steps. First, the campus map was divided into grids and the grids were used as markers. Second, Vuforia System was used to upload the markers, so that the marker could be detected by the camera. Third, the markers and targets were completed; Google earth and camera were used to get pictures of the buildings, roads, and other places around the campus. The data includes models, markers, audio, video, and website links. After all the data were gathered, the application was developed using Unity 3D. The result of the application was promising and encouraging. The Institution Review Board has approved our request for user studies. We are currently conducting user studies. Many people found our application helpful in navigation and learning through the campus.

In conclusion, the application is detecting all the buildings, parking lots, and roads around the campus. It is also blending real world-data and computer generated graphics. Audio is currently working well. For the future, we will integrate GPS (Global Positioning System) so the user's location can be detected while using the application.

Funder Acknowledgement(s): The authors would like to thank the National Science Foundation for supporting the project. This work is funded by grants HRD-1137541 and HRD-1238784.

Faculty Advisor: Sharma, ssharma@bowiestate.edu

OA #56

Subcategory: Computer Science & Information Systems

Indoor Localization System - Its Ability to Detect the Propagation of Influenza Based on Human to Human Contact

Kendra Claiborne, University at Buffalo
Co-Author(s): Tong Guan and Sheng Zhong

The Global Positioning System (GPS) is the premiere navigation system that provide real time location information, which can be applied on a multitude of platforms. Despite its efficiency in localization, it is ineffective within indoor environments due to building obstructions blocking the signals transmitted by the satellites used in this system. This limitation can be overcome by constructing an Indoor Localization System (ILS). Our research presents the design of an ILS using the radio signals broadcasted from wireless access points (WAP) and Bluetooth beacons in the University at Buffalo's Davis Hall. Ultimately, this location based service will be used to build a human contact network. In the case of detecting the health of a user, we will facilitate this through an app that requests users to input their daily health status. The fusion of this information into our epidemic propagation model, we will able to detect the propagation of epidemics in real time utilizing a user's mobile phone.

We employed the fingerprinting method, which involves a two stage process - 1.Calibration (Offline) phase, and 2.Localization (Online) phase. The calibration phase consists of selecting calibration points throughout our displacement area (Davis Hall), recording the absolute physical coordinates, as well as the signal strength readings from stations, like the WAPs and Beacons, on an off-the-shelf commercial smart phone. The signals are interpreted as the Received Signal Strength Indicator (RSSI), which relates to the distance from the receiver station (mobile device) to the broadcast stations. The second phase involves creating an application that research participants will use in order to locate where they are. The app will collect a RSSI on their smart phone, which will be sent to the server where the radio map of fingerprints was built in phase one. A matching algorithm will be used to match the closest RSSI via the radio map to the current RSSI scan just taken via the app.

Future endeavors involve recruiting participants in furtherance of gathering health status data. Participants will be recognized only by the MAC address of their mobile device, for security and privacy. This health information, along with contact networks collected and location traces collected from mobile phones, we want to establish a model that is able to predict epidemic disease propagation (cold or flu for example) from both individual and population level. We want to see how user A's (uninfected) health survey response changes overtime through close range contact with user B (infected) under our controlled environment's tracking of both individuals.

Funder Acknowledgement(s): This research was supported/ funded through a summer research program by SUNY at Buffalo Louis Stokes Alliance for Minority Participation (LSAMP). Funding provided by NSF CNS 0524030 and the use of mobile device(s) through NSF CRI 1205656.

Faculty Advisor: Chunming Qiao, qiao@buffalo.edu

OA #57

Subcategory: Computer Science & Information Systems

Immersive Multi-User Campus Platform

Phillip Devreaux, Bowie State University

This immersive platform allows people to simulate tours of a college campus. This platform also allows people to simulate real world emergencies while standing in a single room. This project presents a multi-user virtual campus which will immerse the user in a virtual college environment. The proposed multi-user environment was created using game engine Unity 3D. First, the terrain was created by placing a picture of the actual environment's map on a plane. Next, the plane was placed onto a blank terrain while the roads were placed onto the terrain accordingly. Trees, buildings, and other objects were constructed and placed. In addition to objects and buildings, character models were added to the terrain. When simulating real world experiences, many platforms and methods are used to inform people of what to do in a given situation. For example, a method used to simulate war is paintball, and method to simulate mountain climbing is indoor rock climbing. This proposed framework can be used to explore virtually immersive tours or for performing virtual campus evacuation drills. This platform can be used in two ways. The person can use their computer to explore the platform, or the person can be fully immersed in the environment with the use of a virtual reality headset. With the fully immersive version, and will have a first person view of the environment. The user will be fully immersed in the campus. Users will be able to look at their avatars and virtual vehicles. While immersed, users will get to experience every drill and tour. The methods to create the most realistic simulation possible combined form a platform that can be used for education, experience, creativity, emergencies, and fun. In conclusion, this platform can be used as a teaching and educational tool for navigation and performing virtual reality drills. Future research includes precise GPS navigation, HUD map navigation, full entry into buildings, online classes, and building and campus emergency evacuation.

Funder Acknowledgement(s): The authors would like to thank the National Science Foundation for supporting the project. This work is funded by grants HRD-1137541 and HRD-1238784.

Faculty Advisor: Sharad Sharma, ssharma@bowiestate.edu

OA #58

Subcategory: Computer Science & Information Systems

Strategies for Data-Rich Projects: Environmentally Responsible Aviation Insect Accretion Mitigation

David Levon Johnson, Virginia State University
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Ali Ansari, Virginia State University, Petersburg, VA

The goal of this project is to archive past and present data for the Insect Accretion Mitigation task of the Environmental Responsible Aviation (ERA) project. Archiving is used to compile and categorize extensive amounts of data. A fundamental understanding of computational techniques is essential to preparing an archiving database. For this work, the data consisted of high speed photography of crickets and flightless fruit flies propelled from a pneumatic insect delivery device towards research coatings and the resulting insect residues remaining on the surfaces. The testing date, test facility, and other materials tested are equally important, though non-obvious, for creation of a robust, searchable archive. Beyond a simple compilation of all of the data collected during the research, a successful archive will enable researchers to readily retrieve desired data, input new data as it is generated, and make comparisons of the archived data. To that end, a user interface was generated using Python to link to the archiving directories. The interface will enable researchers to isolate specific data sets and uncover non-obvious relationships and trends.

The heart of archiving is developing a design space capable of: accurately and concisely organizing existing data, logical expansion to capture new data streams as they are realized, being accessible and searchable to project members regardless of their credentials. The archiving strategy for this work was shaped by considering two important factors: what key terms will people use to search for information and which filing structure will make the system most accessible to navigable. By frequently engaging with researchers, these parameters were identified and incorporated into the archiving architecture as well as the user interface.

An expected goal from this project is the creation of an archiving system that not only is of great utility, but can also be used as a stepping stone for future researchers to incorporate into other existing or future projects. This approach, to actively archive data as it is generated instead of after the project has been completed, can be of utility beyond this work and may enable more efficient research practices and expedited scientific achievements. Enabling researchers to readily access state-of-the-art research and trace how project advances were made will continue to push the envelope of the current understanding of the world around us, which is at the forefront of NASA's missions.

Funder Acknowledgement(s): National Science Foundation (NSF)

Faculty Advisor: Ali Ansari, aansari@vsu.edu

OA #59

Subcategory: Computer Science & Information Systems

Engaging Students with Interactive Exercise Apps Based on Sorting Algorithms

Matthew Meeker, Winston-Salem State University

This presentation addresses a significant learning barrier experienced at many CS departments; the inability of students' to stay engaged in the classroom. As technology advances in portability, the distractions caused by these devices also increases. In our research project, we investigate the applicability of using mobile devices in the classroom to utilize interactive problem-solving exercises in order to enhance class engagement and student learning. Our goal is to engage students during the class period with multi-step interactive exercises using mobile devices, to allow them to respond and interact with information in a non-passive way and to let them construct and modify virtual artifacts while providing immediate feedback based on their interactions. I designed and developed two sorting algorithm exercise Apps to be utilized in the Algorithm course. The Apps run on Android devices as clients in the Mobile Response System (MRS) [1] environment. The Apps are designed as dynamic entities where parameters are populated with randomly generated values to create many variations of the problem. In my Apps, students formulate the answer of a particular problem by following a set of steps of an algorithm. In each step, students make choices that will impact the next step of the interaction provided by the App. Students are allowed to go back and forth through their steps to view or revise their answers. Once the student has completed each step or the allotted time for the exercise expires, the results of their interactions performed at each step are then compared to the correct answers of each step and is provided to the student as immediate feedback. The Apps leverage the opportunity to offer students more individualized feedback while they are working through the exercises. There will be demonstration of MRS software environment and the Apps during the presentation. In conclusion, the Apps will allow students to practice their concept and skills while increasing their class engagement and allow instructors to have real-time evidence of students' comprehension of lecture materials. Future work will involve creating more interactive exercise Apps for both the target and other courses in the CS department.

References: [1] Deb. D., Fuad M. M, Farag, W, "Developing Interactive Classroom Exercises for use with Mobile Devices to Enhance Class Engagement and Problem-solving Skills," Accepted for publications at IEEE Frontiers in Education (FIE), October, 2014.

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OA #60

Subcategory: Computer Science & Information Systems

A Project Management Framework for Cloud and HPC Resource Providers

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Cloudmesh is a project that allows the management of virtual machines in a federated fashion. It can be run in two modes. One is a standalone mode where the users run cloudmesh on the local machines. The second mode is a hosted mode where multiple users share a web server through which the virtual machines are managed. One of the important functions for cloudmesh is to provide a sophisticated user management. This user management is currently conducted in drupal through the FutureGrid portal via an integration to the FutureGrid LDAP server. However, as the rest of cloudmesh is developed in python, the user management in FutureGrid has had some limitations. It is important to identify a python based solution with more advanced features in order to re-implement the user management functionality in cloudmesh to address long term sustainability of the user management component.

This research will explore how to design a data model in python via mongoengine to represent users and user created projects to identify how we can leverage either django or flask to manage such created projects. To address the later, we will first evaluate if we can get a django web application started and identify how to use it. If this turns out to be too difficult, we will fall back to flask. As part of the management, we need to implement a queue in which users are queued for approval, and a project queue whereby projects are queued and approved by a committee. A simple backend system written in python will support this task and provide an abstraction that is outside the web interface. Presently, the users, project, project committee and some aspect of the approval mechanism have been represented in the data model and managed. Hence, the project has not been completed, thus, is being worked on. However, it can be said that progress has been made thus far, as these aspects that have been created, after numerous changes made to them, are working as originally planned.

Funder Acknowledgement(s): National Science Foundation; The School of Informatics and Computing; The IU-STEM Summer Scholars program

Faculty Advisor: Timothy Holston, thost@mvsu.edu

OA #61

Subcategory: Computer Science & Information Systems

SIRA: TREC Session Track 2014

Drew Pintus, Siena College
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Siena's Interactive Research Assistant's (SIRA) participated in the Text Retrieval Conference (TREC) Session Track of 2014. The overall goal of this track is to improve search results during query sessions based on a user's behavior. Query sessions include aspects of a search including query topics with interactions, results, and click times. Sessions also present the results for clicked and non-clicked result pages. SIRA has used several methods to improve search results. Each method of query expansion was individually based off of clicked-on results, non-clicked-on results, pages with the longest visited time, N-Percent (N%) of each page, and framed text. Framing the text is a way to determine the relevance of a particular document to the given query. In other words, it checks for relevance of a document based on the query by putting structure on the unstructured text. Results have been submitted to the National Institute of Standards and Technology (NIST) for the formal evaluation.

Funder Acknowledgement(s): This work has been supported by the National Science Foundation Research Experience for Undergraduates Award 1359008.

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OA #62

Subcategory: Computer Science & Information Systems

Game Theme Based Educational Module for Inheritance

Jeff Ruffin Jr, Bowie State University
Co-Author(s): Sharad Sharma and James Stigall, Bowie State University, Bowie, MD

There are already many ways for students to search for help on concepts that are tough to learn such as tutoring or educational videos. No matter what method is used, each student has their own preference of how to reinforce what they have learnt in class. This project focuses on developing a game theme based instructional module for beginning and experienced computer science students. The hypothesis of this project is that the game theme based instructional module will lead to better student learning outcomes. This is important because there is a constant need of information seeking especially in the classroom setting. A gaming approach to learning computer science concepts will help students learn material more effectively and also apply an entertainment value to learning. This project was completed in three phases. First, the modeling phase involved the gathering of model and materials used in the project. Using 3ds max, the backbone of the project was created. Second, the exporting stage involved the finished product of the modeling phase to be converted into certain files that are compatible with Vizard. And last, the programming stage involved the compatible file being added to Vizard using Python programming and then creating an exe file for use on a computer. The module starts with a tutorial mode followed by a game to reinforce concepts taught in the tutorial mode. The module has been completed and tested on multiple platforms as well as presented in front of peers who gave their input as well for project improvements.

In conclusion, the visual concepts for inheritance developed through a gaming approach will help students learn concepts of computer science faster and more efficiently. Future research will include conducting user studies in the fall 2014 semester. Surveys will be taken for student feedback and further project improvements for the future.

Funder Acknowledgement(s): The authors of this project would like to thank the National Science Foundation for supporting the project and future opportunities to present my work. Grant Award number HRD-1137541 and HRD-1238784.

Faculty Advisor: Sharad Sharma, ssharma@bowiestate.edu

Ecology, Environmental, and Earth Sciences

OA #63

Subcategory: Civil/Mechanical/Manufacturing Engineering

Understanding Community Resilience from Natural and Man-made Disasters

Ifedolapo Akinleye, University of the District of Columbia
Co-Author(s): Pradeep K. Behera, University of the District of Columbia, DC

Over the past decade, the world has faced some of the most devastating natural disasters experienced by mankind. Some of the experienced natural disasters include flooding, earthquakes, tornados, and hurricanes and man-made disasters include wild fires, physical attack by a group or a country and cyber-attack.

With global warming/climate change under full effect, it is reported that (USGS 2008) there is strong potential that the frequency and magnitude of these occurrences will increase.

In order to understand the impact of natural and man-made disasters and the associated consequences on the community, this research will focus on understanding terminologies, disaster classification definitions, community resiliencies from an engineering view point. Our communities rely upon a number of factors which are planned, designed, and operated by engineers that include urban infrastructure such as building systems, transportation systems, drainage systems, dams and water supply systems, energy systems, and electric supply and distributed systems. The research methodology include, data analysis related to disasters, analysis of terminologies of community resilience, application of research to Washington Metropolitan area.

Putting a particular area under the microscope, the Washington, D.C. metropolitan area is examined. While this particular area hasn't faced any significant natural disasters, apart from the fact that it homes the Nation's Capital, this area has a geographic susceptibility to future disaster events due to its coastal location.

Funder Acknowledgement(s): STEM Center: HRD-0928444

Faculty Advisor: P. Behera, pbehera@udc.edu

OA #64

Subcategory: Civil/Mechanical/Manufacturing Engineering

Green Bridge Rating System

Emani Evans, Morgan State University

The objective of this study is to develop a rating system that has the potential to enhance sustainability and efficiency within the design and construction of bridges. The proposed rating system is based on eight major categories: 1) construction, 2) transportation, 3) safety, 4) water efficiency, 5) energy and atmosphere, 6) air quality, 7) sustainability and land use, and 8) regional priority credits. Similar to Leadership Energy and Environmental Design (LEED) criteria for buildings, the rating system for the Green Bridge Rating System is based on points assigned within a rating system. The expected outcome of this study proposed may lead to a new generation of high-performance green bridges that utilize innovative, sustainable materials and construction methodologies that would meet various prerequisites and credits to be classified as bronze, silver, gold or platinum certified bridges. Future work includes evaluating bridge case studies to determine the applicability of the green bridge rating system to increase its sustainability and efficiency.

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OA #65

Subcategory: Climate Change

The Impacts of Seasonal Flooding on the Mississippi Delta and Future Adaptation Management Planning

Ricky Dixon, Mississippi Valley State University

Flooding has been a major part of the Mississippi Delta's history. One of the worst floods occurred in 1927 when the levee in Greenville, Mississippi, the heart of the Delta and my birthplace, broke and flooded the town much like what happened in New Orleans during hurricane Katrina. Typically from December to July the Delta has many floods. My main goals for this project were to to better understand the weather and climate in the Mississippi Delta and its impacts on flooding, as well as to give insights on adaptation measures for future flooding. In order to reach these goals I first had to learn more about climate and get a better understanding of flooding. In order to do this I analyzed reports of past projects on flooding that were sponsored by the Sectoral Applications Research Program. Once I analyzed the reports I then broke them down and put them in a database that now serves as an archive for the SARP team. Next I began interviewing decision-making professionals and stakeholders from the Mississippi Delta as well as NOAA staff and researchers in the area for information on flooding and how the public has dealt with it in the past. This included speaking to hydrologists and climatologist as well as the United States Army Corps of Engineers. I also interviewed my grandfather, Roosevelt Parker, as a means of getting the story from the view of a resident who had lived through the floods that have occurred in the Mississippi Delta. This information has been used to write an article that I will be attempting to have published to the CPO website in the future.

Funder Acknowledgement(s): National Oceanic and Atmospheric Administration Educational Partnership Program

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OA #66

Subcategory: Ecology

Ecological Complexity Influences Agonistic Displays in Slevin's Bunchgrass Lizard

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Spiny lizards (Sceloporus spp.) use visual agonistic displays to advertise territory ownership. Previous research on Slevin's bunchgrass lizard, Sceloporus slevini, indicates a reduced reper-

toire of agonistic displays in comparison to other congeneric species. In the U.S., S. slevini are restricted to dense bunchgrass habitat in isolated mountains and valleys of Southeastern Arizona. Bunchgrass is used for perches and hiding places. We hypothesized that male S. slevini exhibit reduced agonistic displays due to the visual complexity of their environment. Male lizards were captured by hand from the Huachuca and Chiricahua Mountains in Cochise County, Arizona in July, 2013 and 2014. Lizards were transported from the field to laboratory for videotaping. A male was placed in a 2 m diameter wading pool with a dirt substrate and a bunchgrass clump positioned below two 100 watt lights providing heat and illumination. After a 24 h acclimatization period another male was introduced into the filming enclosure. Ten pairs of males were recorded for 20 minute trials. Filming took place from behind a blind using 3 video recorders recording at 30 frames per second. Videos were analyzed with Microsoft Moviemaker. Data were quantified by type and frequency of different behavioral displays. Head nods were displayed in 100% of trials (n=10 trials), full show occurred in 90%, chasing in 30% while behaviors of face off, lashing, and biting occurred in 20% of all trials. The hypothesis of reduced agonistic displays was not supported. These results contrast with previous research suggesting low levels of agonistic displays in this species. Our results suggest that these lizards are highly territorial and have a wide repertoire of agonistic displays, which is even more impressive because interactions were recorded during July, the time of year when testosterone levels are lowest in this species. Future research will examine males during the mating season when their testosterone levels are highest to determine if seasonal differences in agonistic behavior exist. In addition we plan to test female choice for male display characteristics.

References: Carpenter, C.C.1967. Aggression and social structure in iguanid lizards.Pp.87-106.In W.W Milstead (Ed.),Lizard Ecology:Symposium.University of Missouri Press,Columbia, Missouri,U.S.A.
RUBY, D.E. 1978. Seasonal changes in the territorial behavior of the iguanid lizard Sceloporus jarrovi. Copeia 1978:430-438.

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OA #67

Subcategory: Ecology

Effects of Sampling Effort on Estimates of the Mean of Range Size Distributions

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The range size distribution (RSD) for a given region describes the frequency of species exhibiting geographic ranges of different sizes (2). Descriptions of spatial variation in RSD are major elements of current attempts to explain spatial patterns of diversity and identify areas of conservation concern (3). Thus, it is key to understand potential bias in estimates of RSD properties. Here, we hypothesize that bias in estimates of the mean of RSD is determined by sampling effort according to the following model of the probability of not discovering a species (P.m) (eq. 1)
where d is detectability (sensu (6): the probability of detecting the occurrence of the species in a spatial grid cell i), Ci is sampling effort in grid cell i, AOO is geographic range size measured as area of occupancy, and grid cells i=1 through i=AOO constitute the geographic range of the species. Based on equation 1 we predict that bias in estimates of the mean of RSD for any given region is negatively related to mean sampling effort across the region, and positively related to the spatial aggregation of sampling effort across the region, because in poorly sampled areas narrowly distributed species are less likely to be discovered than widely distributed species. We tested these predictions in the context of the current belief that mean RSD of Andean plants is smaller than that of Amazonian plants (3). Botanical sampling effort across Northwestern South America was measured as "collector days", defined as unique combinations of collector name and collection date (6). Aggregation in sampling effort was measured as the log of variance in collector days across grid cells conditional on mean sampling effort. We simulated the geographic distributions of virtual species across the Neotropics using the "stepping stone" model described in (1), and the discovery of each of the virtual species according to observed sampling effort and equation 1 with detectability = 0.1. We calculated bias in the mean of RSD as the difference between true and observed values of the mean of RSD, the latter being the mean AOO of discovered species excluding the undiscovered. The results supported both predictions on bias in estimates of the mean of RSD with p-values < 10-5 and < 3 x 10-4, respectively. Thus, current descriptions of geographic variation in RSD (3) and the density of narrowly distributed plant species across the Neotropics (4, 5) may be more fiction than substance, and should be regarded as highly tentative at best. In future studies, estimates of spatial variation in mean RSD must account for spatial variation in sampling effort.

References: 1. Colwell, et al. 2009. Peaks, plateaus, canyons, and craters: the complex geometry of simple mid-domain effect models. Evolutionary Ecology Research, 11, 355–370.
2. Gaston, K.J. 2003. The structure and dynamics of geographic ranges. Oxford University Press, Oxford, UK.
3. Morueta-Holme, et al. 2013. Habitat area and climate stability determine geographical variation in plant species range sizes. Ecology Letters, 16, 1446-1454.
4. Myers, et al. 2000. Biodiversity hotspots for conservation priorities. Nature, 403, 853–858.
5. Pimm, et al. 2014. The biodiversity of species and their rates of extinction, distribution, and protection. Science, 44, 1246752 (2014). DOI: 10.1126/science.1246752.
6. Sheth, et al. 2012. Understanding bias in geographic range size estimates. Global Ecol. Biogeogr., 21, 732–742.

Funder Acknowledgement(s): David Bogler. The Center for Conservation and Sustainable Development, Missouri Botanical Garden. National Science Foundation.

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OA #68

Subcategory: Environmental Engineering

Phage Therapy in Sludge Samples from Wastewater Treatment Plants of the Greater Salt Lake Basin

Laura A. Hernandez, Humboldt State University

Phage therapy allows for new viruses to be found that can use the lytic cycle to burst bacteria in the wastewater treatment plants. I addressed to what degree the presence of phage in the aquatic environment would decrease the bacterial biofilm. I predicted that the presence of phage would have a greater effect on reducing biofilm and therefore cause less damage to the plant system. Biofilm accumulation is the bacteria colonies that float on the surface and cause costly damage in the treatment plants. Bacteria and viruses in sludge samples were isolated separately using plating methods. These unknown isolated bacteria and viruses were then streaked and incubated to create cultures. The cultures were examined under electron microscopy. Electron microscopy images showed different isolated phages present in the sludge. Further experimenting of these phages would allow me to know the specific species, leading to new knowledge about the potential for these isolated phages to conduct phage therapy in the wastewater treatment plants. Phage therapy is crucial in benefiting the mechanical systems as a whole and most importantly water cleanliness.

Funder Acknowledgement(s): The Graduate Preparation Institute, Graduate School at the University of Utah

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OA #69

Subcategory: Geosciences and Earth Sciences

Diatom Community Structure as an Indicator of Water Quality in Blackbird Creek, Delaware

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Various water quality indicators such as biological and chemical indicators enhance the assessment of environmental conditions. These indicators are important in developing management strategies to evaluate the health of marine systems. Diatoms are biological indicators that respond predictably and reliably to environmental changes and are found to be more sensitive than chemical indicators. Diatoms can precisely record the historical water quality data through its siliceous cell wall. As environmental conditions change over space and time the presence of these indicator species also changes. Blackbird Creek is considered as one of the most pristine marsh ecosystems in Delaware. Water quality at Blackbird Creek will be evaluated seasonally by studying the diatom species at selected study sites along the marsh. Our hypothesis is to see if land use has any effect on Blackbird creek by determining the diatom community. Chemical water quality will also be studied from the pore water isolated from the soil samples and water samples collected at selected sites. Chemical water quality data will be correlated with the diatom diversity to assess the health of Blackbird Creek. The sampling sites include native marsh grass site, invasive marsh grass site, diverse marsh grass site and agriculture sites. To determine the diatom community structure, DNA was first isolated from soil samples using a ZR Soil Microbe DNA Kit then molecular methods such as Polymerase Chain Reaction (PCR) and cloning were used to analyze diatoms. Primers for diatoms were designed for 18s-rRNA sequences. A phylogenetic tree will be constructed from the diatom sequences and their diversity in relation to water quality and marsh location will be ascertained. Our results show that there is a diverse diatom species in the summer. Navicula phyllepta is the dominant diatom in the native marsh grass site and diverse marsh site where nitrate nitrogen and total nitrogen are found in high concentrations. In the area dominated by the invasive marsh grass, Cylindrotheca closterium, has been identified. Cylindrotheca closterium thrives in conditions of high salinity. Thalassiosira aestivalis is rich in marsh areas near to the agricultural sites which may be partly due to fertilizers. Thus microbial diversity varies with marsh habitat in which the soil nutrient composition is being impacted by land use. Further research involves continuous seasonal monitoring of diatoms in relation to marsh location and nutrient conditions to better understand their relation to water quality.

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OA #70

Subcategory: Geosciences and Earth Sciences

Flood Extent Simulation: A Geographic Information System (GIS) River Flooding Extent Approach

Derrick Jones, Mississippi Valley State University
Co-Author(s): Jared Allen, National Weather Service, Jackson, MS

Situational awareness of river flood and evolution through the use of flood extent mapping is critical for emergency management resource allocation, decision making, and overall public alertness. However, current National Weather Service (NWS) mapping guideline rigors for flood extents per gauge site can equate to $10,000-$50,000 and six months to two years of effort expenditures before finalization. This high expenditure burden is placed on limited budgets of local city, county, and state emergency management and is a restricting factor for NWS flood extent mapping implementation. NWS, Jackson, MS, with the support of the U.S. Army Corps of Engineers (USACE), Lower Mississippi River Forecast Center (LMRFC), and the Hydrologic Service Branch (HSB), has developed a river flood extent protocol using ArcGIS and a Flood Extent Simulation Model (FESM) that saves economic and temporal investment while being spatially accurate.

Results on unedited model output on the Leaf River at Hattiesburg, MS and Susquehanna River at Binghamton, NY indicate spatial kappa coefficient accuracy of 62% to 86% for minor to record flooding stages compared to respective Advanced Hydrologic Prediction Service (AHPS) approved HEC-RAS flood extents. However, further quality control measures were implemented and improvement statistics for kappa coefficient and pixel classification were tracked for each updated flood extent version for corresponding AHPS HEC-RAS mapped sites. As a result, the spatial kappa coefficient accuracy was improved significantly (88% to 97%) for the minor to record flood stages for the two sites. The average processing time for the NWS Jackson flood extent protocol is 1 to 2 hours, including additional quality controlling measures. This technique will save resources and further facilitate river flood awareness to NWS core partners and the public.

Funder Acknowledgement(s): National Oceanic and Atmospheric Administration

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OA #71

Subcategory: Geosciences and Earth Sciences

Elwha Dam Removals Effect on the Carbon Cycle: Tracking Particulate Organic Carbon in the Nearshore

Sarra Tekola, University of Washington

Dam removal is an emerging technique for ecosystem management. Reservoirs behind the dams are known to be both carbon sinks and sources. The Elwha dam removals in Washington State are the largest dam removals in U.S. history. In this study the fate of the carbon stored in the reservoirs upon its abrupt release is evaluated. Sediment samples from the estuary, delta and water column were tested for their particulate organic carbon content through loss on ignition testing. Grain sizes of sediment samples were analyzed and volume estimates of carbon deposits were calculated. The results indicated that particulate organic carbon is preferentially deposited in two locations. The large woody debris typically settled on the subaerial delta, while the carbon sorbed to silt and clay settled in the estuary and subaqueous delta. The sudden release of the reservoirs during resulted in a condition where river meandering is minimal. As a result, approximately half of the carbon likely sorbed to the sediment in the reservoirs remains. The rapid sediment accumulation resulted in a higher-than-average carbon burial rate of the roughly 165,000 +/- 124,000 tonnes of carbon deposited on the delta. This suggests dam removal can, not only restore an ecosystem, but it may also be able to help mitigate climate change.

Funder Acknowledgement(s): Nataional Science Foundation; Friday Harbor Labs; Mary Gates Endowment

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OA #72

Subcategory: Materials Science

Subterranean Termite (Reticulitermes sp.) Mortality and Preference to Two Different Formulations of Poly (N-vinyl caprolactam)

Ishara Emerson, Spelman College

Termites are an extremely efficient example of cellulose degradation into simple sugars. Because of this, termites can be used to evaluate this conversion process especially as it relates to a cost and energy efficient model that can be used for the large scale manufacturing of bioethanol from cellulose. The termites used in this study were subterranean termites (Reticulitermes sp.) from the worker caste. They were fed two different formulations of Poly (N-vinyl-caprolactam) (PVCL), each with a different molecular weight, of a combination of cellulose and synthetic fibers. One was labeled PVCL-1, while the newer sample was labeled PVCL-CA (Cellulose-Acetate). There were two questions posed in this study: Will there be a difference along the two different PVCL's in regard to toxicity, which was measured by weight and mortality, and will the termites prefer one type PVCL over the other. This part of the experiment was measured by feeding and the amount consumed, duration, and the number of physical contacts with the two different samples. It has been hypothesized that termites used in our study would have a higher preference for one PVCL-cellulose over the newer sample, and it was anticipated that this preferred PVCL would have a lower toxicity. According to the number of contacts and duration, the data suggests that PVCL-1 was most preferred, but there was no difference in the level of toxicity among the two different PVCL's. Further research in this area will enable us to determine the inner scaffolding of the termite gut so the process can be replicated under laboratory conditions.

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OA #73

Subcategory: Physiology and Health

Growth and Nematode Loads in Kids Under Mixed and Sequential-Grazing System

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Housing and feeding affects the growth and nematode loads in kids under mixed-species grazing systems. Because of the warm, humid conditions during the summer months gastrointestinal nematodes are the greatest health and production challenges for goats in southeastern states year round. Resistance to the anthelmainitc treatment is the major conern in controlling parasitism in goats and possibly cattle. The primary goal is to evaluate the growth, carcass traits and parasitic load of goats produced under mixed grazing systems.The objectives are to evaluate the effects of mixed grazing on the quality of the fecal egg counts per gram of feces, the FAMACHA scores of kids, and the packed cell volume in goats.

Forty eight weaned kids were randomly assigned to four treatments through a 2x2 factorial arrangement.

Results: Fifty kids that were born and weaned under the mixed-species system were assigned to confinement vs. semi-confinement housings and 13% or 16% crude protein (CP) levels. Following an adjustment period of 2 weeks, an initial measurements of body weight (BW), body condition scores (BCS), (1 = thin, 5 = fat) and FAMACHA scores (FS), (1 = red, healthy, 5 = white, anemic) were taken. These measurements were then taken every 14 d for 8 wk. Data were analyzed using SAS MIXED procedure. Kids under confinement were 1.7 kg heavier than kids under semi-confinement housing. Male kids were 3.0 kg heavier than female kids. No differences in BCS or FS were observed due to housing. Level of CP in the diet had no effect on BW, BCS or FS. Kids from pastures that were grazed with cattle had higher BW (19.1 ± 0.4 vs. 17.9 ± 0.4 kg) and BCS (2.6 ± 0.05 vs. 2.4 ± 0.05), and lower FS (1.8 ± 0.1 vs. 2.4 ± 0.1) than kids that originated from goats-alone pastures. Kids that were confined and fed 16% CP were heavier than any other group. BW was positively correlated (0.48) to BCS but negatively correlated (−0.34) to FS. BCS and FS were negatively (−0.28) correlated. Results showed that kids raised under mixed-species system can be confined and fed for 8 wk. to achieve desirable market weights.

Kids raised comingled with cattle were heavier in weight, better conditioned and carried less parasitic load as indicated by lower FAMACHA scores. Results indicated that mixed grazing can improve performance of kids without any negative affect on cattle.

Funder Acknowledgement(s): Southern University Ag Center

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OA #74

Subcategory: Plant Research

A Study on Camassia Quamash on the Flathead Indian Reservation: Geospatial Modeling and Long Term Monitoring of Camas Ecophysiology

Loga Fixico, Salish Kootenai College

Camassia quamash (camas) was one of the most significant plant species to the survival of indigenous peoples throughout the Columbia Basin. Its wetland habitat is steadily declining, which has stressed certain camas populations to critical limits. There is a major concern for the continuance of this plant, so conservation and restoration are of high priority to many tribes such as the Salish, Nez Pierce, and Kootenai. There is currently a lack of geospatial modeling for C. quamash habitat on the Flathead Indian Reservation (FIR), and such modeling could provide a very useful tool for tribal conservation/restoration efforts. Based on a literature review and site verification of this plant's ecophysiology, a model of habitat suitability was created reflecting these characteristics. The traditional ecological knowledge of this plant's habitat requirements give strong support to the factors used in modeling camas habitat. The data layers produced by the weighted overlay modeling done in ArcDesktop predicted suitable habitat at three out of the four known camas locations on the FIR. Long term (4-6 yrs) monitoring of camas on the FIR will be critical to understanding this plant's unique ecology due to a long life cycle and a lack of localized research. This kind of monitoring will greatly increase the predictive capabilities of any future geospatial models that may be developed and would allow more effective conservation/restoration plan to be implemented in the area.

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OA #75

Subcategory: Plant Research

The Effect of Organic vs. Conventional Management on the Marketable Yield and Berry Quality in Virginia High-Tunnel Strawberry Production

Malcolm Galloway, Virginia State University

The present study aims to compare vegetative growth, fruit quality and marketable yield of strawberry (Fragaria x ananassa Duchesesne) grown in high tunnel greenhouses in central Virginia. Experimental variables include cropping system (organic vs. conventional), planting date, cultivar type ('Chandler', 'Albion', and 'Festival'), intentional manipulation of the environment (raising and lowering high-tunnel sides), weekly pruning and removal of flowers in the fall, and fertilizer applications and timing. Different springtime production methods and their effect on marketable fruit quality and marketable yield have been investigated. Data systematically taken from multiple plots, with multiple repetitions (4 plants per plot, 2 plots per variety in both high tunnels) indicates the following trends: While the Chandler variety, which is the strawberry "industry standard," yielded highest by weight (lbs/plot) on average in our yield data, the overall Chandler marketable yield and berry quality was generally lower than the other two varieties (Albion and Festival). This research showed that the Albion and Festival varieties had superior berry quality, size, uniformity, and most importantly – flavor and brix levels. Future research is already planned out and production for the 2015 high tunnel strawberry crop begins in early October.

Funder Acknowledgement(s): I would like to acknowledge Reza Rafie, who has been instrumental in all of this strawberry research as well as our test marketing research, and continues to mentor us students, providing us with a vast array of niche crop production research opportun

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OA #76

Subcategory: Plant Research

Small Fruit and Vegetable Test Marketing Project at Virginia State Universities Randolph Farm

Melissa Thoner, Virginia State University

This study aims to inform local small fruit and vegetable farmers of trends in the sales data of different varieties of small fruit and vegetables sold through a student test farmer's market at VSU Randolph Farm. The student run farmers market was held once a week, where produce, also grown by students at the Randolph Farm, was then sold to VSU faculty, staff, and students. Many diverse, point of attraction varieties were tested, and market trends analyzed. Each week, an inventory of the produce was taken before and after every market in order to determine the economic viability of each cultivar. The product, price, inventory, and unit were analyzed in order to calculate the total number of product sold in terms of percentage and dollars. These results were then used to determine if a variety was worth growing, based on its economic return. Production data is also taken into consideration.

The study also takes a look at the farmer's market display, promotions and marketing, post harvest physiology and packaging, and setting the price. These factors also play a key role in the economic viability of specific crops. Small fruits such as strawberries, blackberries, and raspberrries showed the highest demand at all the markets. Utilizing value added products such as jams and salsas and finding a niche market though unique, point of attraction varieties such as bittermelon are keys to success for local growers at a farmer's market. In the future, more research should be done on the benefits of value added products for small fruit and vegetable producers.

Funder Acknowledgement(s): I would like to acknowledge Reza Rafie, who has been instrumental in our test marketing research and small fruit and vegetable production research, and continues to mentor us as students, providing us with a vast array of niche crop production research opportunities. I would also like to thank Chris Catanzaro for providing us with guidance as well as the Student Research Internship Program here at VSU.

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OA #77

Subcategory: Pollution/Toxic Substances/Waste

Atmospheric Particulate Matter Pollution and Platinum (Pt) in Soil, Road Dust, and Plants in Houston, Texas

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Since the 1970s, platinum-group elements (PGEs) platinum, rhodium, and palladium have been used in catalytic converters to reduce unburned hydrocarbons, carbon monoxide, and oxides of nitrogen into less toxic pollutants. However, this has led to a substantial increase of PGEs in the environment. This research focuses on the environmental fate and transport of platinum (Pt) in Houston, Texas. Highway road dust and surface and core soil samples were acid digested and analyzed using an inductively-coupled plasma mass spectrometer (ICP-MS). Platinum concentrations ranged from 1.25 to 21.4 ng/g in surface soil, 18.2-149 ng/g in road dust samples, and 1.03-2.15 ng/g in core soil samples. In surface soil and road dust samples, Pt concen-

tration increased with decreasing particle size. Road dust showed a significantly higher Pt concentration than surface soil, which may indicate a correlation between Pt contamination and proximity to highways. In core samples, Pt concentration decreased sharply within 5 cm and remained at background level below that layer. This is likely due to relatively recent contamination and the organic-rich top soil layer that behaved as a barrier for infiltration. Plant samples, which included Helianthus annuus, Poa pratensis, and Cyperus esculentus, were also analyzed to investigate the bioavailability of Pt. Platinum concentrations in plant tissues ranged from 6.82 to 11.5 ng/g, giving a bioconcentration factor (BCF) of 6.7 or lower. Atmospheric particulate matter (PM) deposition rates varied from 48.2 to 411 mg/m2/day with no differences between weekdays and weekends, indicating that PM deposition rates were likely affected by local weather, not by traffic volume. PM10 concentrations ranged from 61. 6 to 104 µg/m3 that are below National Ambient Air Quality Standard (150 µg/m3) but exceed California EPA standard (50 µg/m3), indicating that there may be health risks associated with atmospheric PM.

Funder Acknowledgement(s): National Science Foundation Research Infrastructure for Science and Engineering

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OA #78

Subcategory: Pollution/Toxic Substances/Waste

Prelimanary Assesment of Volatile Organic Compounds (VOCs) in Indoor Parking Facilities in the Greater Houston Area

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Automobiles have been widely known as sources of (Volatile Organic Compounds) VOC emissions in outdoor environments; however, the impact of these emissions indoor has not yet been studied in detail and needs to be developed. Two different types of indoor parking facilities have been assessed for the VOC concentrations, which include residential attached parking garages, and commercial ground parking garages. For this assessment, Houston, Texas, a representative big city, was chosen because of its high dependency on private transportation via cars by its citizens, the numerous petrochemicals industries emitting VOCs, and the several days each year that it experiences high ozone levels. These factors significantly increase Houstonians' exposure to VOCs. Indoor air samples were collected using 6-L stainless steel canisters for 24-h period and analyzed using a modified version of EPA Method TO-15, which is TSU-TO15 with GCMS coupled to cryogenic pre-concentrator. The eight most abundant VOCs were identified in each sample. Six out of the eight VOCs identified are classified as hazardous air pollutant based on EPA regulations. This research found that the concentrations of VOCs are higher in attached residential parking garages following, ground commercial parking garages. It can be assumed that the VOCs are greater where there is little to no ventilation.

Funder Acknowledgement(s): NSF (National Science Foundation)

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OA #79

Subcategory: Pollution/Toxic Substances/Waste

Transport of Polyacrylic Acid Modified Zero Valent Iron Nanoparticles in Sediment

Djordje Vuckovic, Columbia University

Limited transport of zero valent iron nanoparticles (nZVI) in sediment is a major obstacle to the successful implementation of nZVI in groundwater remediation technologies. In groundwater, nZVI tend to aggregate and deposit on sediment grains, significantly reducing their ability to reach contamination. Both of these processes are governed by the size, composition and surface charge of nZVI and sediment particles, and by the ionic strength and pH of the groundwater.

Transport of nZVI can be improved by electrostericaly stabilizing the particles with organic or polymer coatings which can significantly reduce their aggregation and deposition. In this study, we investigate the transport potential of polyacrylic acid stabilized nZVI: NANOFER STAR-PAA (STAR-PAA), by testing their affinity for sediment grains, and comparing their stability in solution to the stability of two other commercially available nZVI: PAA stabilized NANOFER 25S (25S) and inorganic coated NANOFER STAR (STAR). The influences of pH (3.5-11.5) and ionic strength (I) (0-300 mg CaCO3 L-1) on nZVI stability were determined by dispersing nZVI in aqueous solution, and measuring particle size and zeta potential with DLS. Influence of I and exposure time (0.5-40 min) on the affinity of STAR-PAA for sediment was determined by mixing vials containing STAR-PAA solution and sediment on a roller, and measuring the difference of iron concentration in solution before and after mixing, with UV-Vis spectroscopy. Two separate controls were prepared for each measurement: one containing sediments in water at appropriate I, and another containing only STAR-PAA solution.

Our results showed that STAR aggregate at all tested pH and I, unlike Star-PAA, which do not aggregate at any tested pH, and 25S which do not aggregate at any tested I. The similar stability of STAR-PAA to 25S, and their significantly greater stability than STAR, indicates that, as expected, the PAA coating plays a significant role in nZVI stabilization. Sediment affinity experiments indicate that sediment grains stabilize STAR-PAA, decreasing

their settling in solution. No significant deposition of STAR-PAA is observed at up to 40 min of exposure time, and an I of 300 mg CaCO3 L-. This indicates that STAR-PAA might transport well in sediment, and therefore have a potential for use in groundwater remediation technologies. Further research involves testing of STAR-PAA transport through sediment columns, and eventually transport in in situ sediments.

References: Laumann, S.; Mici, V.; Lowry, G. V.; Hofmann, T. Carbonate minerals in porous media decrease mobility of polyacrylic acid modified zero-valent iron nanoparticles used for groundwater remediation. Environmental Pollution. 2013, 179, 53-60.
Wiesner, M. R.; Bottero, J. Environmental Nanotechnology: Applications and Impacts of Nanomaterials, McGraw-Hill Professional, 2007.

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OA #80

Subcategory: Water

A Comparative Study to the 2011/2013 Water Quality Assessments in the Pasquotank Watershed in Northeastern North Carolina with a Sea Level Rise Component

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The Pasquotank River Watershed is found in Northeast North Carolina beginning in the Great Dismal Swamp at the Virginia/North Carolina border and flows into the Albemarle Sound. The watershed provides a transition between spawning grounds and the waters of the Albemarle Sound. The sound serves as a nursery area for many fish species and is home to numerous sport and commercial species. Due to indications of rising global temperature and the monitoring of melting ice sheets, these coastal watersheds could be a leading indicator of rising sea levels as their chemical compositions changes. The effects of sea-level rise were also taken into consideration for future monitoring. The 2014 Research Experience for Undergraduates Pasquotank River Watershed Team completed two sets of tests of five tributaries and the river itself. These test points were derived from the 2011 and 2013 Watershed Team research projects with the addition of four points created to sample further downstream in the Pasquotank River itself. Results were compared with previous readings utilizing a Water Quality Index (WQI). The streams tested were the Pasquotank River, Newbegun Creek, Knobbs Creek, Areneuse Creek, Mill Dam Creek, and Sawyers Creek. These streams, along with the river, cover a large portion of the watershed and provide a wide area of study for the watershed. Tests performed in the laboratory on this year's samples included pH, salinity, total dissolved solids, and conductivity. Air/water temperature, dissolved oxygen, wind speed/direction, and turbidity/clarity measurements were taken in the field. The results collected were placed online and displayed in correlation to their position utilizing Google Maps. The data were then compared to the 2011 and 2013 project results and examined for any variations or similarities. It was found that the water quality for some water sources remained in their respective ranges from the past years. The others, such as Knobbs Creek, varied from the previous years. Newbegun Creek, with a water quality index of 59, stayed within the two previous teams' WQI of 50 (2011) and 66 (2013). Mill Dam Creek had a very slight increase in water quality from the previous teams' readings 47 (2013) and 48 (2011) but still managed to acquire a bad reading of 49. Areneuse Creek increased from 49 (2011) and 47 (2013) to reach a medium water quality of 57. The Pasquotank River, ranking as the lowest, has dropped significantly from 64 (2011) to 44 (2013) and continued to be lower in 2014 standing at 41 for its WQI. Sawyers Creek remained consistent between 54 (2011) and 50 (2013) at a low medium range with this year's water quality being 51. Knobbs Creek WQI, having the highest water quality reading, increased from the two past readings of 52 (2011) and 50 (2013) with a WQI of 63.

Funder Acknowledgement(s): Linda Hayden, PI, National Science Foundation(NSF), Center of Remote Sensing of Ice Sheets (CReSIS)

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OA #81

Subcategory: Water

The Solar Mosquito Scare

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More than half the world's population is vulnerable to vector-borne diseases. The National Center for Infectious Diseases (NCID), which is now under the CDC, recognizes that most Arboviral Encephalitides (Mosquito-transmitted viral diseases) causes brain inflammation/encephalitis. The World Health Organization estimates that more than 300 million clinical cases each year are attributable to mosquito-borne illnesses. Despite great strides over the last 50 years, mosquito-borne illnesses continue to pose significant risks to parts of the population around the world. Here are but a few of the well-known viral species: East-

ern equine encephalitis, Japanese encephalitis, West Nile virus, malaria, Dengue Fever, Rift Valley Fever and Yellow Fever.
In order to control the Mosquito population and eradicate or reduce aquatic breeding areas, this project will devise a low cost rechargeable battery/solar powered surface aeration system for small bodies of water. A small body is considered stagnate water from 5 to 30 square meters. The device can be placed in known water collection areas or small ponds where it will cause the water surface to ripple or have waves. This prevents Mosquitos from breeding. The solar panels will keep the batteries charged so that the unit will continue to run throughout the evening and night. The unit will operate on a timer and activate only when a significant amount of water is present. It will be designed to be autonomous and require little if any maintenance.

Battery life has become a tremendous obstacle in this project. The initial project design used base biased transistor circuits to control a much larger current on the output of a voltage divider biased circuit. After testing, this concept was determined to be very inefficient. The circuit drained the batteries so quickly that the Solar Mosquito Scare would only operate for approximately an hour. The system was re-designed to reduce the current drain.

Currently, the new design is being tested. The Solar Mosquito Scare now operates in twenty minute intervals. When the device is inactive, the solar panel recharges the batteries during the day. When there is no sunlight the twenty minute recovery time helps to increase the battery life of the unit. Data are being collected to determine the actual runtime from dusk to dawn. Future research for this project will involve implementing the Solar Mosquito Scare, collecting data to determine its effectiveness and then possibly delivering an eco-friendly mosquito control method to eliminate or reduce the cases of vector-borne diseases around the world.

Funder Acknowledgement(s): APEX Technology Grant - Alabama Agricultural and Mechanical University, (Marius Schamschula, co-PI), Digital Technology Education Collaborative (DigiTEC) J. F. Drake State Community and Technical College (John Reutter, PI/PD)

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Mathematics and Statistics

OA #82

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Long Term Behavior of Three Species in a Food Chain Model

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In previous studies, scientists have interpreted that a two-species predator prey model can only approach an equilibrium or a limit cycle. It has been suggested that chaotic behavior could be much more common in natural systems where species interact, most likely in food chains containing three or more species. In our project, we focused on the long term behavior of a three-species food chain model containing a generalist predator, specialist predator, and a prey. Such a food chain system can be used to model the interactions among Arctic polar bear, Arctic seal, and Arctic cod. The food chain model is built based on Lotka-Volterra scheme and Leslie-Gower scheme. The generalist predator typically preys on the specialist predator and the prey, while the specialist predator only eats the prey. The food chain was analyzed numerically and theoretically using a range of different parameters to determine the steady equilibrium, limit cycles, and chaos. The experimental parameters were the strength of competition among the prey, the birth rate of the prey, and the growth rate of the generalist predator. We apply the Routh-Hurwitz criteria to study the linear stability of equilibrium solutions. In our chosen three-species food chain model, each steady equilibrium represents a different biological case: 1) all species are extinct resulting in no evidence of the species coexisting; 2) only the prey existing concludes in a coexistence when the birthrate of the prey does not exceed the set value for the competition rate among the Arctic Cod population; 3) the prey and the specialist existing in the absence of the generalist predator results in no coexistence when the competition rate amongst the Arctic Cod population is set to 0.5; However, at 0.05 coexistence occurs 4) all species are present which leaves only a small region of stability. We proved the existence of some stable region of the coexistence equilibrium. We also numerically found limit cycles and chaos for some special parameters. In future studies, there will be a continuation in investigating the bounds outside the linear stability of the three-species food chain model.

Funder Acknowledgement(s): MAA-NREUP

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OA #83

Subcategory: Biomedical Engineering

Extinction of Specialist Predators in a Three Species Food Chain Model

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Predator- Prey models can be used to show the behavior between the predator and its prey. A simple food chain consists of

three species where the third species preys on the second one and simultaneously the second species preys on the first one. There are several interesting cases of simple food chains of interacting species. We looked in the difference between a generalist predator and a specialist predator. A predator is a generalist if it can change its food source in the absence of its favorite food which is very common in nature. A specialist is one that requires a specific type of food source and lives in a controlled environment, such as a panda bear, and more than ninety percent of its diet comes from bamboo. We focused our experiment on seeing the interaction of a predator and prey model exclusively on specialist predators.

In our paper, the simple food chain model consists of two specialist predators and one prey. Our model is based on the Lotka-Volterra and the Holling schemes. Varying the parameters was needed in order to determine what factors affect the evolution of the population. Parameters on birth rate and competition rate among the species are mainly investigated. We first found the nonnegative equilibrium point for the system. Then we conducted the linear stability analysis by using Routh-Herwitz criteria on the Jacobian matrix for each nonnegative equilibrium. We used the Routh-Herwitz criteria to evaluate if the equilibrium points were stable. We also used Matlab to numerically evaluate if there was a region of stability where all three species could coexist.

Among the nonnegative equilibrium, we proved that only one equilibrium is stable and all others are unstable. In particular, there was no region where all three species could coexist. This means there was no values where all three populations could survive together. This may be due to the parameters of the system. However it is true that there are very little specialist predators in nature because it puts a species at a disadvantage to rely on one food source which may agree with our results. It may be the reason that most specialist predators are small in population or on the verge of endangerment. In the future, we would like to continue our research by attempting to see if there is correlation between no species coexisting and specialist predators.

Funder Acknowledgement(s): MAA-NREUP

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OA #84

Subcategory: Cancer Research

Investigating the Human Papillomavirus (HPV) in the United States and its Impact on Cervical Cancer Within African American Women Using a Compartment Mathematical Model

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Human Papilloma Virus (HPV) is one of the most common Sexually Transmitted Infections in the U.S. and it is directly connected to genital warts and cervical cancer. There are over 100 different types of strands of the virus which infect men and women nationwide each year. In this study, we focus on the impact HPV causes in African American Women concerning cervical cancer.

A compartmental mathematical model was utilized to derive the 5 important differential equations pertaining to the different stages of the virus in African American Women. The parameter values found in previous studies are used to simulate the direction of the virus via MatLab Programs. The reproductive number is calculated regarding cervical cancer whether left untreated or treated. Both the reproductive numbers for the untreated cervical cancer and the treated cervical cancer produce similar results. It is also found that the reproductive numbers are directly related to the rate of infectivity of HPV multiplied by the rate at which humans infect each other. Because the reproductive numbers for both cases are less than 1, we conclude that the virus will eventually be cleared from the population.

This process only involves the simulation and results of the stages of HPV leading up to cervical cancer. Future research can be directed towards the stages of HPV leading into cases involving genital warts, throat cancer, etc.

Funder Acknowledgement(s): The Talent-21 Program

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OA #85

Subcategory: Cell and Molecular Biology

Dynamics of Glial Cell Defense Mechanisms in Response to Ischemic Hypoxia in the Brain

Matthew Buhr, University of South Dakota

For years, scientists have attempted to understand the role glial cells play during the brain's natural healing process following an ischemic stroke. An ischemic stroke is caused when a blood clot creates a loss of oxygen to vital blood vessels in the brain, causing brain tissue to become asphyxiated, damaged, and die. Glial cells are present to interact with damaging tissue to transform it into scar tissue, gradually bringing the spread of damage to an end. Additionally, glial cells aid in the repair of neurons throughout the healing process. It is conjectured that the initial amount of glial cells in the brain during an ischemic stroke, and the rate of healing caused by other bodily factors can dictate whether a human will survive an ischemic stroke. Research can predict what threshold is required for a person to survive an ischemic stroke.

Three models are introduced that explore the dual role of glial cells in the formation of scar tissue and in the neural repair following hypoxia ischemia in the brain. Scar tissue helps protect

the brain during the acute phase of injury by limiting the spread of secondary damage, but limits recovery by inhibiting the repair of damaged neurons. Scar formation is not ideal, however repaired neurons are still susceptible to damage and do nothing to halt the spread of ischemic injury. A stochastic, spatially explicit Cellular Automaton (CA) model is used to capture the dynamics of neural tissue repair and the containment of damage by scar tissue. In addition, two deterministic models are developed to approximate the stochastic process namely, Mean Field (MFA) and Pair Approximation (OPA) models. We show that the MFA neglects all spatial dependence among state variables. The OPA models the dynamics of state variables evolving as pairs, where spatial adjacency matters. Our results compare how the trade-offs between scar tissue formation and neural repair impacts future brain health. Our findings suggest a strange occurrence: when there are a higher number of active glial cells in the brain, there is less progress being made to end an ischemic stroke via scar tissue formation, which previously hypothesized research would dictate the opposite. We conclude that when glial cells occupy over half of the population space, their interactions with damaged cells will be sufficient to contain the spread of the damage before the body is killed.

Future research currently under consideration are the ways glial cells are affected by the proportion of healthy cells and scar tissue in the population space. We continue to research how continuous variance of proportions of glial, healthy, damaged, and scar cells in our population space will have an affect on our expected outcomes.

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OA #86

Subcategory: Cell and Molecular Biology

Dynamics of Glial Cell Defense Mechanisms in Response to Ischemic Hypoxia in the Brain

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Three mathematical models are introduced that explore the dual role of glial cells in the formation of scar tissue and in the neural repair following hypoxia ischemia (ischemic stroke) in the brain. Scar tissue helps protect the brain during the acute phase of injury by limiting the spread of secondary damage, but limits recovery by inhibiting the repair of damaged neurons. Scar formation is not ideal, however repaired neurons are still susceptible to damage and do nothing to halt the spread of ischemic injury. A stochastic, spatially explicit Cellular Automaton (CA) model is used to capture the dynamics of neural tissue repair and the containment of damage by scar tissue. In addition, two deterministic models are developed to approximate the stochastic process namely, Mean Field (MFA) and Pair Approximation (OPA) models. We show that the MFA neglects all spatial dependence among state variables. The OPA models the dynamics of state variables evolving as pairs, where spatial adjacency matters. Our results compare how the trade-off between scar formation and neural repair impacts future brain health. We note that the concentration of initial damage affects the equilibrium amount of scarring since scar formation is minimized in conditions of clustered damage and exacerbated for conditions of randomly distributed damage. We also note that the initial proportions of certain cells profoundly affects the cellular dynamics following hypoxia ischemia. Future work includes exploring the correlation we suspect between the degree of randomness of initial injury and variance of total equilibrium injury: variance in total injury increases as degree of initial randomness increases.

Funder Acknowledgement(s): We would like to thank Carlos Castillo-Chavez, Executive Director of the Mathematical and Theoretical Biology Institute (MTBI), for giving us this opportunity to participate in this research program. We would also like to thank Co-Executive Summer Directors Omayra Ortega and Baojun Song for their efforts in planning and executing the day to day activities of MTBI. This project has been partially supported by grants from the National Science Foundation (DMS-1263374 and DUE-1101782), the National Security Agency (H98230-14-1-0157), the Office of the President of ASU, and the Office of the Provost of ASU.

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OA #87

Subcategory: Computer Science & Information Systems

A Geometry of Sets

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The Hausdorff metric provides a way to measure distance between certain subsets of Euclidean space. This metric is important for its applications in fractal geometry, image matching, visual recognition by robots, and computer-aided surgery. Previous work has uncovered interesting properties of lines and rays in the geometry generated by the Hausdorff metric. The focus of

this research is determining how one may define and measure angles in the Hausdorff metric geometry.

Using ideas present in rational trigonometry, introduced by Wildberger, we attempt to show that angles can be measured and are well-defined in this geometry. In rational trigonometry, spread, the analog of angle in classical trigonometry, measures the separation of two rays. Wildberger defines spread using ratios of quadrances (squares of Euclidean distances) in right triangles. We try to measure angles in the Hausdorff metric geometry using spread and right triangles because the properties of the metric ensure that distances are well-defined.

Because right triangles are integral to this method, our basic approach involves "dropping a perpendicular" to a ray in order to complete a Pythagorean triple. We classify conditions under which Pythagorean triples may or may not exist in this geometry while satisfying a betweenness requirement defined using Hausdorff distances. Our findings include examples where infinitely many perpendiculars may be dropped from a set to the ray determined by two other sets. Furthermore, we show that an infinite number of sets form a Pythagorean triple with two given sets at a fixed location. Although it is still unclear how spread may be measured in the Hausdorff metric geometry, considering these particular cases is important to building a fundamental understanding of this geometry. Future research entails exploring how these conditions and cases where Pythagorean triples do not exist affect how we may define and measure spread.

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OA #88

Subcategory: Computer Science & Information Systems

Effect of Loss Cut on Investing with Technical Analysis

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When investing in the stock market there are so many things to consider in order to make important decisions, especially when to buy or when to sell. The overwhelming choice of considerations could be confusing. In order to take the emotion out of investing in the stock market, one can use a loss-cut order to sell an asset at a pre-determined price.

The main objective of this research is to determine if utilization of loss-cut improves investing returns. In phase 2 of the research, 5 indicators were used to decide entry conditions for 20 stocks. A loss-cut level was used to determine exit condition. The indicators used are Price & 60-day Exponential Moving Average (XMA), Price & 70-day XMA, Price & 100-day XMA, 9 &15 XMA Crossover, 30 & 50 XMA Crossover, and the MACD indicator. In phase 2, the On Balance Volume (OBV) indicator was used as a complimentary confirmation for the indicators listed above. The loss-cut level used for the exit condition is 10% below the latest high of the given asset. Our analysis indicated that the use of loss cut in exiting a position in an asset is effective.

Funder Acknowledgement(s): Summer Undergraduate Research Program, NSF

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OA #89

Subcategory: Computer Science & Information Systems

Talent -21 Research: Gonorrhea Simulation Models Using Computational and Mathematics Applications

Ashana Evans, North Carolina A&T State University
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Gonorrhea has been an epidemic in this country for a long time. Moreover, various studies that have concluded that elimination factors sexually transmitted diseases, particularly syphilis, might have an impact on Gonorrhea infection. With my research, I will be looking at Gonorrhea to see how well mathematical models can predict its epidemiology in Guilford County, NC. I will explore various SEIR models, and select or adapt the best ones for my study. The models use systems of differential equations to model theoretical interactions of various sub-populations. During this research, I will be looking at sub-populations of susceptible, infected, infectious, and recovered (SEIR) populations with Gonorrhea, with the goal of developing theoretical simulations. I will gather data for Guilford County, to determine quarterly trends and to estimate parameters for the SEIR models. Once the model parameters are determined, I will create numerical simulations of SEIR models, and compare the results with the real data.

Ultimately, conducting this research I will understand how computers and math can be used to understand biological systems. It will give me exposure to mathematical applications to epidemiology problems, with hands-on experience using computational software and simulation models.

Funder Acknowledgement(s): Talent-21 Research Program, NSF, Department of Mathematics At North Carolina A&T State University

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OA #90

Subcategory: Computer Science & Information Systems

From Impossible to a Split Second: The Monte Carlo Solution to Endless Iterated Integrals

Paulana Hall, Fort Valley State University

The old joke that pedestals rocket scientists as the most difficult profession might hold less water than one would think. There are more than three times as many rocket scientists as there are nuclear scientists and perhaps rightfully so. Imagine, as a nuclear physicist, facing the task of evaluating a twelve dimensional integral in order solve a problem. By standard methods, a computer capable of nearly a billion calculations per second could take ten million years to calculate a twelve dimensional integral. In other words, it would be completely impossible. By use of the Monte Carlo method, the same calculation could be done in less than a second.

The Monte Carlo method approaches this task using the general, well-known theories of statistics and probability. Easily demonstrated in two dimensions, consider the laws of integration. It is understood that in a xy-plane the integral of a curve can be defined as the area within the bounded region of integration. Imagine a circular dartboard. If one were to throw a million darts, inevitably some will hit the board and some will not. If 800,000 darts hit the board and their average position was calculated, one would have found the approximate area of the board. The a priori hypothesis here states that random sampling of points within a given region of integration, followed by the average of the values within the region, can be used to determine an approximate area of the region, thereby solving the integral.

To demonstrate usability, the Monte Carlo method was applied to single, double, and triple integrals and simulated using Excel with automated random sampling. The values were compared to analytical values given by mathematical software and showed a minute margin of error of less than 0.2 percent. With little to no coding necessary, this method is accessible on both an educational and professional level. This method enhances the ability to predict future outcomes, understand multiple-case scenarios, and more. It is being currently being used by corporations and special analysts all over the world. With continued refinement, accuracy can be further improved and results can be better analyzed to indicate probability of error in realistic application. A following case would involve applying the method to logic based scenarios to improve decision analysis with a precedence in artificial intelligence.

Funder Acknowledgement(s): National Science Foundation, Nuclear Regulatory Commission

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OA #91

Subcategory: Computer Science & Information Systems

Determining Critical Courses Through Student Performance

Vanda Johnson, Savannah State University

Every institution of higher learning has at least one funding model (formula) imposed on it by the state and federal government. The most common funding model is the enrollment model, in which institutions of higher learning receive funding based on how many full-time students are enrolled each academic year. In recent years an increasing number of states have adopted a new funding model called the performance-based model, in which funding is based on criteria such as the number of degrees awarded, time to degree completion, etc. In this research, we analyze patterns in student registration data to identify what we call critical courses: courses in which poor performance is predictive of delayed graduation. We analyze anonymized course data with statistical analysis and data mining methods. Our procedure allows us to identify a relatively small set of courses in a given major which are highly correlated with delayed graduation. This information could be used to provide extra student support and/or better placement in these classes as a first step towards higher on-time graduation rates.

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OA #92

Subcategory: Materials Science

Equal Circle Packings on a Square Flat Klein Bottle

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The study of maximally dense packings of disjoint equal circles is a problem in Discrete Geometry. The optimal densities and arrangements are known for packings of small numbers of equal circles into hard boundary containers, including squares, equilateral triangles, and circles. Recently, progress has also been made in establishing the optimal circle packings of two, three, and four equal circles on any flat torus. In this project we determine

the optimal packing of three equal circles on the boundaryless surface of a square flat Klein bottle.

To ensure that we considered all potential packings, we began with all possible combinatorial multigraphs which can abstractly represent potential circle packings. We used Euclidean geometry and combinatorics to eliminate most of the combinatorial multigraphs as not corresponding to an equal circle packing. The remaining graphs we embedded on our topological Klein bottle using Dr. Dickinson's program, KBEmbedding. We then eliminated all but one of the embedded circle packings by hand using Euclidean geometry and results from Rigidity Theory.

This process left only one embedded graph that we were able to prove was a locally maximally dense circle packing. This was accomplished using a concept from Rigidity Theory called the infinitesimal flex of the strut tensegrity framework associated to a packing. Once the packing was proven to be infinitesimally rigid, it followed that the arrangement is a locally maximally dense. As the only such locally maximally dense packing, it is also therefore the globally maximally dense circle packing.

It is somewhat surprising that there was a unique arrangement of three equal circles on the square flat Klein bottle. Future research will be done on packings of greater numbers of equal circles on the square flat Klein bottle, as well as on packings of equal circles on Klein bottles of different dimensions. Perhaps we shall find that the number of possible packings is always so restricted due to the non-orientability of a Klein bottle or the one dimensional moduli space of flat Klein bottles.

References: Robert Connelly, Rigidity of packings, European Journal of Combinatorics. 29(2006) 1862-1871.(electronic).
Jenny Kenkel and Anna Victoria Ellsworth, GVSU REU Final Report: Equal Circle Packing, (2011).

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OA #93

Subcategory: Microbiology/Immunology/Virology

The Influences of Onchocerciasis on the Human

Amanda Reeder, Norfolk State University

Onchocerciasis is an eye and skin disease and is commonly known as the River Blindness disease. Symptoms of Onchocerciasis include eye damage that lead to visual impairment or blindness, skin lesions, severe itching, maculopapular rashes, Sowdah, loss of weight, and musculoskeletal pain. Onchocerciasis is a parasitic disease and is caused by the host's inflammatory responses to dead or dying microfilariae. This disease is a vector-borne disease and is transmitted from the bites of infected blackflies of Simulium species. The blackflies carry immature larval form that are spread from human to human. Once inside of the human host the larval grow into adult worms that reside in nodules under the skin. These adult worms can produce 1300-1900 microfilariae per day that can easily move through the skin and connective tissue. Onchocerciasis occurs in 34 countries in Africa, Latin America, and the Arabian Peninsula. An estimated 25 million persons are infected with the parasite worldwide and 123 million people live in areas that put them at risk of infection. This endemic disease has caused blindness in 300,000 people and left another 800,000 people with severe visual impairment. Onchocerciasis has had some major impacts on the economic and social fabric of communities and is recognized as a neglected tropical disease by the World Health Organization. This project develops a mathematical model that illustrates the epidemiology of Onchocerciasis by describing the interactions between the host and the vectors. An SIRS-type model is used to describe the transmission factors within the human host and an SI model for the vector population. Compartmental models allows the analysis of the dynamics of the interactions between the vector and the host. Using the Next Generation Operator (NGO), the disease epidemic threshold value, R_o, is determined. From this analysis it is observed that when R_o is greater than one the disease is able to persist in the population, whereas when R_o is less than one the disease is not able to persist. MATLAB is used to facilitate various simulations of the models.

References: Basáñez, María-Gloria, and Jorge Ricárdez-Esquinca. "Models for the population biology and control of human onchocerciasis." Trends in parasitology 17.9 (2001): 430-438.
Filipe, João AN, et al. "Human infection patterns and heterogeneous exposure in river blindness." Proceedings of the National Academy of Sciences of the United States of America 102.42 (2005): 15265-15270.
Chubb, Mikayla C., and Kathryn H. Jacobsen. "Mathematical modeling and the epidemiological research process." European journal of epidemiology 25.1 (2010): 13-19.
Allen, Linda JS, and P. van den Driessche. "The basic reproduction number in some discrete-time epidemic models." Journal of Difference Equations and Applications 14.10-11 (2008): 1127-1147.
Burnham, Gilbert. "Onchocerciasis." The Lancet 351.9112 (1998): 1341-1346.

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OA #94

Subcategory: Physics (NOT Nanoscience)

Identifying Solitary Wave Solutions of Boussinesq Equation as Inverse Problem Using Mathematica

Brandon Bailey, Southern University at New Orleans
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A special numerical technique for identification of solitary wave solutions of Boussinesq and Korteweg--de Vries equations has been proposed in Marinov at al., Novel Numerical Approach to Solitary-Wave Solutions Identification of Boussinesq and Korteweg-de Vries Equations. Int. Journal of Bifurcation and Chaos. Vol. 15, No. 2, 2005. The stationary localized waves are considered in the frame moving to the right. The original ill-posed problem is transferred into a problem of the unknown coefficient from over-posed boundary data in which the trivial solution is excluded. The Method of Variational Imbedding is used for solving the inverse problem.

In the present work the proposed technique was applied to the Boussinesq equation. We construct an algorithm to investigate numerically the solitary wave-like solutions of the Boussinesq nonlinear differential equation using Mathematica. We reformulate the bifurcation problem, introducing a new parameter and in such a way we expel the nontrivial solution from the original problem. The Method of Variational Imbedding (MVI) is used for solving the inverse problem. We illustrate the approach with two sample codes: using Finite Difference Scheme and using NDSolve function.

Funder Acknowledgement(s): Jackson State University

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Nanoscience

OA #95

Subcategory: Cancer Research

Ti-doped ZnO Nanoparticles as Novel Direct Generator of Singlet Oxygen for Photodynamic Therapy

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Photodynamic therapy (PDT) is an alternative to traditional cancer treatments. This approach involves the use of photosensitizing (PS) agents and their interaction with light. As consequence, cytotoxic reactive oxygen species (ROS) are generated that, in turn will destroy tumors . On the other hand, ZnO is a biocompatible, nontoxic, and biodegradable material with the capability to generate ROS, specifically singlet oxygen (SO), which makes this material a promising candidate for 2-photon PDT. Doping ZnO with Ti species is expected to induce the formation of oxygen vacancies in the host oxide structure that should affect the electronic transitions related to the generation of SO.

The present work reports the effect of the level of Ti-doping on the structure and capability to generate SO. Ti-doped ZnO nanoparticles were synthesized under size-controlled conditions using a modified version of the polyol route. The structural and optical properties of these nanostructures were studied by X-Ray diffraction (XRD), FTIR spectroscopy (IR), Photoluminescence spectroscopy (PL) and UV-Vis spectroscopy (UV-Vis). XRD measurements confirmed the development of well-crystallized ZnO Wurtzite; the average crystallite sizes ranged between 11.7 and 14.2 nm, with an increase in Ti content. The corresponding band gap energy values, estimated from UV-vis measurements, decreased from 3.32 to 3.29 eV. PL measurements of Ti-ZnO revealed the presence of emission peaks centered on 361, 390, and 556 nm; these emisiion peaks correspond to the exciton emission, transition of shallow donor levels near of the conduction band to valence band, and oxygen vacancies, respectively . The observed decrease of the emission intensity in the 556 nm broad peak was attributed to the reduction of the defects (vacancies) due to the incorporation of dopant species into the host oxide lattice. The fact that Ti-doped ZnO nanoparticles produce high levels of SO species when compared to pure ZnO, enable this nanomaterial as a potential direct PS agent for cancer treatment by PDT. Forthcoming efforts will be focused on the analysis of the correlation between type and concentration of structural defects with the yield of SO generation in presence of Ti and other dopants (e.g. Li+).

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OA #96

Subcategory: Materials Science

Synthesis of Graphene Oxide Sheets Using Hybrid Sonochemical Technique with 20 kHz Glass Sonotrode in Acidic Solution

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Synthesis of Graphene Oxide has become increasingly important due to the role it plays as a precursor in creating single sheet graphene. Graphene is crystalline allotrope of carbon with hexagonal two-dimensional (single layer) structure. The high charge carrier mobility, good optical transparency, as well as remarkable conductivity of graphene make it highly suitable for a variety of applications, most noticeably as supercapacitors. There have been many different methods in synthesizing graphene oxide in recent years, most noticeably Brodie, Staudenmaier, Hummers, Daniela and Huang. The latter created what is known as simplified Hummers method. However, due to the 72 hour synthesis time, a new and improved method is required for creating graphene oxide. We report a simple method of fabricating Graphene Oxide in our lab using ultrasound to aid hybrid sonochemical oxidation. Graphene oxide contains the epoxy, carbonyl, carboxylic, and hydroxyl groups that are attached on the basal plane and edges on the graphite layers. The passage of ultrasound through a liquid leads to acoustic cavitations and the forces created prevent the aggregation of graphene oxide as it is formed, thus providing a different and interesting alternative to already standard methods in graphene oxide fabrication.

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OA #97

Subcategory: Materials Science

Creep Behavior of a Biopolymer-based Nanocomposite

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Polymer matrix composites are attractive because of their low cost, high tensile strength, high stiffness, and good corrosion resistance. The present study focuses on the study of creep behavior of chitin-multiwall carbon nanotubes (MWCNTs) bionanocomposites. Chitin was selected as the matrix because its availability, low cost and biodegradability. Preliminary research demonstrated that chitin films reinforced with MWCNT have superior mechanical strength compared to bare chitin films. However, at the time no study on the effect of temperature on the composites was conducted. The present work addresses the evaluation of the composite under creep conditions. We sought to develop a model that describes and predicts the composite creep response at different temperatures. To this purposed we characterized the composite films with Fourier transform infrared spectroscopy and thermomechanical analysis. The resulting creep models will be discussed.

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OA #98

Subcategory: Nanoscience

Free Standing Semi-Flexible Composite Carbon Nanofiber Oxide Films Using Functionalized Carbon Nanotubes and Polyvalent Crosslinking Ions

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Historically, conjugated carbon nanomaterials, such as carbon nanotubes and graphene, have been studied for their electronic properties and applications in supercapacitative devices. In recent years, carbon nanofiber (CNF) has come under increasing study due to the similarities between the molecular structures of carbon nanotubes and graphene. CNF is a nanostructure derived from the graphene carbon alotrope, in which a stack of graphene “nano-cones” are held together to form long fibers. Its molecular arrangement consists of sheets of SP2 hybridized carbon atoms forming large, interconnected conjugated pi systems above and below the molecular plane. This allows for transverse delocalization of electrons and leads to an electronically active material with many possible configurations. However, due to its low surface area and its inability to form colloidal suspensions, CNF can be regarded as an unfavorable material to work with. By functionalizing CNF into carbon nanofiber oxide (CNFO), subsequently exfoliating, and reducing the fibers, the electronic properties are largely maintained, while allowing the material to form colloidal suspensions and increasing its structural stability. Stabilizing such a material into workable films would allow its use in electrical double layer capacitors among other applications.

Funder Acknowledgement(s): NSF Award #1062607

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OA #99

Subcategory: Nanoscience

Aluminum Oxide for Surface Passivation in Photovoltaics

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Surface and bulk recombination are the two main ways in which solar cell efficiency is reduced significantly. As the thickness of a silicon wafer is decreased, the effects of surface recombination begin to outweigh the effects of bulk defects. This issue is becoming increasingly relevant due to the fact that solar companies, with the goal of reducing production costs, are constantly making wafers thinner and thinner. Surface passivation employs the method of adding a nanometer-thick layer to the surface of silicon wafers in order to reduce the amount of recombination that occurs. Aluminum oxide, in particular, has been studied extensively mainly for its naturally occurring negative charge, which assists in its ability to slow the recombination rate. In this research, aluminum oxide thin films of approximately 30 nanometers were deposited to p-type and n-type monocrystalline silicon substrates after cleaning using atomic layer deposition. They were then annealed in a box furnace with a nitrogen atmosphere for 30 minutes at 425˚C. The minority carrier lifetime in each instance was then measured using a photoconductance lifetime tester with a variable temperature stage, both before and after annealing the samples, as well as from 50˚C to 230˚C. The results show a positive relationship between the increase in temperature and the increase in the lifetime of available carriers, which is expected since the additional energy imparted to the samples in the form of heat helps to fill empty levels in the band gap, therefore reducing the rate of recombination. With these results, a model for the relationship between surface recombination velocity and temperature for aluminum oxide as a passivation layer may be created. Once a relationship can be drawn between the two, it will be possible to subtract the effect of surface recombination from the total effective lifetime, which furthermore will provide for the characterization of the high quality bulk silicon underneath.

Funder Acknowledgement(s): I would like to express my gratitude to my PI, Mariana Bertoni, my mentor, Simone Bernardini, as well as Laura Ding, for all their assistance and guidance. I would also like to thank everyone at the Center for Solid State Electronics Research and MacroTechnology Works at Arizona State University for all their resources and help, as well as the NSF for making the NNIN REU program possible.

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Physics

OA #100

Subcategory: Astronomy and Astrophysics

Improvement in applying observations to understanding glitches in pulsars

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Pulsars (rotating neutron stars) are supreme laboratories to discover the properties of extremely dense matter. Radio pulsars are observed to spin down due to torque exerted by their magnetic field. However some pulsars exhibit glitches - sudden decreases in period every few years - that are thought to arise from the interactions between the neutron star crust and core, but the details of that interaction remain elusive. By comparing the predictions of theoretical models to empirical data of glitches, we hope to pin down the details of the glitch mechanism and constrain the underlying nuclear matter equation of state (EOS) which determines the structure of the neutron star. The basic glitch paradigm supposes that some part of the crust does not spin down with the rest of the star until a critical lag between the frequency of that part of the crust and the core is reached, at which point angular momentum is transferred from crust to core, spinning the star up. We focus on model predictions of how strongly the crust couples to the core, this determines how much of the core gets spun up when the glitch occurs and can be tested by data from the Vela pulsar, which exhibits the largest glitches. The crust and core couple via mutual friction, in which electrons scatter off of magnetized superfluid neutron vortices in the core. We generate many EOSs spanning the current range of uncertainty in the nuclear symmetry energy - the most uncertain part of the EOS - and consistently calculate the strength of mutual friction throughout the core of the neutron star for each EOS. We find that, considering the most conservative range of EOSs, the crust cannot provide a large enough angular momentum reservoir to explain the Vela data, and that the crust-core coupling model therefore has to be revised.

References: Chamel, N. 'Crustal Entrainment and Pulsar Glitches.' Physical Review Letters 110.1 (2013).
Dodson, R. G., P. M. Mcculloch, and D. R. Lewis. 'High Time Resolution Observations of the January 2000 Glitch in the Vela Pulsar.' The Astrophysical Journal 564.2 (2002).
Espinoza, Antonopoulou, Stappers, and Lyne. 'Neutron Star Glitches Have a Substantial Minimum Size.' Royal Astronomical Society (2014).
Hooker, Josh, William G. Newton, and Bao-An Li. 'Efficacy of Crustal Superfluid Neutrons in Pulsar Glitch Models.' Royal Astronomical Society (2014).

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OA #101

Subcategory: Astronomy and Astrophysics

Multifield Dynamics and Non-Minimal Couplings of Inflation

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Inflation represents the idea that the universe underwent a period of exponential expansion immediately after the Big Bang. This period of rapid expansion could have been driven by one or several scalar fields. Realistic models of high-energy physics typically involve more than one scalar field; and each field may be expected to include a non-minimal coupling to the spacetime Ricci curvature scalar, since such couplings are required for renormalization. Hence, multifield models with non-minimal couplings offer one promising way to characterize the period of early-universe inflation. Moreover, predictions from such models for observable features of the cosmic microwave background radiation are in excellent agreement with recent observations from the Planck satellite. Unlike single-field models, multifield models produce different types of quantum fluctuations, which can interact with each other and yield interesting effects, both during inflation and during the post-inflationary 'reheating' period. Analyzing such phenomena requires understanding conformal transformations, which can be used to relate different representations of such models, as well as understanding parametric resonance, which dominates the early stages of reheating, as the energy that had driven inflation dissipates into other forms of matter.

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OA #102

Subcategory: Astronomy and Astrophysics

Igniting a Standard Candle: Detection Parameters for Double Degenerate Type Ia Supernova Progenitor Candidates in Open Star Clusters

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The significance and utility of Type Ia Supernovae (SN Ia) within astrophysics and cosmology is widely understood, especially for dark energy studies. However, the progenitors that ignite these standard candles are not well understood and have not been detected to date. There are two primary classes of proposed SN Ia progenitors, those being the single-degenerate (SD) model and the double degenerate(DD) model. DD SN Ia are thought to be the result of the merger of two white dwarf (WD) stars with a total mass ≥Mch that lose angular momentum due to gravitational radiation and spiral together, resulting in a merger of the WDs that will detonate as a SN Ia (the double-degenerate, or DD, channel; Iben & Tutukov 1984). However, a DD SN Ia would leave practically no progenitor trace, thus the only option for detection of a DD SN Ia is to look for the progenitors themselves that have not merged as of yet. In the field of NGC 6633, we identify 13 confirmed white dwarfs, of which only one (LAWDS 27) is consistent with the cluster distance modulus (Williams & Bolte 2007). However, two additional WDs (LAWDS 4 and LAWDS 7) are ignificantly more massive (0.79M and 0.87M respectively) than the mode of the field WD mass distribution (0:65M Tremblay & Bergeron 2009) and have distance modulii almost exactly 0.75 mag foreground to the cluster. Simulations of star cluster evolution suggest a binary WD cooling sequence should exist (e.g., Hurley & Shara 2003; Geller et al. 2013), and observations of rich star cluster WD cooling sequences can be interpreted as a binary cooling sequence (e.g., Garca-Berro et al. 2011), though a He-core WD cooling sequence could also explain these observations (Kalirai et al. 2007). We therefore suggest in Williams & Bolte (2007) that LAWDS 4 and LAWDS 7 may be double degenerates. Since this publication, other open cluster WDs with distance modulii 0.75 mag foreground to their cluster have also been suggested as DDs. We present time series spectroscopy for DD candidates in the open cluster NGC 6633. We find that the candidate LAWDS 4 is consistent with being a single object or long period binary as a likely cluster member. We find LAWDS 7 to not consistent with being a cluster member or a single object though it may be a radial velocity variable possibly indicating binarity. We also present a discussion of minimum detection parameters for DD SN Ia progenitors in open star clusters needed in order to detect DD progenitors in worst case scenarios.

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OA #103

Subcategory: Materials Science

Integration of Atomic Force Microscopy and Traditional Piezoelectric Techniques

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Atomic force microscopy (AFM)/ piezoresponse force microscopy (PFM) technologies are revolutionary tools to make measurements on the scale of nanometers. However; because of the complicated geometry of electric fields associated with the AFM tip, quantitative piezoelectric or hysteretic measurements are not easily obtained. When the cantilever is applying a voltage through the sample, it does not flow in a straight line, rather it spreads out radially. A traditional piezoelectric measurement utilizes a simple parallel plate capacitor geometry creating a uniform electric field, making the calculations for the piezoelectric constant d33 possible. We have integrated the simple geometry of traditional testing techniques with the sensitivity of newer AFM/PFM technology. Samples were tested using Radi-

ant Technologies software and hardware and the NT-MDT's NEXT AFM. Samples are prepared like a capacitor, with a dielectric material that has piezoelectric properties. The deflection of the AFM laser is used to measure the displacement of the sample; this signal is output as a voltage by the AFM and received by the Radiant software. One of the challenges was finding the relation of the output voltage to the displacement measured. To do this we take a force distance curve giving us the relation between the displacement in nanometers, and the deflection current. When finding the relationship between the deflection current and the voltage output, the deflection output is connected to an oscilloscope and data points are taken relating the voltage output to the deflection current. The sample used was a 1µm thick PNZT AC capacitor with an area of 100,000 µm2. The sample saturates at about 200 kV/cm, resulting in a displacement of 1.6 nm and a d33 value of .08 nm/V. Future research will utilize this method to investigate potential organic ferroelectric and piezoelectric materials.

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OA #104

Subcategory: Materials Science

Investigating the Interactions of Competing Adsorbates on Pt Catalysts using Electrochemical Techniques

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A limiting factor in the commercialization of fuel cells is durability. Impurities found in the air can enhance the durability factor which degrades the performance of a fuel cell. Studying half cell reactions of fuel cells using electrochemistry we are able to examine only one half of the fuel cell. In this case we studied the anode half of a fuel cell. Common impurities in the air are carbon monoxide and hydrogen sulfide. We studied the interactions of carbon monoxide and hydrogen sulfide on platinum electrodes, in both isolated and combined experiments. The catalyst used on the electrode was 4.8% platinum using graphitized carbon. The electrode was placed in a 0.5 M sulfuric acid solution. This study utilized a 200:1 concentration ratio for carbon monoxide and hydrogen sulfide hydrogen sulfide, respectively. Such ratios are not uncommon in hydrogen fuel streams. Furthermore, we varied the time of exposure for each adsorbate to capture their signature oxidation peaks, and subsequently repeated the experiments with both species present. By varying the time of exposure we can study the affects of carbon monoxide and hydrogen sulfide on the electrode. We show a direct correlation between the time of exposure and surface coverage by probing the chemical adsorption of carbon monoxide and hydrogen sulfide and their subsequent oxidations for quantification. Also, with time we will show which gas is more aggressive. Our findings agree with previously reported polymer electrode membrane fuel cell results, in that the carbon monoxide adsorption kinetics are faster but they form much weaker bonds with platinum surfaces.

Funder Acknowledgement(s): Los Alamos National Laboratory (LANL), Minorities Serving Institutions Partnership Program (MSIPP)

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OA #105

Subcategory: Nanoscience

Emission Studies in the UV Region of Tungstate Hosts Used for Volatile Organic Compound Detection

Mark Auden, University of Rochester
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Acetonitrile is a Volatile Organic Compound of modest toxicity1 widely used in the pharmaceutical industry. It is important to detect and quantify the presence of these compounds to prevent industrial accidents and environmental damage. Acetonitrile is also known to damage animal cell membranes, death or the blood condition methemoglobinemia. In 2012, researchers of North Carolina Agricultural and Technical State University reported the synthesis of Tungstate host, which could act as a a tunable white light nanophosphor. In their paper, Tunable white light-emission of a CaW1−xMo x O4:Tm3+, Tb3+, Eu3+ phosphor prepared by a Pechini sol–gel method Zerihun Assefa, Matthew Mickens and Dhananjay Kumar reported the crystal structure of their compound possessed vacuum sites which could contain guest molecules. The aim of this study was to test the potential of the tungstate host to be incorporated in a passive sensor of Acetonitrile. To determine the usability of the host, changes in the luminescence profile and crystal structure were examined. Laser spectroscopy was performed using a Surelite Continuum 1064 nm Dye laser, McPherson Model 2035 Monochromator and a Photon Technology International Spectroflourometer were used to obtain emission/excitation spectra at lower ranges. Crystal structure was studied using an X-ray Diffractometer. Examination of diffractometer plots showed no significant crystal changes in the host due to exposure. Significant changes were observed in the luminescence profiles. After exposure excitation wavelengths experienced a red shift of 6 nm which is a significant enough change to use the material in a sensor. Future research involves testing the detector response to different quantities of acetonitrile.

References: Greenberg, Mark "*Toxicological Review of Acetonitrile*" Mickens, Matthew; Assefa, Zerihun; Kumar, Dhananjay "*Tunable White Light-emission of a CaW1-xMoxO4:Tm3+, Tb3+, Eu3+phosphor Prepared by a Pechini sol–gel Method*"

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OA #106

Subcategory: Nanoscience

Growth and Carrier Dynamics of II - VI Semiconductor Nanowires

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II-VI nanowires have potential applications in a wide variety of optoelectronic devices, including photodetectors and solar cells. Nanowires exhibit resonantly enhanced optical absorption spectra, excellent electrical conductivities and are relatively inexpensive to fabricate, enabling potentially large increases in device efficiencies. Proposed device heterostructures for these applications feature nanowires acting as light absorbers and charge transport media. Characterizing the dynamics of photogenerated charge carriers along the length of nanowires grown through standard techniques is critically important to understanding device performance.

We report here correlated, sub-micron spatial resolution measurements of photoluminescence (PL) and ultrafast transient absorption (TA) spectra of individual CdsxSe1-x nanowires. Nanowires were grown through physical vapor deposition in a tube furnace, using colloidal Au nanoparticle catalysts. Nanowires were characterized by scanning electron microscopy, electron backscattered diffraction (EBSD, Oxford Instruments), and energy dispersive x-ray spectroscopy (EDX, Oxford Instruments). Scanning electron microscope images show nanowires with diameters between 50 nm and 200 nm. EBSD measurements revealed nearly all nanowires are wurtzite (hexagonal) phase, while EDX showed that stoichiometries were within experimental error of the expected 1:1 (Cd: Se+S) ratio. S:Se ratios were dependent on the relative amount of S and Se powder used, and varied from 1:10 to 10:1. PL measurements showed near band edge emission from the nanowires and defect band emission at longer wavelengths. Both defect and band edge PL intensities along the lengths of individual nanowires varied significantly. TA spectra of the nanowires exhibited a strong bleach at the bandgap energies that is well described by a bi-exponential decay function (2 -20 ps fast component, 100 - > 1000 ps slow component), and below bandgap bleach attributed to defect states. TA lifetimes also varied significantly along the length of the nanowire, with areas exhibiting decreased lifetimes strongly correlated to areas showing decreasing band edge PL emission. This behavior, which occurred at all S:Se ratios studies, indicates that trap densities along the length of the nanowire. Future studies will focus on the effect of passivation, including coating with wider bandgap materials, on carrier dynamics in CdsxSe1-x nanowires.

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OA #107

Subcategory: Physics (NOT Nanoscience)

The Study of Polarized (_^3)He Target Cell lifetime

Peibo An, College of William and Mary

The (_^3)He target cell polarized by spin-exchange optical pumping(SEOP) is used as an excellent neutron substitute to study the inner structure of the neutron via electron scattering experiment at Thomas Jefferson National Accelerator Facility. By studying the inner structure of neutrons, we can unveil the myth of quarks. We don't use neutrons directly because one free neutron is unstable and has a lifetime of only 885.7±0.8 seconds.[1] The problem for a (_^3)He target cell is that once polarized, (_^3)He target cell depolarizes itself exponentially. The lifetime of a cell is the decay constant of the polarization. The typical lifetime of cells produced in our lab is about 22 hours. Longer lifetime indicates higher electron beam effective time and thus reduces uncertainty. My work presents the study of cell lifetime improvement. With a newly designed vacuum system where the base pressure is as low as 〖10〗^(-8) torr and the new vacuum alkali ampoule that promises alkali purity, we hope to produce a cell named Tom which contains only (_^85)Rb, (_^87)Rb, nitrogen and (_^3)He with a longer cell lifetime. We stop using potassium for cell Tom because our previous research shows that potassium and rubidium mixed cell tends to have a lower average cell lifetime. We use nuclear magnetic resonance (NMR) to measure the relative polarization of (_^3)He when we perform both spin-up and spin-down experiments. Our result shows that unfortunately the newly made cell Tom only has a lifetime of 2.69 hours. We are not sure about the cause and are currently still working on it. We do suspect the quality of the glass used to make our cell.

References: [1] K. Kluttz, Studies Of Polarized and Unpolarized (_^3)He In The Presence Of Alkali Vapor. Ph.D. Thesis, The College of William and Mary, 2012.

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OA #108

Subcategory: Physics (NOT Nanoscience)

Modeling the Sensitivity of Electron Trapping in a Quadrupole Magnet to Bunch Current

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In 2013, long-term electron trapping in a quadrupole magnet was first observed at the Cornell Electron Storage Ring Test Accelerator (CESRTA). The understanding of electron cloud buildup and trapping in a quadrupole magnet is important for assessing possible operational limitations of current and future particle accelerators, specifically for the International Linear Collider (ILC) damping rings. Measurements were made using a Shielded -Pickup Detector aligned with the magnetic pole face of a quadrupole magnet, which samples the flux of electrons onto the beam-pipe surface. These measurements have shown trapped electrons to survive the full 2.5 ?s period of the beam revolution.

Data was taken using the Shielded-Pickup Detector installed in a 7 T/m quadrupole magnet with a 5.3 GeV positron beam in the stainless steel storage ring. The 20-bunch train was injected with 14 ns bunch spacing for each of the measurements at 6.4e10, 10.0e10, 11.6e10, and 13.2e10 positrons per bunch. Using numerical simulations we were able to analyze parameters affecting electrons produced by secondary emission and their effect on the electron trapping phenomenon. While this does provide a general understanding of the trapped cloud dynamics, a nonlinear relationship exists between the simulated electron cloud in the beam pipe and the detected signal electrons. A very detailed numerical model is therefore necessary to infer cloud characteristics from the measurements.

To explain the features of this nonlinear relationship we studied the characteristics of the detector's acceptance and the behavior of the cloud in the beam pipe. From this we are able to provide an in-depth characterization of the cloud as well as a new understanding of the detector's sensitivity and cloud behavior. This new understanding has been demonstrated in the simulations and has succeeded in describing many facets of the nonlinear relationship. A few peculiarities still remain and the detected signal electrons have yet to be perfectly modeled. Adjusting parameters of the model to completely characterize the detected signal electrons and investigating how the trapped cloud interacts with the detector is a topic of future research. Understanding of the electron trapping mechanisms will help with the creation of new electron cloud mitigation techniques and improve accelerator performance.

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OA #109

Subcategory: Physics (NOT Nanoscience)

An analysis of the FrequencyHough method for an all-sky search for continuous gravitational waves

Andrew Miller, The College of New Jersey
Co-Author(s): Pia Astone

In this talk we present the Rome-Virgo hierarchical data analysis pipeline for all-sky searches of continuous gravitational wave signals, like those emitted by spinning neutron stars asymmetric with respect to the rotation axis, with unknown position, rotational frequency and spin-down. The core of the pipeline is an incoherent step based on a particularly efficient implementation of the Hough transform, that we call FrequencyHough, that maps the data time/frequency plane to the source frequency/ spin-down plane for each fixed direction in the sky. We developed a narrow-band version of the pipeline centred at some reduced parameter space regions, which could be applied to mock-data-challenge analyses using LIGO or Virgo data. Examples will be shown.

Funder Acknowledgement(s): National Science Foundation

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OA #110

Subcategory: Physics (NOT Nanoscience)

Deciphering the Nature of Nuclear Symmetry Energy with Nuclear Reactions in Terrestrial Laboratories

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Nuclear symmetry energy refers to the energy difference between pure neutron matter (PNM, 100% protons and 0% neutron) and symmetric nuclear matter (SNM, 50% protons and 50% neutrons). It is currently the most uncertain part of the Equation of State (EOS) describing properties of super-dense matter inside neutron stars [1]. Nuclear symmetry energy also affects the structures of nuclei and properties of nuclear reac-

tions in both terrestrial laboratories and astrophysical environment. However, our current knowledge about nuclear symmetry energy is still very poor. Thus, pinning down nuclear symmetry energy and its density dependence has been a longstanding goal of both nuclear physics and astrophysics [2].

Nuclear symmetry energy consists of a kinetic part and a potential part. In the last few decades both the nuclear physics and astrophysics community have been concentrating on exploring the potential part of nuclear symmetry energy while assuming that the kinetic part is simply given by the prediction of Fermi gas model. However, very recent studies based on both phenomenological models and many-body theories indicate that the kinetic part is far smaller than the free Fermi gas model prediction because of the strong short-range correlation in symmetric nuclear matter. We modify the kinetic part of nuclear symmetry energy and examine the effects of reduced kinetic symmetry energy on experimental observables of terrestrial nuclear reactions. Our work was carried out by performing large scale computer simulations of nuclear reactions using codes based on quantum transport theories [3]. Within existing constraints on nuclear symmetry energy, we explored the effects of the reduced kinetic part of nuclear symmetry energy on nuclear reactions. We found that the reduced kinetic part of nuclear symmetry energy due to the short-range nucleon-nucleon correlation affected nuclear reactions significantly [4]. In particular, several observables were identified as potentially useful probes to determine the relative strength of the kinetic part and potential part of nuclear symmetry energy using terrestrial nuclear reactions.

Our findings from this work indicate that the reduction of kinetic part of nuclear symmetry energy has to be considered in studying properties of neutron stars, rare isotopes and nuclear reactions. Incorporating the reduced kinetic part of nuclear symmetry energy, our future research will focus on determining the density dependence of nuclear symmetry energy by comparing our transport model calculations with experimental data and astrophysical observations.

References: [1] James M. Lattimer, Annual Review of Nuclear and Particle Science 62 (2012) 485.
[2] B. A. Li, L. W. Chen, and C. M. Ko, Physics Report 464 (2008) 113.
[3] B. A. Li, Physics Review Letters 88 (2002) 192701.
[4] B. A. Li, W.J. Guo and Z.Z. Shi, arXiv:1408.6415, submitted for publication.

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Science and Mathematics Education

OA #111

Subcategory: Materials Science

Near Space Graphene and Battery Testing

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For our battery division we tested a newly manufactured lithium ion battery. Our hypothesis for this division of testing is that the battery would not decrease in performance when placed in near -space conditions. For our graphene division we tested how graphene would react in conjunction with led lights. Our hypothesis for this division is that when the IR LED lights shine on the graphene, the graphene will emit heat; enough heat to alter the environment experienced in near-space conditions.

For both divisions we sent our experiments up in a balloon that would reach high altitudes, known as HARP. While in these HARP balloons, instruments would record the data we needed to see if our hypothesis were true. After retrieving the data we would compare it with the data we collected when we tested the experiments within the atmosphere. For the near-space test we tested to see if the heat generated by the LEDs would be enough to sustain life; in this case termites.

We learned that the performance of the battery was slightly altered due to near-space conditions, and that the graphene did emit heat when shined upon by Infrared LED lights.

After our in-Lab experimentation, we observed that the Lithium Ceramic Battery's voltage decreased as the temperature decreased. Furthermore, we noticed that there was a correlation between temperature and voltage decrease. Graphene: It is hypothesized that the Graphene/IR-LED heater would significantly increase HARP module temperature. It was found that the Graphene/IR-LED heater significantly increased in temperature in comparison to non-graphene treated system. This data led us to conclude that the graphene provided extra warmth, but it was not capable of maintaining an optimal environment for the termites, 24˚ to 35˚ Celsius.

Funder Acknowledgement(s): NSF-HRD-1043330- Morehouse Wide Initiative for Sustainable Energy, NST-DMR-0934142- Coalition for Research and Education Enhancement in Materials.

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Social, Behavioral, and Economic Sciences

OA #112

Subcategory: Cancer Research

Prostate Cancer Knowledge, Myths, and Misconceptions Among Haitian-American Men

Olivia Moline, Florida A&M University
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Similar to other Black men, Haitian men are at risk for prostate cancer. However, little is known about prostate cancer in Haitian American men. To address this gap in the literature, this study assessed the prostate cancer knowledge and misconceptions of Haitian American men. The research questions were: (1) What is the level of prostate cancer knowledge among Haitian men? (2) What are the common myths and misconceptions associated with prostate cancer among Haitian men? (3) Which demographic factors are associated with prostate cancer knowledge, myths, and misconceptions? The inclusion criteria for participants were men of Haitian ancestry, 40 – 70 years old, with the ability to speak, read and write in English. Data collection took place in two Florida cities, and was by self-administered survey. A total of 95 men were recruited during health forums and at a church. Incentives were provided for participation in the study. Descriptive analysis and linear regression were employed to analyze the data. Prostate cancer knowledge was found to be low among the participants. In addition, prostate cancer myths and misconceptions were low.

The data from this experiment discovered that men who are often from lower socioeconomic groups seem to acquire less knowledge concerning prostate cancer and often have some misconceptions about the disease. More education is needed to help target particular areas where knowledge was found to be low to help better inform men about prostate cancer. Too often immigrants are grouped together in health disparity research, which often causes there to be a limitation on the ability to correctly address health care disparities. It is important to analyze people not just by race, but to dissect race into categorizes to examine the effects of culture and how it pertains to an individual's lifestyle. This study focused solely on an understudied minority and found useful information to benefit Haitian-American men and the literature. The future plan for this study is for it to be published in a medical journal.

Funder Acknowledgement(s): Florida A&M University, University of Florida ReTool Program

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OA #113

Subcategory: Physiology and Health

Sex Differences in Developmental Trajectories of Resting State Networks

Sara Kimmich, University of California, San Diego

This study investigates how resting state brain activity in the human brain may correlate with executive function, focusing on how this interaction differs between males and females throughout development. A cross-sectional study of males (n=29) and females (n=30) between the ages of 8 and 24 were scanned for an 8 minute period of task-negative, eyes-open rest, during which their baseline resting state brain dynamics were recorded using functional Magnetic Resonance Imaging. Both seed based (hypothesis driven) and ICA based (data driven) analysis revealed that female brains develop co-activated resting state activity before males, and this is positively correlated with n-back memory tasks (p=.05). A significant correlation was also found between connectivity and medial and dorsal prefrontal cortex was found in females (p=.04), but not not in males. This research points to fundamental differences in the developmental trajectory of the dynamics of the human brain between males and females, and further research is needed for a nuanced understanding of how learning and reasoning differ between the genders across development.

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OA #114

Subcategory: Social Sciences/Psychology/Economics

Finding NAIRU: Estimating the Non-accelerating Inflationary Rate of Unemployment

Levi Boxell, Taylor University
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The non-accelerating inflationary rate of unemployment (NAIRU) is a fundamental concept in macroeconomics. Defined as the rate of unemployment at which the inflationary rate is constant, NAIRU is widely used by policymakers to help determine fiscal and monetary policy. However, NAIRU presents a challenge in that one cannot directly observe NAIRU in the same manner that one can observe the unemployment rate. This challenge also makes it difficult to determine how accurate the esti-

mates of NAIRU are. Our research examines the various methods used in economic literature to estimate NAIRU and compares their ability to predict inflation within the context of a Phillips curve. We first begin by using various univariate smoothers and filters, such as kernel smoothers, Butterworth filters, and Hodrick-Prescott filters, to extract the underlying trend from the more volatile unemployment rate. We also analyze several structural models, including the current status quo within the literature of utilizing a state-space model of the Phillips curve and assuming NAIRU follows a random walk within the state equation. This state-space model can be estimated using the Kalman filter along with an EM algorithm to give an estimate of the NAIRU time series.

We expand on the current literature of estimating NAIRU by utilizing a more general multivariate autoregressive state-space model (MARSS) that incorporates structural changes in the labor market within the state equation, instead of assuming NAIRU follows a random walk. Our results indicate that the MARSS model makes several improvements on the previous methods. First, it allows for a more intricate understanding of how various policy decisions, such as extending unemployment benefits or changing the minimum wage, affect NAIRU and gives a way of estimating the size of the impact. Second, it increases the precision of the NAIRU estimates by directly modeling labor market changes that were previously incorporated into the stochastic error term of the state equation. Finally, it also increases the predictive ability of the NAIRU estimates at a statistically significant level (p-value<.05) according to Diebold-Mariano tests. Future research in this area should continue to explore how various labor market variables influence NAIRU within the MARSS model.

References: Gordon, Robert J. 1997. 'The Time-Varying NAIRU and Its Implications for Economic Policy.' Journal of Economic Perspectives, 11-32.

Funder Acknowledgement(s): Funding was provided by the NSF/REU at Lafayette College through Ethan Berkove and Qin Lu.

Faculty Advisor: Jeff Liebner, liebnerj@lafayette.edu

OA #115

Subcategory: Social Sciences/Psychology/Economics

Smart Phones for Smoking Cessation: Cognitive Interventions for Addiction

Eumala Braithwaite, University of the District of Columbia

There is a pressing need to improve cessation outcomes among smokers. In this study, we hope to reduce smoking in adults by using attentional retraining (AR) over an 18-week period. Attentional Retraining refers to the use of modified tasks to change attentional bias and is most often conducted using modified visual probe tasks. Attentional bias is the tendency of our perception to be affected by our recurring thoughts. Smokers have an attentional bias toward smoking cues. We propose to reduce exposure to smoking cues in smokers' natural environments by reducing attentional bias to smoking cues. Reduced exposure should lead to reduced cravings and use. The overall objective is to examine the ability of smart phone-based attentional retraining intervention for reducing craving for cigarettes, reducing cigarette smoking in smoking adults. Participants are recruited through advertisements and screened on the phone. Eligible participants attend a baseline meeting to confirm eligibility, and provide written informed consent. Participants are then randomly assigned to the AR or control group. Eligible participants perform several cognitive assessments, complete self-report measures, and receive a smartphone. Participants then carry the smartphone with them for six weeks. They are prompted to complete four assessments every day at random times. Participants are given smoking cessation education at each visit over the course of the study along with the attentional retraining activities. With 36 in roles and only 2 dropouts, Project SMaRT is the longest running attentional retraining study thus far. Project Smart has a 90% compliance rate. Project with a total of 38 participants in the study, two have completed the treatment and have managed to significantly reduce their smoking. We are awaiting more participants to finish the 18-week study so that we can accurately interpret the results. Future work will include using the data from this study to find better and more productive ways to improve cessation outcomes among smokers. If AR reduces attentional bias, smokers could better navigate their cue-rich environments. Long-term, this intervention could be paired with other effective interventions. AR is inexpensive and may be implemented on smartphones, which would make mass distribution accessible.

Funder Acknowledgement(s): The Uniformed Services University of the Health Sciences Department of Medical and Clinical Psychology Research Mentor Emily Brede, Ph.D., RN Postdoctoral Fellow Laboratory of Cognitive Interventions Addictions Department Head Andrew J. Waters, Ph.D. Associate Professor Director of Graduate Studies. This work is funded by the NIH/NCI and the University of the District of Columbia NIH/NIGMS Marc U* Star Honors Program (5 T34 GM087172-03).

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OA #116

Subcategory: Social Sciences/Psychology/Economics

The Relationship Between Aggression and Submission in Spotted Hyenas

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Agonistic behavior amongst spotted hyenas (Crocuta crocuta) can be classified as aggression or submission. Aggression is behavior intent on damaging another individual while Submission marks subordinate status relative to a dominant individual and serves to diffuse escalated aggression. It is unclear if these two forms of agonistic behavior are opposite ends of a single continuum or if they are two independent behaviors. This research investigates the relationship between these two behaviors in individual spotted hyenas.

The data was collected from a population of spotted hyenas in the Talek region of the Masai Mara National Reserve in southern Kenya between the hours of 6:00 am to 9:00 am and 5:00 pm to 8:00 pm during the years 2001, 2002, 2005, and 2006. Data was recorded using Microsoft Access and R-Studio software used to create maternal pedigree and analyze data via Spearman's rank correlation.

We compare the rate of aggression to the rate of submission within the 35 adult female hyenas. We found that there was no correlation between the two suggesting that the two behaviors are on two independent continuums.
These results suggest that there may be multiple hormones at work mediating the two agonistic behaviors but future work is needed to further explore this question.

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OA #117

Subcategory: Social Sciences/Psychology/Economics

The Relationships Between Perceptions of Scientists and Gender, Based on School Type

Oliver Greene, Morehouse College

This study is intended to further understand why women are underrepresented in STEM fields (Else-Quest, Mineo, & Higgins, 2013). To do this, the relationships between school type (public or private school), gender, and perceptions of scientists were assessed. Understanding these relationships can help predict the chance of a female student's pursuit in or desire for a career in STEM based on her school type. Prior research suggests that there is a difference in student achievement between public and private schools (Amjad & Macleod, 2014). The hypothesis is that gender and school type have a significant association with perceptions of scientists for undergraduate STEM majors. The scientific literacy survey for college success in STEM (SLSCS-STEM) was conducted on a sample of undergraduate STEM majors from seven institutions. Within the survey, a section labeled "POS" consisted of questions used to assess each student's perceptions of scientists. The items in the POS section were computed into a POS scale ($\alpha = .71$). T-Tests showed that female participants had more positive perceptions of scientists than male participants did on the entire POS scale ($t(1030.06) = -2.47$, $p < .01$). Females scored higher than males on items: POS2 ($t(1201) = -2.81$ $p < .01$), POS6 ($t(1203) = -3.01$, $p < .01$), and POS9 ($t(1112.66) = -2.75$, $p < .01$). When running one-way between-groups ANOVA tests for POS with four groups containing both gender and school type (public school males, public school females, private school males, and private school females), results showed a significant difference at the $p < .05$ level on the items: POS2 ($F(3, 1199) = 3.80$, $p = .01$), POS6 ($F(3, 1201) = 4.35$, $p < .01$), and POS9 ($F(3, 1201) = 2.75$, $p = .04$). Multiple comparisons of the ANOVA tests showed that public school females scored significantly higher on item POS2 than public school males ($p = .02$) and private school males ($p = .03$). Private school females scored significantly higher on item POS6 than public school males ($p = .03$) and private school males ($p = .01$). Public school females scored significantly higher on item POS9 than private school males ($p = .02$). The results of these analyses showed that females generally have more positive perceptions of scientists than males, yet the specific items they scored higher on varied by school type. Future studies should pursue understanding why females show more positive perceptions of scientists, but are still underrepresented in STEM fields.

Funder Acknowledgement(s): This study was supported by an NSF HBCU-UP Education Research grant awarded to Lycurgus L. Muldrow, PhD, Director of Sponsored Research and Integrative Activities, Morehouse College.

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OA #118

Subcategory: Social Sciences/Psychology/Economics

Does Science Test Confidence Enhance the Predictability of Parent Education Levels on Science Test Scores?

Cary Junior II, Morehouse College

This analysis is looking to assess whether confidence in science test taking moderates the relationship between the education level of parents and their child's science test scores, acquired from the scientific literacy scale for college success in STEM (SLSCS-STEM) survey. Prior research found that higher parent education levels resulted in higher involvement in their child's education through strategies and that parent involvement was a significant predictor of GPA (Valleymalay, 2011; Hortaçsu, 1994). However, little research has been found relating to science achievement or the implementation of parent education as a variable that effects success on science testing. The hypothesis states that testing confidence will increase the relationship be-

tween parent education levels and test scores. Students from seven different institutions between fall 2011 and spring 2013 were analyzed (N = 1239) using data from the SLSCS-STEM survey. This instrument assesses three dimensions of scientific literacy: scientific reasoning skills, attitudinal and behavioral domains of scientific literacy, and content knowledge of scientific concepts (Benjamin et al., 2014). Science test confidence is a scale derived from confidence questions in the scientific reasoning and content knowledge sections of the survey. A reliability analysis on the scale resulted in good reliability (α = .761). A hierarchical regression analysis was run to assess the ability of parent education levels to predict science test scores after controlling for the influence of science test confidence. The following values have been truncated. Science test confidence explained 27.3% of the variance in the test scores, F (1, 1234) = 463.65, p < .001. Both models explained a total 27.6% variance, R squared change = .003, F change (1, 1233) = 5.27, p = .02. Science test confidence recorded a higher beta value (beta = .51, p < .001) than parent education level (beta = .05, p = .02). These beta values show that testing confidence has a greater contribution, thereby enhancing the overall predictability of parent education levels on science test scores. Even though there is no direct effect by parent education levels, this shows the importance of parent's pursuit of higher education. Further research should search for more associations with parent education to discover what other factors contribute to the relationship between parent education level and science achievement.

Funder Acknowledgement(s): This study was supported by an NSF HBCU-UP Education Research grant awarded to Lycurgus L. Muldrow, PhD, Director of Sponsored Research and Integrative Activities, Morehouse College.

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OA #119

Subcategory: Social Sciences/Psychology/Economics

Smoking Behavior Controlled by Automatic and Non-automatic Cognitive Processes

Tiffany Long, University of the District of Columbia
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The Center for Disease Control reports that an estimated 42 million people in the United States smoke cigarettes. Dr. Tiffany (1990) hypothesized, that frequent or repeated use of a drug results in the motor actions of drug use becoming more controlled by more automatic processes than nonautomatic processes. Urges and cravings are conceptualized as responses supported by nonautomatic cognitive processes. This study examines the cognitive processes controlling the motor behaviors involved in smoking a cigarette which may differ in terms of automaticity among heavy and occasional smokers. This study examines each specific smoking sequence by assessing the reaction time to see what part of the smoking behavior is automatic or nonautomatic. This study hypothesized that the reaction time for heavy smokers on the button press task within the pretend smoking condition will increase because the puffing is being inhibited. Heavy smokers reaction time will decrease during button press task within the smoking and nonsmoking condition because smoking is a well practiced behavior. Which might suggest automatic processing is required for heavy smokers to smoke. For occasional smokers the study hypothesized that the reaction time on the button press task within the smoking and pretend smoking conditions will be increased because smoking is not a well practice behavior. Which might suggest that nonautomatic processes is required for occasional smokers to smoke. Participants engaged in dual tasks, consisting of the button press box within the three different smoking conditions to measure participants reaction time within the study. This study consisted of 52 participants both heavy and occasional smokers ages 18 to 25 within the University of Buffalo and surrounding areas. The materials used in the study were carbon monoxide meter, Direct RT software, Button press box, video recording software, questionnaires on; smoking urges, Brief version, and the State Anger Scale. Results on the questionnaires show there was no difference in craving or frustration level across the 3 task when baseline levels were taken into account which suggest that any disruption in reaction time task performance would not be due to craving or frustration. This study extends previous research on the automaticity of smoking behavior through its use of additional methodological components. Future research will examine smokers that are older and smokers who do not fit within the extremes.

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Technology and Engineering

OA #120

Subcategory: Biomedical Engineering

Fabrication of Shape Shifting PNIPAAM Stamps for Cell Printing and Alignment

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Tissue engineering offers the promise of repair of diseased or damaged organs. Conventional tissue engineering using scaffolds cause adverse effects such as inflammation at the implantation site, host rejection of the scaffold, and poor cell organization and cell proliferation. Assembling patterned cell sheets without the use of scaffolds has the potential to overcome these limitations. We fabricated stamps consisting of arrays of micro-beams made from poly-N-isopropylacrylamide (PNIPAAM), a thermo-responsive polymer, to test the hypothesis that shape-shifting surfaces can be used to control cell organization into tissue modules and direct intact tissue module release during contact printing. The geometry and thermo-responsive swelling of these stamps cause them to rapidly change shape, and the dimensions of the micro-beams can regulate cell attachment, cell alignment and cell-to-cell connections to mimic native tissue structure.

The shape shifting stamps are made by photopolymerizing a PNIPAAM polymer mixture within a PDMS master mold to form the desired micro-beams on surface -activated coverslips. Then, NIH3T3 mouse fibroblasts are seeded onto the sterilized micro-beams. After 24 hours, the confluent cells are released or contact-printed onto target surfaces by using the shape-shifting properties of the stamps induced through temperature manipulation. The impact of release and printing on the viability and alignment of tissue modules are then analyzed.

Release and contact printing was observed to depend on the surface expansion of the microbeams. Cell viability and transfer efficiency were influenced by pressure and stamp patterns. The results suggest that the reduction of pressure during micro printing significantly increases cell viability and closely spaced patterns in the micro-assays provides optimal tissue module alignment.

Overall, the micro-patterned sheets are capable of printing viable 3D tissue structures. The patterned assays that localize the cells upon their release separate this research from other cell sheet technologies. Future research involves optimizing the pressure applied during micro printing to maximize cell viability and transfer efficacy. In addition, we will investigate more complex pattern geometries and the assembly of tissue building blocks via contact printing to mimic native tissue structures.

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OA #121

Subcategory: Biomedical Engineering

Optimization of a Passive Flow Microfluidic Device for Live-cell Imaging

Larisa Gearhart-Serna, Mills College
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Measurements of single-cell dynamics are vital in understanding cell responses to pharmaceuticals and other stimuli, as well as how cell-to-cell variability affects cellular activities. Imaging is a powerful tool for analyzing single cells, but presents obstacles when cells are non-adherent or the microscopy technique is low -throughput. Microfluidic devices provide a potential solution to these problems. Microfluidic devices use very small reagent and fluid volumes, are high-throughput, are compatible with time-lapse and fluorescence microscopy, and can provide greater control over the spatial and temporal locations of cells. In order to overcome the difficulty of single-cell analysis when working with cell suspensions, we fabricated and optimized a gravity-driven microfluidic single-cell trapping device compatible with live-cell imaging. The poly(dimethylsiloxane) (PDMS) devices are made by negative replication of a patterned Silicon master mold, and are then oxygen plasma-treated to render them hydrophilic, and to bind them irreversibly to a glass coverslip. Jurkat T-cell suspension is loaded via pipet into the inlet and driven by gravity through a microchannel featuring one of two different trap designs in two different trap densities. In order to maximize single-cell trapping efficiency while minimizing non-specific binding, we optimized four different aspects of the protocol: the use of blocking agents to increase wettability and flow of the channel, varying the plasma treatment time of to study hydrophilicity of the PDMS, and varying the cell suspension density and flow volume to study the effect of flow rate on trapping efficiency for each of the four trap designs. Overall trapping efficiencies within the channels reached up to 99%, while single-cell trapping reached up to 55%. To test if cells were effectively trapped, we performed a wash step post-loading and found that cell trapping was not significantly affected, demonstrating that complex protocols involving fixing, staining, and washing could occur on-chip. Overall, we have designed and optimized a microfluidic protocol for single-cell analyses and live-cell imaging that could be easily implemented in other laboratories.

Funder Acknowledgement(s): National Science Foundation, Yale University's Raymond and Beverly Sackler Institute

Faculty Advisor: Kathryn Miller-Jensen, kathryn.miller-jensen@yale.edu

OA #122

Subcategory: Biomedical Engineering

Intracellular Delivery of Microgels into Macrophages for Vaccine Development

Tamara Lambert, Cornell University
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Macrophage (MCP) cells act as one of the immune system's primary defenses against infections. MCPs are responsible for clearing debris from circulation, help activate T-cell immunity, and engulf infectious agents. Bacterial cell walls contain glycosylated proteins with mannose, which MCPs use to identify bacteria and phagocytize them. After phagocytosis, MCPs present antigens on their surface signaling the presence of the bacteria to helper T-cells, activating an immune response. MCPs' ability to phagocytize pathogens and activate T-cells by presenting them with antigens can be exploited for a vaccine delivery system. Microgels are micron sized hydrogels formed by cross-linking hydrophilic polymers that have received much attention for the delivery of proteins, because they do not compromise the protein's 3-D structure. In this study, "pathogen-like" microgels were synthesized for intracellular delivery into MCPs. It is hypothesized that microgels coated with mannosamine, a mannose derivative will promote phagocytosis. Microgels of different cross-linking densities were synthesized by cross-linking poly(acrylic acid) with poly(ethylene glycol) by esterification. Their ability to absorb and retain proteins as model antigens was evaluated. Microgels with a "pathogen-like" character were synthesized by decorating the surface with mannosamine via amide bond formation, followed by fluorescein isothiocyanate (FITC) tagging for subsequent confocal microscopy. Microgels without mannosamine were also tagged with FITC to serve as the control. Microgels with and without mannosamine were incubated with J774A.1 MCPs for 2 hours for microgel phagocytosis. MCPs were fixed, stained with DAPI for nuclei and phalloidin for F-actin, and imaged using confocal microscopy. Microgels successfully absorbed and retained proteins with high efficiency, suggesting them as good antigen carriers. Preliminary results did not exhibit microgel phagocytosis, however MCPs incubated with "pathogen-like" microgels showed directed elongation compared to controls, indicating a response. Additional work is being conducted for optimization of experimental parameters. In conclusion, the synthesized microgels can be used as antigen carriers, however their efficacy to deliver antigens intracellularly to macrophages must be further evaluated.

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OA #123

Subcategory: Civil/Mechanical/Manufacturing Engineering

Understanding Disaster Risk from Natural and Manmade Disasters on Urban Infrastructure

Olasupo Akinleye, University of the District of Columbia

It has been recognized that natural disasters such as extreme weather related events, earth quakes and manmade disasters such as chemical spills, spreading of incurable diseases and terrorist attacks can have impacts not only on our human and ecosystem lives but also on our infrastructure. Moreover these disasters can have severe impacts on the metropolitan areas due to high density populations and business centers which are nation's economic centers. Disaster risk reduction is the concept and practice of reducing disaster risks through systematic efforts to analyze and reduce the factors of disasters. Reducing exposure to hazards, lessening vulnerability of people and property, management of land and the environment, and improved preparedness and early warning for adverse events are all examples disaster risk management. In order to understand disaster and risks, the purpose of this research is to analyze and understand disaster risk from natural and manmade disasters on urban infrastructures. The research methodology includes understanding of terminology and definitions, classification of natural and man-made disasters and analysis of disasters within the Washington Metropolitan DC area. In this research, historical tidal flooding data was analyzed. By thoroughly assessing recent natural disasters in the Washington DC area, we can make a valid Building-level risk assessment that will lead to more accurate Asset-level risk assessment.

Funder Acknowledgement(s): University of the District of Columbia Stem Center

Faculty Advisor: Pradeep Behera, pbehera@udc.edu

OA #124

Subcategory: Civil/Mechanical/Manufacturing Engineering

Pedestrian Safety at Signalized Intersections: Mwenge Intersection, Dar es Salaam, Tanzania

Sajeeda Chin, Howard University

Roadways need to be designed to accommodate the needs of all road users. However in most cases, pedestrians are at a very high risk of collision with motor vehicles at intersections. Since pedestrians are among the most vulnerable of all transportation facility users, particular protective measures are required to ensure their safety. The objective of this study is to investigate and document current pedestrian facilities conditions at signalized intersections and propose measures to improve pedestrian safety. The intersection of study is the Mwenge intersection

which consists of Ali Hassan Rd, Coca Cola Rd, New Bagamoyo Rd and Sam Nugoma Rd. Surrounding the intersection is outdoor markets and vending, it is frequented by many pedestrians and vehicles alike. Through frequent visits and further research on pedestrian facilities suggestions to increase pedestrian safety were made. While at the site, pedestrian counts for each cross walk was taken for fifteen minute intervals at a time at different time of day. Through different pedestrian safety studies from around the world in places such as the United States and India, suggestions for improvement were made. They include revitalization of traffic signals, construction of ramps to accommodate pedestrians with disabilities, clear side walk of vending and parking and introduction of indented medians. For the future, if implemented, the number of deaths due to vehicles will greatly decrease and the quality of life will increase.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Mentor, mushule@udsm.ac.tz

OA #125

Subcategory: Civil/Mechanical/Manufacturing Engineering

Analytical Discrepancies in Fiber Model Analysis of Unbonded Post-tensioned Precast Concrete Walls

Lucas De Buren, California Polytechnic University, Pomona

This presentation investigates discrepancies in fiber model analyses of unbonded post-tensioned (UPT) precast concrete walls under combined gravity and cyclic lateral loads using the DRAIN-2DX program.

Previous work showed that fiber model analyses of UPT walls with relatively large initial prestress accurately represent the experimental base-shear lateral drift response under monotonic and cyclic lateral loads. It is expected that the base-shear under monotonic loading represent an upper bound to the base-shear lateral load response under cyclic loading. However, for two of these lightly prestressed walls, the analytical base-shear under cyclic loading exceed both the experimental base-shear and the analytical base-shear under monotonic loading. Therefore this research aims to establish a lower bound prestress level for which the fiber model produced acceptable (i.e. No significant over prediction of the monotonic response) base-shear response values of an UPT wall subjected to cyclic lateral loading.

The application of the prestress level will be taken into consideration when narrowing down the scope and has been deemed accurate to provide a 2% variance in prestress. Since the prestress level must be applied with a tensile machine consideration must be taken into account when narrowing down the prestress level. Upon determining the lower bound of prestress the further research will be directed towards implementing various alternatives for the fiber model. Such alternatives would be possible metal bracing for the extreme ends of the walls to possibly reduce the over prediction of base-shear response values under cyclic loading for walls with prestress lower than 0.3318 fpi/fpu.

Funder Acknowledgement(s): Ronald E. McNair Scholars, Louis Stokes Alliance for Minority Participation.

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OA #126

Subcategory: Civil/Mechanical/Manufacturing Engineering

Inland Desalination and Brine Management: Salt Recovery and Beneficial Uses of Brine

Lucas De Buren, California Polytechnic University
Co-Author(s): Ali Sharbat, California Polytechnic University, Pomona CA

As of May 2014, nearly 60 percent of the state of California is officially in an “exceptional” drought — the highest level, above “severe” — and meteorologists are seeing no immediate change in a relentlessly dry forecast. Even more alarming is that scientists are warning that the Southwest’s cyclical droughts could become longer and more frequent as the climate warms. Having conservation in mind, the solution is reaching out to the new sources of water, such as reclaimed and brackish/saline water. Except a few communities that are located next to the ocean, the rest of country does not have the luxury of having direct access to the ocean for intake and disposal of the concentrate stream.

Recent developments have led to more efficient RO and ED/EDR systems. Yet innovative and current systems for inland desalination require large amounts of electrical energy and are very cost demanding. More importantly, a larger problem that arises from the situation is the control of concentrate produced from desalination of brackish water, as in many systems the concentrate disposal cost is higher than the cost of desalination. Methods for management (disposal) of concentrate vary widely due to the variability of parameters such as: volume, regional regulations, quality of concentrate, public perception and CapEx/OpEx costs. Conventional methods for concentrate management in inland systems are commonly designed to dispose of the concentrate.

Recent research has shown that it is possible to; a) precipitate metals and nutrients such as Barium and Phosphate out of inland concentrate using chemical and biological processes, b) salt recovery via various techniques including ZLD, chemical precipitation processes, and SAL PROC process, c) using concentrate for biofuel production though algae and/or cyanobacteria growth, d) using concentrate for biomass production via halophyte plant growth, and e) using concentrate for food produc-

tion via fish and algae farming. This study has evaluated various case studies and outlined the outcome of the evaluation. Detailed analyses of various uses are performed on the available case studies. The objective is to develop suggested protocol for addressing the issue of concentrate disposal for inland desalination and find appropriate uses for the concentrate stream.

Funder Acknowledgement(s): Louis Stokes Alliance for Minority Participation, Ronald E. McNair Scholars

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OA #127

Subcategory: Civil/Mechanical/Manufacturing Engineering

Performance Evaluation of Corrosion-Resistant Rebar for Enhancing Sustainability of Bridges

Kyle Edmonds, Morgan State University

The deterioration of prestressed steel strands in prestressed concrete beams and girders is the one area that has been particularly problematic throughout the United States. To address issues of deterioration and corrosion, the use of corrosion-resistant rebar (CRR) can offset these challenges. This research focuses on exploring materials such as stainless steel prestressing strands that can be used in prestressed concrete girders and slabs given their inherent properties to provide durable corrosion protection and prevention of premature spalling or corrosion-induced cracking. The objective of this study is to compare the performance of stainless steel rebar to conventional black steel rebar and based on experimental testing results, where bars are tested under direct tension. The data-driven analysis will be based on the strain-stress relationships of tested rebar. The final results will show differences in the ultimate strength and strain of CRR compared to conventional steel rebar. These results will further contribute towards the investigation of CRR alternatives which can lead to the long-term goal of promoting sustainability and environmental protection to increase the life expectancy of bridges.

Funder Acknowledgement(s): National Science Foundation (NSF HBCU-UP)

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OA #128

Subcategory: Civil/Mechanical/Manufacturing Engineering

Comparing the Performances of Controllers Under Time Delays Using a Rotary Servo Plant

Aaron Faulkner, Louisiana State University

This research lies at the interface of applied mathematics and engineering. It experimentally implemented three controllers under time delays, and compared the controllers' performances, using Simulink. Controllers are ways to automatically adjust the behavior of dynamical systems in response to information about the systems' states and surroundings, and are important for developing autonomous engineering systems [1]. Time delays occur when the current states are not available for measurement. When the current states cannot be measured, traditional controllers do not ensure the required tracking properties. Over the past ten years, several new controllers were developed for time delayed systems, but there was no literature that quantitatively compared their performances on the same test bed. This project helped fill this significant gap in the literature. The test bed was the Quanser rotary servo plant, which is a DC motor turning a mechanical load. The goal was to track step and sine waves.

The three controllers that were tested were a proportional derivative (or PD) control, a modified Smith predictor [2], and a predictor-based control [3]. The hypothesis was that the predictor-based control would provide more stable tracking than the other two controllers. The controllers were tested under many conditions. The PD control was found to be on the verge of instability for a delay of D=0.05s. By contrast, the modified Smith predictor was on the verge of instability for D=0.11s, and the verge of instability for the predictor-based control was D=0.1s. The conclusions were that (a) the modified Smith predictor and predictor-based control can compensate for delays better than the PD control and (b) the modified Smith predictor performed slightly better than the predictor-based control. Future research will quantify the differences in the performances of the controls on more complex test beds involving active magnetic bearings, which are important for rotating machinery.

References: [1] H. Khalil, Nonlinear Systems, Third Edition, Prentice Hall, Upper Saddle River, NJ, 2002.
[2] M. Krstic, 'Compensation of Infinite-Dimensional Actuator and Sensor Dynamics,' IEEE Control Systems Magazine, Vol. 30, No. 1, pp. 22-41, 2010.
[3] N. Sharma, S. Bhasin, Q. Wang, and W. E. Dixon, 'Predictor-Based Control for an Uncertain Euler-Lagrange System with Input Delay,' Automatica, Vol. 47, No. 11, pp. 2332-2342, 2011.

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OA #129

Subcategory: Civil/Mechanical/Manufacturing Engineering

Gait Lab Validation of Direct Force Measurement in a Transfemoral Prosthesis

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Technological advancements in prosthetic limbs for individuals with lower-limb amputation have resulted in a number of microprocessor-controlled knee and ankle systems in the commercial market. Such systems have the potential to provide enhanced and expanded functionality by being able to actively react to changes in terrain or gait. However, the extent to which this potential is realized in practice remains an open question. There are multiple methods to evaluate the performance of the amputee limb system. The conventional approach to gait analysis involves motion capture cameras and floor-embedded force transducers that are limited to laboratory settings that fail to adequately simulate real-world locomotor function. Alternatively, the approach of direct force measurement provides gait assessments via sensors directly integrated within the prosthetic limb system. This method, when combined with wireless data transmission, enables continuous measurement of prosthetic-limb performance in field settings unsuitable for conventional gait analysis. The objectives of this effort are to compare the prosthetic-limb kinetics as measured by limb-integrated transducers to that obtained via conventional gait analysis and ultimately validate direct force measurement as a tool for field evaluation of prosthetic-limb performance. The work to be presented will discuss the technical details of each system and the progress to date in the collection and analysis of gait data from a single patient with unilateral transfemoral amputation.

References: Dumas, R., Cheze, L., & Frossard, L. 2009. Loading applied on prosthetic knee of transfemoral amputee: comparison of inverse dynamics and direct measurements. Gait & Posture 30:560-562.
Frossard, L., Beck, J., Dillon, M., & Evans, J. 2003. Development and Preliminary Testing of a Device for the Direct Measurement of Forces and Moments in the Prosthetic Limb of Transfemoral Amputees during Activities of Daily Living. American Academy of Orthotists & Prosthetists. 15:135-142.
Simon, S. R. 2004. Quantification of human motion: gait analysis -benefits and limitations to its application *to clinical problems*. Journal of Biomechanics 37:1869-1880.

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OA #130

Subcategory: Civil/Mechanical/Manufacturing Engineering

Seismic Vulnerability Assessment Using Ambient Vibrations on Buildings in Central Mexico

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Considering the impact of earthquakes on society (loss of life and property), the importance of mitigating the risk associated with this phenomenon has been recognized around the world. One of the strategies for mitigation is to have buildings that can withstand the effects brought about the earthquakes. To avoid or reduce the consequences or the amount of damage caused by these events, the earthquake engineering provides criteria, methods and tools for structural design of such infrastructure, as well as testing, maintenance and reinforcement, if necessary, of existing buildings. Two procedures for estimating the seismic vulnerability for existing buildings in Central Mexico using ambient vibration records are presented. The vulnerability is estimated in terms of a reliability measure. The reliability analysis is carried out using analytical models which provide the linear and non-linear responses. The dynamic properties of those models are calibrated from experimental analysis considering ambient vibrations of the buildings. The simplified procedure, using linear responses, employs a safety factor. The detailed procedure, using the non-linear responses, employs a damage index defined as the Secant Stiffness Reduction Index (ISSR); here the capacity measure of the structural systems is estimated from the pushover analysis. In order to illustrate the procedures, two buildings, both in central Mexico, were analyzed, one of them was a reinforced concrete school building that belongs to the infrastructure of the UPAEP University and is located in Puebla; another one is a precast concrete Hospital building located in Tlaxcala. After analyzing the results we can conclude that the building studied presents an acceptable level of reliability. Finally, the procedures presented here can be used to other kind existing buildings and the information obtained can be useful for mitigating the seismic risk of existing buildings.

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OA #131

Subcategory: Civil/Mechanical/Manufacturing Engineering

Improvement of the Level of Service of the Sam Nujoma and African Road Roundabout

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In Dar es Salaam traffic congestion is a major issue within the city. In order to mitigate and reduce congestion on roadways, traffic studies of the traffic control system and design of intersection is necessary for possible improvement of the level of service of intersections. Level of service is a qualitative measure of the quality of service of a road way. This research focused on the use of traffic simulation modeling software to model design alternative of intersection for the possible improvement of the level of service of the Sam Nujoma and African Road roundabout. Turning count movements and design of current conditions were inputted into the software SIDRA in order to compare to design alternative. Several design alternatives were created to model possible solutions. These design alternatives did not result in an improvement of level of service for the intersection. With the improvement of level of service of a roadway this in return possibly decrease congestion, increase traffic flow and safety of roadways. Further studies, data collection, and data analysis are necessary for improvement of current situation. Due to the results in SIDRA, and limitations of the software, this research needs to be evaluated using a different software that can evaluate the performance of more than one intersection at a time. Addressing the design and signalization of roadways provide a minor solution in major congestion of Dar es Salaam road's congestion.

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OA #132

Subcategory: Civil/Mechanical/Manufacturing Engineering

Wood Stove Combustion: Effects of Biomass Composition

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Inefficient combustion processes in wooden stoves have resulted in hazardous indoor/outdoor air conditions for the more than three billion homes with little to no access to electricity. Lengthened cooking times require more fuel, deleteriously yielding high particulate matter emissions, rapid deforestation and an exacerbation of the problems being faced in the developing world. Three-fire stoves, the most pervasive stove type in the developing world, lie at the crux of the problem, with their overexposed flames and debris. The purpose of this paper is to evaluate the composition of lignocellulosic biomass (that is biomass containing the lignin, cellulose, and hemicellulose molecules) overwhelmingly represented as fuel sources for wooden stoves, to find links that will produce a hotter and cleaner burn. Several other works have attempted to address these issues separately, either redesigning the stove to trap more heat during combustion or adding a filtered bin to capture particulate deposits. While there is literature on the redesign of three-fire stoves as well as information regarding the composition of lignocellulosic biomass and its effects on the combustion cycle, through laborious research, there still remains a limpid gap in the literature on the ways both the redesign and lignocellulosic biomass composition work together. A deductive quantitative analysis is used and gas chromatography and mass spectrometry are both employed to determine the chemical makeup of the biomass sample, char, and gaseous byproducts as a result of the combustion cycle. Lignin, hemicellulose and cellulose were all found to have decisive effects during the combustion and breakdown of plant matter. Although researchers successfully redesigned the three-fire stove and introduced the innovative improved cook stove and advanced biomass stove into several villages, there remains a general apathy among the people being encouraged to replace their current three-fire stove method. This paper's quest is to take the cultural dignity of the people into account while looking at the composition of the lignocellulosic biomass to eventually increase the efficiency of the combustion process, resulting in a cleaner burn with fewer emissions in the form of fly/bottom ash.

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OA #133

Subcategory: Civil/Mechanical/Manufacturing Engineering

Design of an Uninterrupted Power Supply Utilizing Multiple Renewable Energy Sources

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As renewable energy sources are being developed to serve as sustainable alternatives to polluting and finite fossil fuels, challenges persist for their integration into the Uninterrupted Power Supply (UPS) necessary to provide continuous power to infrastructural systems. Intermittent availability and prohibitive resource commitments, both financially and spatially, preclude the viability of any single renewable source as the predominant alternative to fossil fuels. Additionally, peak demand for electricity often does not correspond to peak production of renewable energy. Challenges in storing harvested renewable energy for later use necessitate the integration of multiple energy sources to maintain a renewable UPS.

The goal of this design is to develop an interdisciplinary approach to the design of a UPS that integrates and utilizes multiple renewable energy sources. The UPS must be able to accom-

modate different configurations of energy sources and storage at varying scales. A twelve volt direct current (12VDC) demonstration scale prototype will be constructed to test the system's ability to deliver uninterrupted power to a constant load. In this configuration, wind and solar energy are harnessed through a turbine and photovoltaic panels respectively. Surplus energy is stored in the form of potential energy. Chemical potential energy is stored using standard 12V marine batteries. Gravitational potential energy is stored by pumping water from a lower to a higher elevation using two 275 gallon tanks in a closed system. In times when solar or wind energy are not available, an electronic flow control valve allows the water to flow from the higher tank to the lower tank, passing through an in-line hydroelectric turbine. A microcontroller is used to implement a supervisory control subsystem that integrates, manages, and monitors energy sources, storage, and output. This subsystem prioritizes the use of solar and wind sources when present and minimizes dependence on chemical storage by prioritizing gravitational storage.

The experimental test period of the demonstration prototype is expected to produce proof of concept for the supervisory control logic and reveal proportions at which multiple available renewable energy sources can be integrated to provide a UPS. Future test configurations can then be scaled to appropriately for a multitude of energy systems and application scenarios (e.g., municipal water towers, refugee camps, forward operating bases).

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OA #134

Subcategory: Civil/Mechanical/Manufacturing Engineering

Geosynthetic Soil Reinforcement

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Turkey is a high risk area for seismic wave propagation. As such, it is crucial to obtain solutions for soil improvement and decrease the possibility of soil failure due to liquefaction and shearing stress failure. There are several methodologies that have been developed to prevent soil failure. One technique to do this is by using deep foundation systems to support the building. This means that the footing of your foundation will be dug deeper into the earth in comparison to a shallow foundation. This in turn enhances the bearing and settlement capacity of the structure. However, the downside to deep foundation systems are that they are very costly to install. In our experimentation, we explored another method of improving some of the strength parameters of soil through the use of geosynthetics. We hypothesized that if we were to inject soil with glass fibers, the fibers would enhance the shearing strength as well as decrease the hydraulic permeability of the soil. In order to test out this theory, we conducted a series of direct shear tests and hydraulic permeability tests on man-made Silica soil with and without the reinforcement of glass fiber. We varied the relative density of the soil as well as the fiber content in order to extract a better analysis from the data we collected. According to the data we have collected from the shear box test, the shear strength of the silica sand improved for all relative densities with reinforcement of 0.50% glass fiber. With an addition of 0.25% fiber, improvements only occurred in the 20% and 40% relative density sands. For 60% relative density and 0.25% fiber reinforcement, the shear strength of the sand decreased. Our data from the hydraulic conductivity test reveals that our fiber reinforced soil doubles, and in some cases triples the coefficient of hydraulic conductivity in comparison to the plain silica sand. Therefore, adding fiber into the sand is not an effective method of preventing liquefaction but it can improve your shearing strengths. For future researchers, it is recommended that there be a series of experiments conducted on the shaking table. This will provide much needed information on the performance of our glass fiber reinforced soil during an earthquake.

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OA #135

Subcategory: Civil/Mechanical/Manufacturing Engineering

Ziploc Mechanism for Low Frequency Damping-A Finite Element Analysis

David Simmons II, North Carolina A & T State University

Dissipation of energy within a structural/material system is essential in many applications today, such as earthquake damage prevention, military equipment, and shock absorbers in automobiles, to name a few examples. Polymers being viscoelastic material pose the important property of dissipating energy, or can act as a good damper. Depending on the application area to maximize the damping property of the polymers, one needs to optimize the materials and the geometry of the system. In the

present work, a finite element analysis is performed to find out an optimal geometric configuration, which has a similarity with ziploc mechanisms, and select the optimal polymer materials for maximizing energy dissipation at low frequency vibration.

Currently several case studies are undergoing. In the future, an iterative study will also be performed to find out the optimal geometric configuration of the assembly. In the finite element simulation of the proposed assembly simulating the contacts between multiple materials surfaces (gel like fluid-soft polymer, gel-like-rigid polymer) is the critical one. Currently a surface to surface contact with friction is used in ABAQUS. The coefficient of friction is chosen to be higher between the gel surface and the flexible polymer surface. The polymers and the gel are modeled as viscoelastic materials with different stiffness and relaxation properties. A linear viscoelastic material model is used in ABAQUS for the simulation. By the conclusion of this research, the objective is to determine the suitable polymer materials and the optimal geometry of the proposed Ziploc mechanism that result in the most efficient energy dissipating and damping mechanism.

Funder Acknowledgement(s): North Carolina Space Grant Agency

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OA #136

Subcategory: Civil/Mechanical/Manufacturing Engineering

Automated Hurricane Storm Surge Simulation to Setup an Evacuation Plan

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This research presents one multi-scale integrated simulation technology for emergency preparedness with a holistic approach in hurricane related storm surge flood forecasting, infrastructure assessment, and emergency planning. This is a potential emergency management tool to aid the decision-makers and first responders in preparation for the appropriate response to an impending hurricane disaster. The devastation caused by recent hurricanes outlines a dire need for operational research to develop technology that is capable of predicting storm surge disasters for better emergency preparation.

Two primary models, storm surge and overland flooding, are executed in sequence to generate the necessary results for the proposed integrated emergency planning and preparedness tool. Using the results of the primary models, two secondary models are executed to assess local infrastructure vulnerability and to determine the optimal evacuation routes for impacted inhabitants. The models are run sequentially to generate the data necessary during an actual event. The sequence is fully automated using Python and Shell scripts, which allows users to interact with each model through a series of Graphical User Interfaces. The results from each model are post-processed and saved as Keyhole Markup Language (KML) files that are viewable in Google Earth for overlay analysis and decision-making.

Hurricane Gustav (2008) in the Mississippi coastal area is chosen as a case study to validate the developed tool. Hurricane Gustav is chosen because a large amount of data is available for this hurricane. The results generated from the models are expected to be used to mock setup an emergency evacuation. The development of technology described here would not only satisfy the scope of the project, but also be of great significance to national homeland security in the area of emergency preparedness and response. Future research involves improving the accuracy and speed of the model by utilizing parallel computing.

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OA #137

Subcategory: Computer Engineering

Sun Seeking Solar Cells Pt. 2

Rahu Bannister, Southern Polytechnic State University
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This summer research project is a continuation of a previous project so a standard model panel and two prototypes were already developed. My team and I were tasked with the testing of the overall power output between these three panel. After tests were run we had to improve upon the best prototype to develop a sun tracking system that more accurately followed the sun. This was broken into two teamsm, one of which was the electrical team and the other was the mechanical team. Decision matrices were used to decide upon controllers, motors, photo diodes, resistors, etc. and preliminary work began. The group never passed the preliminary stages so there are no final results. We do however have the total power output gains of the solar panels which are listed below:

- Standard: 9.699216 W
- Prototype 2: 9.320457 W
- Prototype 3: 6.836724 W

The standard panel did produce the highest maximum power output but the prototype 2 best the standard in overall power output by 1.08%. This little increase in power showed that following the sun produces more overall energy that staying stationary.

This project is part of a bigger research agenda that is scheduled to take an entire academic year to complete and be presented at the P3 competition June of 2015. Because of this the entire research question is not complete. Improvements to the prototype 2 are under way to increase solar absorption to yield a 10% increase in power over the nations standard prototype.

Funder Acknowledgement(s): Bill Diong

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OA #138

Subcategory: Computer Engineering

iPhone Indoor Navigation System for Visually Impaired People

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Localizing visually impaired people maneuver with ease within indoor environments such as large campus building, museums, etc. is critical important for them to have a normal social life. In this work, we implemented an iPhone based indoor navigation app to help visually impaired people dealing with localization and navigation problem. This application system is implemented using a smartphone (iPhone currently) with a special designed omni-directional lens mounted on its case. The lens takes omni-directional images, which represent panoramic information of the environment in single shot. All the indoor environment information covered within this system are compacted by extracting concise features from them and stored in a remote GPU--enabled server. When users want to localize themselves, they just need to capture a short period of video. The app will send the compressed information to the server and the server will calculate the location and feedback to the user. In the server processing procedure, this information is compared to the already stored information in a large database and the current location is identified based on that. We apply socket programming to communicate between iPhone front ends the server backend. The server can potentially provide service to multiple users at the same time, which makes the system easy to scale up. The application can process data acquisition, transmission, and query process in real time, and as fewer mobile memory as possible are used to free the phones from other functions. The Graphic User Interface (GUI) is also designed specially for visually impaired people by dividing it into two panels. The user's panel, which is for the visually impaired, is simple and intuitive to use, and the configuration panel, which is for the developer/family member, can accept different kinds of parameters to make the system suitable for different kinds of environment and visually impaired personal preferences. Real campus building indoor environment database is built and the tested result shows a good performance both in terms of accuracy and robustness.

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OA #139

Subcategory: Computer Engineering

Test-Bed for Efficient Data Collection in Wireless Rechargeable Sensor Networks via Unmanned Vehicles

Jamaal Roby, Texas Southern University
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Energy consumption is an obstacle to various applications of wireless sensor networks (WSNs). This major drawback of WSNs is due to the long-distance multi-hop transmissions from the sensors to the sink. To address this issue, we employ multiple wireless charging vehicles (WCVs) to travel inside WSNs to replenish the energy of designated sensors while mitigating long-distance transmissions. Different from prior works, we let each WCV, not only, recharge the sensors, but also collect data from the sink, in coordination with other WCVs. This method allows nearby sensors to use short-distance transmissions to deliver their traffic to each designated sink while greatly increasing the lifetime of a WSN. We initially evaluated our idea with a small scale test-bed.

The test-bed is focused on the idea of wireless charging (i.e., transferring electric power from one storage device to another without contact) using the P2110-Eval-01 development kit, Lego NXT Robots (NXT), and LabVIEW (LV). A program was then created in LV by guiding the NXT to follow a line guiding it to the sensor node via PID control. Battery capacity will be monitored by a virtual remote (VR) lab that was modified from existing project in the NSF CREST center at TSU. The VR lab will also have the capability to send any pre-programed commands to the WCVs.

We have modified the VR lab to send/receive data and also created a program that allows the NXT to follow a line. Also, we are able to power a sensor with battery. Some critical findings during the implementation of the test bed were: 1) we were unable to charge a battery with our current equipment 2) charging a battery would also be more comprehensive than simply applying current 3) the NXT motors lacked efficient torque to support the weight of the transmitter and its power supply (PS) and 4) we would need a more effective method to locate the sinks on a larger scale. With respect to these challenges, we have devised

possible solutions for each case. A battery management system would address the inability to charge a battery, and we ordered a WCV with stronger motors and added functionality. Furthermore, we will include location based services in the WCVs and sensor nodes.

Future work will consist of full implementation of the VR lab, creation of a BMS and adding a method for locating nodes. A stronger WCV was purchased to carry the transmitter while permitting added control. We conclude that these steps would allow us to meet our objectives.

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OA #140

Subcategory: Computer Engineering

Assess Security Risk of Google Glass

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The use of innovative wearable technologies is a growing trend in the technological world with devices, such as Google Glass, Apple Watch, Galaxy Gear Fit, Nike Fuelbands, Fitbits, and more. With these devices on such a high demand, the problem is that they may share potential security risks that could affect users privacy. This inspired following question, "Can the Google Glass' web activity be monitored the same way as other wireless devices?" If this device has been recently released to the public, there may be probable security dangers that many aren't aware of. Also noting that the Google Glass is wireless device, which could mean its security could be comparable to other wireless devices such as tablets and smartphones. The approach was to focus on data sent from the Google Glass, primarily on web browsing and shared posted photos. The setup was to use the Glass to browse webpages and take then post pictures to an online profile (Facebook/Google+), then passively attack using Wireshark, packet-sniffing software, to capture the data packets and determine if the Glass is encrypting data. The captured data received from the Glass was in hexadecimal format. That data was used search for identical patterns with the original picture taken directly from the Glass. The process was then repeated, using an Android tablet and smartphone. Since the Glass is powered by Android, it was decided to compare it to other devices with similar operating systems. After comparing the packets captured to the data pulled from the Google Glass, the data sent appears to be encrypted. Using unencrypting software, it's presumed that some information can be eventually recognized, but would take more difficult measures to determine. Although the web browsing activity information can easily be acquired, show the weakness in security from this device. It concluded that either the Google Glass encrypting the data or it is being rearranged when transmitted. Furthermore, the web browsing appears indistinguishable to other wireless devices. More approaches to find more security risks with the Glass have been determined and being implemented in the future. The possible phase may require developing API to assist in determining the encryption of the photos being sent as well as using a similar approach to acquire the GPS functionalities exposing more potential privacy risks with the device.

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OA #141

Subcategory: Computer Science & Information Systems

Exploring Technological Preventive Methods for School Shootings

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The horrific and tragic deaths that resulted from infamous school shootings has terrified and deprived the American culture from a sense of security in what has traditionally been a nurturing and safe environment. This research will discuss different preventive methods for school shootings. The most current preventive methods are examined for fitness based on a variety of school shootings that have occurred in the past. If a preventive method cannot prevent a school shooting from escalating further, that particular method is discarded as an option for protecting students and faculty from school shootings. The framework for a school shooting protection device is then proposed. Ideally, the goal of this research is to prevent as many additional deaths and injuries from occurring during a school shooting by building a device based on the proposed framework to protect students and faculty on school property. With the framework presented in this paper, an efficient and comparatively affordable preventive method could be released in the near future.

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OA #142

Subcategory: Computer Science & Information Systems

Virtual Reality Subway Evacuation Drill with Multi-User Environment

Stephon Mackey, Bowie State University

Sometimes people are not aware of the dangerous situations they could face being in a subway station. The virtual reality subway evacuation with multi-user environment will introduce a new way of performing an evacuation drill. Having a virtual subway evacuation drill will allow data to be collected from users in dangerous situation with tactics that are more safe and efficient than a live one. Also, this project can introduce and prepare people for the dangers that could be associated with using public subway transportation. Our hypothesis is that a multi-user virtual subway evacuation drill can be useful for collecting data on subway evacuation behavior and procedures. We developed the proposed multi-user VR subway evacuation using a gaming engine called Unity3d.

The developed multi-user environment also included a waypoint algorithm for navigation. PUN (Photon Unity Networking) is a Unity3d asset tool that allows users to log onto a cloud network simultaneously. The network is client-server based and allows a person to create a room for others to join. This type of network foundation will allow users to easily connect with one another without any networking problems. A multi-user environment is suitable for this type of project because more accurate data can be collected from different users in real-time as opposed to one user running the simulation alone.

The multi-user environment currently has a provision to connect 10 clients. We have also integrated the project with the use of Oculus Rift, which allows users to be immersed in the virtual environment. We also incorporated intelligent/emergency signs, which help users exit the station. We are conducting user studies for the multi-user subway evacuation. For future work we will incorporate steering behaviors for panic, threat, leadership and fleeing.

In conclusion, the virtual reality subway evacuation with multi-user environment is a stepping-stone into more safe and efficient evacuation drills. Once fully complete, we plan to present it to a Metro representative for further support and studies.

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OA #143

Subcategory: Computer Science & Information Systems

Design and Implementation of an Energy Efficient Android Controlled Smart House

Jabari Stegall, North Carolina A&T State University

Energy Savings, increased safety, and convenience can be achieved through the use of smart house technology. Smart House technology has been a key discussion due to the new interest in "The Internet of Things" concept, which is the network of physical objects accessed through the Internet, as defined by technology analysts and visionaries. These objects contain embedded technology to interact with internal states or the external environment. Also the 'Internet of Everything' concept, which is bringing together people, process, data, and things to make networked connections more relevant and valuable than ever before-turning information into actions that create new capabilities, richer experiences, and unprecedented economic opportunity for businesses, individuals, and countries. A smart home is an integration of technology and services through a home network for better quality living. The smart home is meant to provide unequivocal comfort and support to its occupant. The smart home also has the capability to save the occupant money on energy savings by allowing them full control over their HVAC, lighting, all of their domestic appliances, and also their home entertainment. The smart house owner could also increase safety by having a smart security system that can monitor various dangers, such as fires, break-ins, carbon monoxide, etc. The convenience of a smart house would stem from being able to monitor all of those smart aspects via a central controller i.e. Cellphone or compute. I plan on implementing a smart house using a Wireless sensor network monitors with a ZigBee Radio as a controlling node in the network. This special node takes the responsibilities of controlling data communications, establishing communication links and protecting equipment inside the network. Data is collected using the Zigbee nodes and transferred to server or monitoring center via a GPRS network and the internet. The connection to the internet allows the central controller to communicate with the network. A Wireless Sensor Network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes. A major obstacle is the energy consumption when implementing a wireless sensor network. Major factors that contribute to the data consumption of the nodes is idle listening and non-efficient paths when passing data between nodes. A way to combat energy consumption is to implement a MAC protocol called S-MAC. S-MAC uses three novel techniques to reduce energy consumption and support self-configuration. S-MAC uses three novel techniques to reduce energy consumption and support self-configuration. Inspired by PAMAS, S-MAC also sets the radio to sleep during

transmissions of other nodes. Finally, S-MAC applies message passing to reduce contention latency for sensor-network applications that require store-and forward processing as data move through the network.

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OA #144

Subcategory: Electrical Engineering

Investigation and Evaluation of a Dynamic Spectrum Access Scheme for Broadcasting to Remote Transceivers

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Cognitive Radio (CR), a novel radio technology intelligent enough to autonomously change its parameters configuration to adapt to its environment, increases the efficient usage of the underutilized radio spectrum. One proposed technique to achieve this goal is Dynamic Spectrum Access (DSA), a technique in which a secondary (unlicensed) user (SU) senses and accesses the idle frequencies of the spectrum band owned by a primary (licensed) user (PU). The term "idle frequencies" refers to parts of the spectrum that are unoccupied at a certain time and location by the primary user. As research on CR and DSA becomes widely conducted by many engineers worldwide, a system that test the performances of CR becomes necessary. The main focus of this project is to evaluate the performance of the CRs when performing DSA in broadcasting - transmission to multiple cognitive receiving radios. Specifically, a C++ program uses open source Liquid-DSP, Cognitive Radio Networks Testbed (CORNET) and Cognitive Radio Test System (CRTS) software to test the performance of CR nodes while performing DSA. Performance metrics such as rendezvous time, evacuation time, spectrum usage, probabilities of false alarm and detection/ misdetection as well as metrics such as bit error rate (BER) are evaluated. The simulation results indicate that increasing the number of SU's frames per burst increases the spectrum efficiency but increases the evacuation time as well. Increasing the number of bins of the Fast Fourier Transform (FFT) sensing function increases sensing accuracy but increases also the evacuation time as well as SU BER. For instance, 50frames/burst is optimal when using 512 FFT bins; resulting in higher spectrum usage and lower evacuation time. Therefore, for an optimum result that allow higher spectrum usage and lower bit error rate, care must be taken to match each FFT to an adequate frames/burst. This research can be furthered by including CR adaption capability, different noise scenarios, and multiple PUs and SUs.

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OA #145

Subcategory: Electrical Engineering

Near Field Communication: Researching and Exploiting a Potentially Vulnerable System

Michael D. Alexander, Tennessee State University

Near Field Communication (NFC) is being utilized to conduct transactions where sensitive data is being transmitted wirelessly using mobile devices. Intercepting the sensitive data transmitted during these transactions can be accomplished. Tennessee State University has investigated the methods of interception and exploitation to determine if the implementation of NFC presents a security threat to end users.

Intercepting an NFC transmission can be accomplished by the use of an oscilloscope. Because NFC uses amplitude shift keying in the Manchester format, the waveform gathered from the oscilloscope must be decoded. To easily decode this signal, a corporation known as Frontline has designed an NFC protocol analyzer. This analyzer utilizes a simple antenna to capture the 13.56 MHz ASK modulated signal, and passes this data through a decoder that utilizes the library libNFC; this allows fidelity to be gained on what has been transmitted for the purposes of debugging NFC devices. To investigate the potential security flaws, a transmission was set up such that the exact same information would be transmitted through an antenna connected to an oscilloscope, and then the exact same information was transmitted to the ComProbe NFC Analyzer.

A TeleDyne Lecroy WaveSurfer oscilloscope was utilized, and once equipped with a BNC Male → SMA Female adapter, the oscilloscope was able to capture the NFC transmission's waveform. This oscilloscope was chosen for its fidelity and variety of available export options: the resulting signal's data was able to be exported to file types .xls, .dat, .prn, .trc, and .txt, all comma delimited. A Sony Xperia Z and Samsung Galaxy Nexus (19250) on Android's KitKat were the mobile devices used to exchange the known data. The data transmitted between devices was a simple contact, titled NFC Testing, and with the number 555-555 -5555 associated with it. Once the data was gathered and exported from the oscilloscope, the same exact transmission was repeated with the ComProbe NFC Analyzer. The NFC Analyzer's gathered data was exported as a .xls file, delimited by frames with associated hexadecimal values.

At the time of this writing, this data must be decoded and analyzed to determine if what was transmitted can be represented clearly. Moreover, financial applications require the transmission of sensitive data to abide by AES standards. If sensitive data were successfully intercepted, it would additionally need to be decrypted. Alternatively, one could exploit the financial institution's use of the AES standards, the mobile application handling the transmission, the physical devices, or crack the encrypted data directly. Future research into this matter involves decoding the data obtained in the aforementioned experiment. The use of the AES standards by institutions handling sensitive data must also be analyzed. It is probable that certain institutions have not adequately handled this data according to the standards in place.

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OA #146

Subcategory: Electrical Engineering

Fiber to the Premises: Characterization of Avalanche Photodiodes (APD's)

Avery Cunningham, Norfolk State University

Fiber to the Premises (FTTP) is technology used to provide voice, video, and data services to homes, apartments, and businesses within the community through the use of optical fibers. Optical fibers are used as an information channel for lightwaves. The use of lightwaves allow for more information to be sent at higher speeds with less loss due to the optical fiber's larger bandwidths at certain wavelengths. In this process, information is sent from a transmitter through optical pulses to the photodetector. The photodetector then absorbs the optical pulses received and converts them to photocurrent. The electronic signals are then sent to the receiver circuit and to the homes, apartments, and businesses of the user. Uncoded signals sent through the circuit network run the risk of being intercepted. Through the use of cryptography, the information sent is secured from hackers. Research on avalanche photo diodes will allow for the characterization and design of avalanche photo diodes that operate in Geiger mode. Avalanche photo diodes operating in Geiger mode could be the key to providing a more secure network through the use of quantum cryptography. This research presents the characterization of avalanche photo diodes and its implementation in an optical link.

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OA #147

Subcategory: Electrical Engineering

Automating Aeroponics

Michael Flot, University of New Orleans
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Traditional farming techniques are becoming less capable of sustaining the world's food demands as population swells. The struggle to keep up has had an adverse effect on the environment and the quality of food produced. In order to reduce the stress that agriculture of this scale puts on the environment, new methods must be considered. Aeroponics is the practice of growing plants without using soil as a medium. This method uses mist to provide nutrients to the plant and uses up to 98 percent less water than normal farming techniques. Aeropnics systems tend to require rigorous maintenance and regulation. This requires time and effort that most people prefer not to invest. If the process were made simpler, however, aeroponics could encourage urban farming. This could supply healthy food to many people without the high transport cost and land restructuring of traditional farming methods. I am currently designing and testing an automated aeroponics system that reduces the maintnence required by the user.

I have begun growing tomatoes as test subjects in a manual aeroponics prototype and am in the procces of designing and integrating sensors to control different parameters. By December, I expect to have completed the automated design. I will then clone the test subjects that were initially grown and use them to test the equipment. I will grow plans in the automated aeroponics system as well as in soil. These two environments will be given the same amount of light in the same room. I intend to prove that the system efficiently grows the tomatoes faster than using soil.

Funder Acknowledgement(s): Currently self-funded.

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OA #148

Subcategory: Electrical Engineering

Coupled Thermal and Electric Models for Power Analysis of a Photovoltaic Module

Ebholo Ijieh, Tennessee State University
Co-Author(s): Muhammad Akbar, Tennessee State University, Nashville, TN

The power generation performance of a photovoltaic module is analyzed using computer models. Photovoltaic systems are used to convert solar energy into electrical energy. However, not all the incident solar radiation on the PV cells can be converted into

electricity. As their operating temperature increases, PV cells suffer a significant ef?ciency drop. Designing a high performance PV device requires modeling, simulation, as well as development of the PV system. In the present study, thermal and electric models are developed and coupled to analyze a PV module. The cell temperature is calculated by a thermal model that uses available solar irradiance as input. A finite element based computer model is developed for this purpose. A 5-parameters electric model evaluates the electrical performance of the module. The characteristic values of the module are calculated using Newton Raphson methods in the electric model.

Meteorological data for a typical day is extracted from literature, which is used as input to the thermal model. The cell temperature calculated by thermal model is an input to the electric model, whereas the power calculated by electric model is an input to the thermal model. The calculated module temperature and power results are compared with available literature data. The comparison is reasonable.

Future research is to develop and incorporate a radiation model in the study. The radiation model will calculate the amount of radiation actually absorbed into the photovoltaic module, which depends on meteorological data and module properties. Currently an average value for radiation absorption is used in the thermal model.

References: Akbar, M. 2014. Finite Element Method Based Model to Solve Three Dimensional Heat Conduction Equations for Photovoltaic Modules. 11th AIAA/ASME Joint Thermophysics and Heat Transfer Conference. Atlanta, USA. June 16 - 20.
Eteiba, M.B., Shenawy, El E.T., Shazly, J.H. & Hafez, A Z. 2013. A Photovoltaic (Cell, Module, Array) Simulation and Monitoring Model using MATLAB/GUI Interface. International Journal of Computer Applications. 69(6):14-28.
Duffie, J.A. & Beckman, W.A. (2013). Solar Engineering of Thermal Processes. John Wiley & Sons.
Siddiqui, M.U., Arif, M.A.F., Kelley, L. & Dubowsky, S. 2012. Three-dimensional Thermal Modeling of a Photovoltaic Module Under Varying Conditions. Solar Energy, 86 2:620-631.

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OA #149

Subcategory: Electrical Engineering

Designing a Polarized Variable Angle Spectrometer for Testing Gold Nanoparticles

Christine McGinn, Swarthmore College

An apparatus to spectroscopically measure the angular dependence and polarization sensitivity of light scattering of off gold nanoparticle suspensions is designed and tested. This information is important because of gold nanoparticles' wide applications in medical imaging, targeted medicinal delivery, and electronics, such as photovoltaic cells, and understanding how they interact with light will allow us to design more efficient devices. Designing the apparatus for this testing involved both optical design work, using Mathematica's Optica package to choose the positioning and types of optical components used, and physical design work using Solidworks. To predict the scattering patterns, COMSOL modeled the system because more complicated models than those provided by Mie theory must be considered for plasmonic particles. This scattered field can be decomposed into a linear combination of polarization dependent electric and magnetic dipoles and higher order poles, which this apparatus strove to capture in testing gold nanoparticles with a diameter of approximately 400 nm.

Testing involved using a supercontinuum laser, which provided a range of wavelengths, focusing that light onto a vial of gold nanoparticles, and then rotating a detector to observe the electric and magnetic fields scattering off of the gold nanoparticles over 180 degrees. Initial testing probed four wavelengths: 570 nm, 670 nm, 774 nm, and 950 nm. The scattering seemed to accurately capture the bandwidth of the main peak for all wavelengths. Some of the local maxima outside of the main peak for 570 nm incident light, a result of higher order electric multipoles, were also correctly captured. These maxima also appear in the experimental measurements for 670 nm and 774 nm incident light, although predicted to occur closer to 90 degrees. A possible explanation is an incorrect assumption of the solution's monodispersity, causing the relative size of the light's wavelength and nanoparticles to be closer together. Higher order electric poles then result and cause the local maxima to appear.

Preliminary testing then shows that the apparatus is capable of qualitatively distinguishing features in angular scattering patterns for gold nano particles at varying wavelengths. While testing to improve the apparatus could be done, the most interesting extension would be testing the properties of nonspherical gold nanoparticles because they are anticipated to have widespread applications.

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OA #150

Subcategory: Electrical Engineering

Target Search Simulation with Noise Dependent Observations for Adaptive and Non Adaptive Search Strategies

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At the juncture of the fields of signal processing and information theory, we can explore the problem in which we analyze signal decisions with a known noise dependency. For example, in the case of target detection technologies, a noisy signal from the detection sensors will lead to a small probability that the system will not detect or track the target. Consider the task of determining the position of a target via search methods, with these noisy observations. These methods may be adaptive, where an iterative search is updated each iteration in order to provide new information, or non-adaptive, where the iterative search is completely random. Adaptive and non-adaptive methods for simulation algorithms have been previously developed in order to quickly arrive at precise position estimates for the noise independent version of this problem. However, we cannot simply consider noise independent strategies because these assume that the tests are always true with entirely noise independent data. Noise dependent observations are more representative of real world systems, taking into account the error introduced by noise, and should therefore also be used in order to arrive at more accurate position estimates. This research project aims to develop a computer simulation of a system with a known noise dependency in order to quantitatively compare and analyze adaptive and non- adaptive searching strategies. The program is written and administered in a MATLAB, it can be used as a tool by researchers to simulate the noisy search within a one dimensional subset for a target with unknown location. A real time animation of the virtual search is displayed as the program is running. The mathematical basis for this iterative searching process is Bayes' Posterior Probability Theorem. Conclusions, such as elapsed time, are displayed at the end of the virtual search. In order to test this simulation and objectively compare results from adaptive and non-adaptive search strategies, all other parameters of the search were kept the same.

Preliminary results show that adaptive search methods can be much faster than non-adaptive ones (56% faster for a 99% accuracy). The preliminary results discussed support both the original hypothesis, that by introducing error the search will be affected by a multiplicative gap for adaptive and non-adaptive search methods. We believe the current computational methods used to program this strategy could be improved in order to reduce elapsed search time. The ultimate goal is to convert this project into a two-dimensional case so that a two- dimensional subset may be searched. The two- dimensional version of this simulator will introduce a higher level of complexity, especially if we introduce color parameters, for applications such as image processing. In addition to improving the code, and developing it into a two- dimensional problem, the user interface will also be improved.

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OA #151

Subcategory: Materials Science

Experimental Characterization of Thermo-physical Properties of Gd2Zr2O7 on YSZ Thermal Barrier Coatings with NiCoCrAlY+Hf+Si Bond Coat Material

Uchenna Agu, Southern University and A&M College
Co-Author(s): Breanna Lewis, Stephen Akwaboa, and Patrick F. Mensah, Southern University, Baton Rouge, LA

In use of thermal barrier coatings (TBCs), materials with low thermal diffusivities, oxidation and corrosion resistance are desirable for power generation system such as gas turbines. Gd2Zr2O7 on YSZ thermal barrier coatings (GZ+YSZ TBCs) with NiCoCrAlY +Hf bond coat material show low thermal diffusivities with reduced oxidation of the bond coat and expected superior thermal cycling endurance life. This study is an investigation of the thermo-physical properties (thermal diffusivity, specific heat capacity and thermal conductivities) of an experimental TBC candidate which contains YSZ+GZ as top coat material and NiCoCrAlY+Hf+Si as the bond coat material.

Samples were made of multilayered with Gadolinium zirconates in the top coat of the YSZ coating. All of our samples were prepared using air plasma spray standard coating type. The bond coat was made of NiCoCrAlY+Hf+Si, and the top coat was made of YSZ and GZ combinations. These materials were air plasma sprayed on disk shaped IN738 superalloy samples which were 12.54 mm in diameter and 3 mm thick. The laser flash method was used to measure thermal diffusivity and specific heat capacity as a function of the temperature from 100 to 1100OC. The testing atmosphere was filled with inert argon gas to prevent any possible reactions.

By changing the amounts of GZ found in the YSZ top layer as well as ratio of Hf and Si in the bond coat of the thermal barrier coatings we were able to observe a significant decrease in the levels of the thermal diffusivity and thermal conductivity properties measured. From this observation, the conclusion can be made that by increasing the GZ levels in double layer YSZ TBC the thermal conductivity can be lowered and in turn provide a better insulation for TBC's operating at higher temperatures.

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OA #152

Subcategory: Materials Science

Multi-Length Scale Characterization of Selective Sorbent Materials Using X-Ray Scattering Techniques

Meagan Papac, Boise State University

Multi-Length Scale Characterization of Selective Sorbent Materials Using X-Ray Scattering Techniques Meagan Papac, Boise State University Recent developments in materials measurement techniques combine ultra-small angle X-ray scattering (USAXS), small-angle X-ray scattering (SAXS), and wide-angle X-ray scattering (WAXS), to provide multiple length scale characterization of complex material structures. In addition, a state-of-the-art sample chamber allows scattering and diffraction experimentation across a wide range of temperatures and pressures. Thus, environmental effects on structure and microstructure can be observed in situ, providing greater insight into material behavior in response to changing environmental conditions. While this approach shows great promise for probing complex materials with microstructural heterogeneities and large crystal structures, its accuracy must be proven through comparative metrology. To evaluate the application of SAXS/WAXS data for phase identification and lattice parameter determination, selective sorption materials (sodium aluminosilicate and bis(2-methylimidazolyl)-zinc, commonly known as NaY zeolite and ZIF-8) were characterized, generating both SAXS/WAXS and conventional X-ray diffraction (XRD) patterns for comparison. Analysis showed that SAXS/WAXS peak positions varied less than 0.22% from peak positions in the conventional XRD data. While differences exist between the raw data patterns, their overall similarity suggests that, with appropriate data acquisition, reduction, and analysis, combined SAXS/WAXS diffraction data can be effectively used for materials characterization. To explore further usefulness of this method, SAXS/WAXS data of other selective gas sorption materials (Ni(1,2-bis(4-pyridyl)ethylene)[Ni(CN4)] and catena-bis(dibenzoylmethanato)-(4,4'-bipyridyl)nickel(II), or Bpene and DBM) were analyzed across a CO2 partial pressure range from ambient to 17 bar. Changes in peak positions and intensities as a function of CO2 partial pressure were observed. A similar data set involving the same materials and CO2 partial pressures, and including N2 gas at equal partial pressures, was used to explore the effects of the second gas on the adsorption behavior of the materials. The maximum peak shift seen in DBM corresponds to a lattice spacing change of 0.423 Å. Bpene showed a maximum lattice spacing change of 0.211 Å. Observation of these changes indicates that further development of instrumentation, such as an extended q-range and more accurate intensity data, would facilitate the use of SAXS/WAXS diffraction peaks for structural characterization.

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OA #153

Subcategory: Physiology and Health

A Fitness Application for Increasing Productivity in the Workplace

Diliorah Arah, Bowie State University

With the technology we have today, life has become substantially easier for day to day living. Communicating and interacting with people has never been simpler, but with the technological advances we are also able to do things such as traveling with the aid of GPS, checking bank accounts, checking the news, monitoring traffic while you are driving as well as social media. With these possibilities already established, cell phone users should also be given the ability to have applications where they can promote health and maintain fitness. Our hypothesis is that the proposed fitness application will increase productivity and morale in the workplace.

When it comes to the healthcare field, there have been many applications created to promote living healthy. Applications such as Nike+ Running where you can map out runs and track your exercise all while being motivated to do so. This proposed application gives the user specific generated exercises to keep them active while at the workplace. The user credentials are entered at the time of your registration. The credentials include: gender, age, work status, work type, height, weight and any medical diagnosis. Once the user has finished the exercise for the day,user data is stored in a cloud database.

We have used CodeName One to develop this fitness application for both Android and iPhone operating systems. One feature of this application that we are trying to pursue is the ability to see the progress of co-workers who are also using this application. In conclusion, we hope that this proposed application will help in keeping people fit and productive in the workplace. The proposed application is tested with a limited set of people. Future work will include conducting user studies for the mobile application after getting the IRB approval.

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OA #154
Subcategory: Water

The MadiDrop: A Novel Point-of-Use Water Treatment Technology for the Developing World

Chloe Rento, University of Virginia

The World Health Organization (WHO) estimates that over 1.1 billion people lack access to an improved drinking water source (WHO 2014). Individuals consistently drinking contaminated water show signs of increased rates of malnutrition and suffer from growth stunting and impaired cognitive development (Petri et. al 2008). Technologies have attempted to improve the microbiological quality of drinking water, but many are limited in their effectiveness due to high costs, short life spans, or complicated maintenance and use procedures. Researchers developed the MadiDrop as a low-cost and effective solution to this global problem.

The MadiDrop is a novel ceramic tablet used to treat up to 20 liters of water per day continuously for 6 months. Nano-sized patches of silver are formed when a mixture of clay, sawdust, and silver solution is molded in to a cylindrical shape and fired in a kiln. When dropped in water, the metallic silver is gradually oxidized to ionic silver before diffusing through the pores in the ceramic medium into the bulk solution. Ionic silver is an effective disinfectant for a wide range of waterborne microbial pathogens and thereby makes the water safe to drink.

The MadiDrop was tested by a field study in Limpopo Province, South Africa. On average, the MadiDrop reduced the amount of total coliform bacteria in the water by 90%, and silver levels never went above the WHO drinking water standard of 0.1 parts per million (ppm). In fact, silver concentrations in the effluent water were measured to be closer to 5 or 6 parts per billion (ppb).

Higher concentrations of silver lead to larger reductions in bacteria, so further laboratory testing was conducted to investigate methods to increase silver release rates. The following parameters were adjusted: relative fraction of sawdust (1% to 20% by weight), embedded silver mass (0.05g to 3g), and firing protocol (varying ramp times and hold times). Silver release is measured by placing MadiDrops in 10 liters of water. Samples are collected after 24 hours and analyzed for total silver concentrations using a graphite furnace atomic absorption spectrometer. Our results suggest a disk with 10% sawdust, embedded with 1 gram of silver, and fired to 900˚C and held for 6 hours performs best (15 ppb silver). Future research will study the effect of reducing the diffusion length for silver to improve silver release rates. By combining the best results from the optimization of each individual component, a final design could be created to treat water in developing communities around the world.

References: WHO/UNICEF. Progress on Drinking Water and Sanitation. 2014; 7, 48.
Petri Jr WA, Miller M, Binder HJ, Levine MM, Dillingham R, Guerrant RL. Enteric Infections, Diarrhea, and Their Impact on Function and Development. J Clin Invest. 2008; 118(4):1277.

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Undergraduate Abstracts for Poster Presentation

Biological Sciences

1
Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Characterization of the Serine,Threonine Kinase Domain of the Tudor Protein STK31-TDRD8

Gloria Calderon, University of New Orleans
Co-Author(s): Chen Chen

The Tudor family of proteins is involved in several important biological processes such as genome stability, cell division and gametogenesis. Tudor proteins are primarily expressed in the germ line cells and have the ability to bind methylated arginine or lysine residues in other proteins. In the germ line cells, they also interact with other proteins to silence genes that affect fertility. STK31 is one of the identified Tudor protein that might affect the process of spermatogenesis. STK31 has two different active sites to modify the substrate with which this protein interacts. One of the domains is a Tudor domain and the other is a serine/threonine kinase domain. This serine/threonine kinase domain is assumed to phosphorylate substrate. To further understand how this domain interacts with its substrate our lab studied the serine/threonine kinase domain in isolation. Vector cloning techniques were employed to express the STK31 protein kinase domain. This recombinant serine/threonine kinase domain was isolated and phosphorylation was quantified performing a kinase assay. ATP and substrate myelin basic protein were used to mimic a kinase reaction with the recombinant active domain. We anticipate that our study will investigate further the activity of the serine/threonine kinase domain for better study of the protein characteristics. Since the Tudor family of proteins expressed in the testis affect the process of spermatogenesis,

understanding how the Tudor protein STK31 interacts with other proteins and substrates is important to predict how this protein may affect gametogenesis.

Funder Acknowledgement(s): Michigan State University Graduate School BEACON/SROP Program

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2

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

The Effect of Protein Kinase A on Cystic Fibrosis Transmembrane Conductance Regulator (CFTR) Protein Stability

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Cystic Fibrosis Transmembrane conductance Regulator (CFTR) is a member of transport proteins but functions as a channel for chloride ions and fluid homeostasis on epithelial surfaces. CFTR is a membrane protein which is responsible for cystic fibrosis (CF) disease when a mutation occurs. A deletion mutation of phenylalanine at the 508 position (ΔF508) is one of the most common mutations associated with cystic fibrosis. We hypothesized that protein stability can be achieved by phosphorylating the ΔF508 with protein kinase A and compare it to the wild type CFTR. Our focus included: what CFTR is, what it does, what is wrong with it in disease, and what might be done to fix it. A protocol was established for the phosphorylation process together with trypsin digestion. The project was based on two conditions, that is, with and without Protein kinase A (pKA). The tryptic digestion serves as a condition to indirectly determine the protein stability. During the experiment specific primary and secondary antibodies were used, (450,660) and (IgG1, IgG2b) respectively. The primary antibodies were diluted (1:1000) in 5% milk/PBS solution and the secondary antibodies in 1:5000. After preparing my samples for both wild type CFTR and ΔF508, I ran a western blot and scanned the blots using infrared imaging scanner. Images from the scanner appeared to be red (700 channel) and green (800 channel), complimenting the specific antibodies used for both WTCFTR and ΔF508 protein bands. Data was collected from the scans and the bands of interest were quantified and graphs were plotted. After repeating the experiment in triplicate, results show that our samples for both wild type CFTR and ΔF508 were phosphorylated because antibody 660 binds to the protein which produces good signal bands in the 800 channel; while antibody 450 was phosphorylation sensitive and could not bind. However, observations indicate that even though WTCFTR is unstable, ΔF508 protein still remains more unstable because it was well digested by the trypsin.

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3

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Purification and Characterization of Recombinant Fibromodulin for the Investigation of Wound Repair

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Fibromodulin (FMOD) is an extracellular matrix (ECM) proteoglycan, comprised of a leucine-rich protein core with four glycosaminoglycan side chains. Our previous studies have demonstrated that premature fetal skin healed without scar formation, while adult wounds healed with scarring. Interestingly, FMOD deficiency resulted in scarring in fetal wounds and enlarged scar formation in adult wounds. Moreover, application of human recombinant FMOD could re-establish the scarless repair in FMOD-deficient wounded fetal rodent and benefit adult wound healing by improving gross visual appearance and reducing scar size, evidenced in mouse, rat and pig cutaneous models. Furthermore, FMOD was also used to reprogram human somatic cells into multipotent cells that can differentiate into neurons, muscles, bone and other tissues without increasing the tumorigenesis risk. Unfortunately, FMOD is not effectively produced in either bacteria or yeast recombinant systems. To further investigate and develop medical applications of FMOD, we infected Chinese Hamster Ovary-K1 (CHO-K1) cells with the plasmid pLZZF01, harboring the gene encoding poly-His and c-myc tagged human FMOD. The FMOD produced and secreted by the CHO-K1 cells into the culture medium was purified by a nickel affinity column. SDS-PAGE and Western Blotting indicated the presence of a protein with the correct molecular weight and epitope of the recombinant FMOD; however significant product loss and remaining impurities indicate that the poly-his tag is not specific enough for efficient purification. Therefore the c-myc epitope of the recombinant FMOD will be targeted in the next purification attempts as an alternative to the poly-His tag. Further work must be done to determine the FMOD yield using the Bradford assay as well as characterize the FMOD by cell invasion.

References: Zheng Z, Jian J, et al. (2012) Reprogramming of human fibroblasts into multipotent cells with a single ECM proteoglycan, fibromodulin. Biomaterials 2012; 33; 5821-5831.
Zheng Z, Nyugen C, et al. (2011) Delayed Wound Closure in Fibromodulin-Deficient Mice Is Associated with Increased TGF-B3 Signaling. J Investigative Dermatology. 131, 679-778.

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4

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Monitoring DNA Binding to a Yellow Fluorescent Hepatitis C Virus NS3 Helicase Fusion Protein Using FRET

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Hepatitis C is a liver disease caused by the hepatitis C virus (HCV), which infects 170 million people worldwide each year. One enzyme that is necessary for HCV replication in vitro is the HCV helicase, which is located on the helicase domain of the non-structural protein 3 (NS3). A helicase displaces strands of DNA or RNA, and inhibiting the helicase can stop HCV replication in cells. Förster Resonance Energy Transfer (FRET) was used to monitor DNA binding by measuring the energy transfer between a donor and acceptor fluorophore. The donor fluorophore in my assay was yellow fluorescent protein (YFP), which was substituted for the protease domain of the NS3 protein. The acceptor fluorophores were Hexachlorofluorescein (Hex), Cyanine 3 (Cy3), or Cyanine 5 (Cy5), which was bound to the strand of DNA. Measuring the change in fluorescence intensities when both fluorophores are bound at a set range of emission wavelengths shows whether FRET is occurring.

The results demonstrate that YFP-hel and Hex and YFP-hel and Cy3 are potentially an effective donor-acceptor pair, and this assay is suitable for the quantitative measurement of the DNA binding activity of HCV NS3, while YFP-hel and Cy5 is potentially not an effective donor-acceptor pair. Model inhibitors are used to displace labeled oligonucleotides, which return the fluorescence intensities back to normal. However, this didn't occur as much as expected when the unlabeled oligonucleotide, dT20, was added to the YFP-hel and acceptor pairs. Future experiments are to repeat the experiment using other donor and acceptor fluorophores such as measuring FRET between YFP-NS3h and mCherry, and calculate the Förster distance, the rate of energy transfer, and the efficiency of energy transfer.

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5

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Acute Dopamine Transporter Inhibition Enhances Probabilistic Learning Performance in Mice

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Bipolar disorder (BD) is a chronic disorder with no cure. Therapeutics have been limited to compounds with serendipitous origins and unknown mechanisms. There is a call for a better understanding. Lithium is primarily used to treat BD but has been called into question for decades due to its strenuous, inconsistent and detrimental side effects. Using pharmacological means (GBR 12909), the manic abnormalities of BD were modeled in mice and lithium was used to treat the abnormalities in the probabilistic learning task (PLT) and progressive ratio breakpoint test (PRBT). It was hypothesized that (a) GBR12909 would impair performance in the PLT and increase motivation-like behavior in the PRBT; (b) lithium at a high dose would impair performance in the PLT; and (c) lithium at a lower dose would normalize the abnormal behaviors induced by GBR12909. In contrast to what was expected, GBR 12909 improved performance in both paradigms. Lithium at low doses attenuated the effects of GBR 12909 and at high doses impaired cognition. C57BL/6J male mice (n=45) were purchased from Jackson Laboratories at 3 months old. GBR12909 at 16 mg/kg was administered by intraperitoneal injection 10 min prior to testing. Lithium chloride was dissolved into the drinking water at 0.6 or 1 g/l and given for 10 days. During the first training phase (Hab1), mice were required to recognize 30 µl strawberry milkshake as a reward and collect at specific intervals. During the second training phase (Hab2), mice were trained to holepoke into one of two lit holes to obtain the reward. Consistently responding mice, were baseline-matched on total responses and received either normal drinking water (vehicle) or drinking water with 0.6 g/l lithium. Results were analyzed using a one- or two-way ANOVA. The level of probability for statistical significance was set at 0.05. All statistics were performed using SPSS. Consistent with our hypothesis and similar to previous observations (Young and Geyer, 2010), acute DAT inhibition by GBR12909 administration increased motivational behavior in mice. Post hoc analyses revealed that GBR12909 increased switches in the vehicle-treated mice ($p<0.05$), but lithium blocked this effect ($p<0.05$). In contrast to our expectations however, GBR12909 enhanced probabilistic learning performance. Lithium by itself impaired probabilistic learning at a high dose ($F(1,39)=4.4$, $p<0.05$), but did not at a lower dose of 0.6 g/l. Interestingly, chronic lithium at this lower dose blocked the effects of GBR12909 in both the PLT and PRBT. For future work; studies with nicotinergic pathways have shown promising responses when treating mental disorders (ADHA, Schziophrenia) and may lead to a treatment for BD. The final component would be testing the therapeutics that respond in the mouse models with human patients afflicted with BD.

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6

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Carbon Nanodots as Antimicrobials Against Multi-Drug Resistant Gram-Negative Bacteria

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The World Health Organization's 2014 Antimicrobial Resistance Global Report on surveillance describes antimicrobial resistance as one of the greatest threats to public health. With the increasing incidence of bacterial resistance to existing antibiotics, there is a great need to develop new antimicrobial agents to combat resistant bacteria. A new class of carbon-based nanoparticles holds promise as a molecular template for designing more effective antimicrobials.

The objective of this study is to assess the antimicrobial activities of functionalized carbon nanodots (CNDs). We hypothesize that CNDs could serve as a molecular scaffold for small polyamines to accentuate their antimicrobial activities. CNDs prepared from Malaysian sago starch were functionalized with polyamines (PAMs) by microwave-assisted synthesis. They were tested against representative Gram-positive (Staphylococcus aureus) and Gram-negative (Escherichia coli) bacteria by using the antimicrobial susceptibility testing assay to determine their minimum inhibitory concentrations. Control experiments were conducted with two common antibiotics, as well as the originating CND and PAMs. Select prioritized Gram-negative bacteria by the US Center for Disease and Control were tested to evaluate the spectrum of activities. Synergistic effects were also assessed in combination with colistin, an antibiotics of last therapeutic option for infections caused by multi-drug resistant "superbugs", and tetracycline, an antibiotic commonly used to treat pneumonia, acne, urinary tract infections and others. These tests were conducted by a broth microdilution checkerboard assay.

The results from this study show that PAM functionalized CND exhibits selectivity for Gram-negative bacteria and shows antimicrobial activity against Klebsiella pneumonia, Enterococcus facecium, Pseudomonas areuginosa, and Acinetobacter baumannii. Additionally, it shows synergistic effect in combination with tetracycline against the multi-drug resistant A. baumannii, which has been reported to cause a range of infectious syndromes. In conclusion, polyamine functionalized CNDs exhibit significant antimicrobial activities and could be promising as synergistic agents in enhancing bacterial killing.
Future research in the rational design of functionalized CNDs is a worthwhile pursuit to combat the ever-increasing threat of antibiotic resistance in this post-antibiotic era.

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7

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Statistical Analyses of Molecular Dynamics Simulations of Nucleic Acids

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Molecular dynamics simulations have made great advances in the last few decades and are becoming part of the standard way of researching and understanding biomolecular systems. Typically, the first step in analyzing molecular dynamics simulation data is to determine if the system has converged. This is difficult in practice because there is no universally accepted method for doing so. Challenges associated with determining convergence include the difficulty in calculating statistical errors in the simulation and the prevalence of inadequate sampling. Progress in this area has been made for simulations of proteins but little attention has been given to nucleic acids, such as single-stranded RNA aptamers. In this study the Good-Turing statistics method is used to determine the quality of sampling in nucleic acid simulations. An assessment of convergence based on the Good-Turing method is compared to the popular method of assessing convergence by evaluating the root mean square displacement as a function of time. Each of these methods was applied to nine different trajectories of five aptamer systems and the results were compared to see how well they were in agreement of convergence of the systems. The results showed that six of the nine trajectories that were evaluated by each method showed agreement in determining whether the system had converged or not, while the other three trajectories were in disagreement with each other. These results show that using statistical analysis alongside more commonly used methods to quantify convergence validates the conclusions being drawn from these results. Further work needs to be done to determine the best statistical analyses to apply, including testing other methods. This research could lead to determining a standard protocol in which to measure the quality of simulations in the future and therefore quantifying the convergence of a system.

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8

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Anti-microbial Properties of Hibiscus Sabdarrifa in E. Colitis

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The ancient use of plants and earthly materials for medicinal purposes remains prevalent. The contest between humans and illness has been the reasoning behind the research for natural treatments for diseases. Hibiscus sabdarrifa (Hs), a annual or perennial dwarf shrub native to the tropics. Hs is woody-based with white to pale-yellow flowers and flesh-like red sepals once matured. Hibiscus sabdarrifa has shown itself to be successful in aiding in treatments of popular human conditions and illness, such as constipation, cardiovascular disease, hypertension and hyperlipidemia. Prior research has not reported any adverse events or side effects of its use. Hibiscus sabdarrifa has also shown itself to possess anti-microbial properties. To investigate the antimicrobial properties of Hibiscus sabdarrifa, our lab used Escherichia coli (E. coli) in a Rapid Diffusion Assay with a Hibiscus sabdarrifa extract and compared its zone of inhibition to the zones of inhibition of dH_20, DMSO, and Clorox (a known disinfectant). The zones of inhibition were determined by the lack of microbial growth around the solution soiled disks, after an incubation period of twenty-four hours, and were measured with a ruler. There was no inhibition for dH_20 and DMSO. Inhibition for Clorox inhibition was between 30 mm and 50 mm. The inhibition for Hibiscus was between 5mm- 33mm. In conclusion, our lab has shown that Hibiscus sabdarrifa has anti-microbial properties. Further investigation would include changing the concentration of the Hs extract, the microbes used and the cellular reasoning behind the anti-microbial properties.

Funder Acknowledgement(s): Tuskegee University

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9

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

The Effects of Visual Color Stimuli on Zebra Finch Behavior and Stress Response

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It is expected that the experimental colors, except red, should not elicit increase in stress hormone corticosterone (CORT) in zebra finches. Animals are affected by many environmental stimuli, including visual stimuli. Some stimuli activate the secretion of stress hormones, such as corticosterone (CORT), or act as a non-stressful positive stimulus. Zebra finches (Taenopygia guttata) are songbirds that can see in the entire visual light color spectrum as well as UV light1. Colors, especially red, are important in female mate choice2. Therefore, altering the colors of the housing environment may elicit a stress response. Experimental birds are exposed to 24 hours of a color stimulus near their cages (22”x 28” rectangular colored paper; green, blue, red, brown, yellow) with white as the control. Groups of adult males and adult females (n= 5/sex) are housed separately. Baseline plasma CORT levels are measured 24 hours before and after color exposure using radioimmunoassay (RIA). Behaviors, such as perching distance relative to the color stimulus, gazing at the stimulus, and typical stress behaviors (beak opening), were recorded. For all colors, immediately after placement of color stimulus, birds of both sexes were observed to temporarily fixate on the stimulus. The activeness of the animals (i.e. continuous hoping between perches) decreased slightly. Only male birds were observed with beak opening. For the CORT level, data were analyzed with paired t-test ($p<0.05$ considered statistically significant). There were no statistical difference between the baseline and Treatment CORT for green, blue, brown, yellow, and control. There was a statistical difference in the red color trial.

These findings suggest that, although colors on the body of zebra finches elicit observable behavior responses from conspecifics, environmental colors have no such effect2. Alternatively, CORT levels may have been acutely raised after color exposure but returned to baseline even as the color stimuli remained present. The future direction for this project is to use larger sample size and test for acute response (i.e. record plasma CORT levels under 10 hours of exposure).

References: 1.Hunt, S., Cuthill, I. C., Swaddle, J. P., & Bennett, A. D. (1997). Ultraviolet vision and band-colour preferences in female zebra finches, Taeniopygia guttata. Animal Behaviour. 2.Garson, P. J., Dunn, J. L., Walton, C. J., & Shaw, P. A. (1980). Stimuli eliciting courtship from domesticated zebra finches. Animal Behaviour

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10

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Effect of Germination Power on Peroxidase Activity and Concentration in Obatampa Maize

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Peroxidases are classes of enzymes found within prokaryotes and eukaryotes that have implications in a variety of cellular functions. Within plants, peroxidases function in lignification, cellular stress response and defense, and auxin metabolism. Because they play a significant role in plant growth, a greater understanding of the mechanism by which plants utilize peroxidase requires an understanding of the relationship between peroxidase expression and germination power. This knowledge can then be harnessed to gain a deeper understanding of how plants utilize peroxidase for growth and development. Due to its wide availability within Ghana, Obatampa maize was selected to determine the relationship between germination power and both total protein concentration and peroxidase concentration. The effect of substrate concentration on peroxidase activity was also determined as a function of absorbance. Crude peroxide extract was isolated from five maize samples: unmalted maize, maize steeped for 24 hours, maize steeped and germinated for 24 hours, maize steeped for 24 hours and germinated for 48 hours, and maize steeped for 24 hours and germinated for 72 hours. The amount of peroxidase in each sample was determined as a function of absorbance. Germination power increased with length of germination and negatively correlated with total protein concentration. There was no correlation between germination power and peroxidase concentration, however. Likewise, variance of substrate concentration demonstrated a weak negative correlation between germination power and peroxidase activity.

We concluded that germination power does not appreciably affect peroxidase activity or concentration in Obatampa maize. We recommend for future studies that the effect of changing pH and temperature on peroxidase activity in Obatampa maize be determined. Additionally, we recommend that future studies utilize another plant source widely available within Ghana to further investigate the relationship between germination power and both total protein and peroxidase concentration.

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11

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Investigation of Plk1 Function Using Mass-spectrometry-based Proteomics

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Mitosis is a crucial step of the cell, in which a cell divides into two identical daughter cells. Faithful mitosis is essential for cellular survival and errors in this process lead to birth defects and cancer. Mitosis is tightly regulated through the interplay of many proteins, including protein kinases. Protein kinases are enzymes that modify other proteins by adding a phosphate group to serine, threonine, or tyrosine residues, a process called protein phosphorylation. Polo-like kinase 1 (Plk1) is a protein kinase that regulates many steps of mitosis from entry to exit and is often amplified in cancer. Besides its kinase domain, Plk1 contains a substrate recognition domain, the polo-box domain (PBD), that binds to phosphorylated residues on Plk1 substrates. Upon binding, Plk1 phosphorylates its substrates at specific sites. Mutation of essential residues within the PBD abolishes Plk1 subcellular localization and substrate recognition in cells. Using purified Plk1 and naturally-derived peptide libraries, we have determined Plk1 activity and substrate preferences in the absence of phosphorylation-dependent substrate priming by mass spectrometry-based proteomics. We hypothesize that the PBD is not required for kinase activity of Plk1.

To test this, we will purify wild-type (WT), Pincer (P) (PBD mutant), and kinase-dead (KD) Plk1 and will compare their activity and substrate preferences in vitro by mass spectrometry-based proteomics. From the in vitro kinase reaction, the Plk1 mutants yielded phosphorylated peptides that were found to be: WT (1292), KD1 (148), KD2 (6), P1 (791) and P2 (436). The kinase motif for each Plk1 variant from the in vitro kinase assay was found to be: WT ([D/E/N]XpS and pSF), KD1 (pSP, sPXXE and RXXsP), KD2 (no significant kinase motif found), P1 ([D/E/NXsP and sPF) and P2 ([D/E/NXsP). WT and Pincer mutant Plk1 were determined to have the same kinase motif, while KD Plk1 did not contain a similar kinase motif to WT Plk1. This research will provide insight into a target for drug therapy used in cancer treatment.

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12

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Investigating the Effects of Thyroid Hormones, Benzodiazepine, and Ivermectin on the α1, β1, γ1, and GABAA Receptor in Xenopus Oocytes

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Co-Author(s): Joshua Lee, Steve X. Moffett, Kyle Jenkins, Rachel L. Sohn, Felisha Robinson, and Joseph Martin

The function of chloride (Cl) channel proteins is to regulate the permeability of Cl across cell membranes. Within the central nervous system (CNS), Cl channels are activated by gamma-aminobutyric acid (GABA) via the GABAA receptor. This receptor is responsible for hyperpolarization inhibition of membranes, which plays an important role in the regulation of consciousness. In this investigation, the GABAA receptor was studied using the model organism Xenopus laevis in order to determine the effects of thyroid hormones, benzodiazepine, and ivermectin on this receptor. Oocytes extracted from X. laevis were injected with to mRNA that coded for the alpha, beta, and gamma subunits of the GABAA receptor and subsequently were capable of expressing the receptor. Application of thyroid hormones, benzodiazepine, and ivermectin to the oocytes showed that T3 inhibited GABAA receptors up to 50% proving that it is an inhibitor of GABA, benzodiazepine (BZDs) act as a positive allosteric modulators and potentiate the effects of GABA by increasing the frequency of chloride channel currents, and ivermectin acts very similarly like GABA, making it very similar to GABAA. In the future the lab will study pregnenolone sulfate, a GABA-negative substance that may share a binding site with cholesterol that could act as a possible feedback loop. This could help explain the health implications of either having high cholesterol or low cholesterol in the body and can better explain how the GABAa receptor Functions.

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13

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Generation of HIF-1α and HIF-2α Hybrid

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Reprogramming cells to pluripotent stem cells requires a change from an oxidative state to a lower oxidative state. During the process of reprogramming human cells, the process requires hypoxia inducible factors (HIF) at an early state, which is essential when changing the high oxidation state of the cells to a low oxidation state. According to previous research, HIF is classified in mainly two factors of HIF-1α and HIF-2α, knowing that HIF-1α allows the formation of colonies while HIF-2α limits the formation of colonies (Mathieu et al., 2014). Knowing that HIF-1α and HIF-2α have a similar structure, but different results when each is used, and that both are essential to the reprogramming of cells, a hybrid of both HIF-1α and HIF-2α make the reprogramming of cells more efficient. To create an HIF hybrid, the process of Gibson's Assembly, polymerase chain reaction (PCR), and Western Blot is required to break HIF-1α and HIF-2α into fragments, and rejoin the specified fragments of both HIF-1α and HIF-2α together to create the HIF hybrid. With the creation of the HIF hybrid, the reprogramming of human cells will be more efficient because the HIF hybrid would only be used once during the process, so colonies could form and also have a limit. However, without the HIF hybrid the process of reprogramming cells would require both HIF-1α and HIF-2α at different times in order to form colonies and restrict production of colonies; therefore, with one HIF hybrid the process of reprogramming cells at a hypoxic state will be more efficient.

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14

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Understanding the Role of Dihydroflavonol 4-reductase Substrate Specificity and Promiscuity in Flower Color Regulation

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Plants, unlike other organisms, cannot move and thus have evolved unique ways of adapting to their environment. These adaptations include the production of specialized compounds called secondary metabolites. Flavonoids, a class of secondary metabolites, are abundantly represented in angiosperms but not completely understood. They display a diverse spectrum of biological functions in plants, including coloration and UV protection; they may also provide health benefits to humans, such as reduced risk of heart disease and cancer. A subgroup of flavonoids, anthocyanins, are responsible for the primary pigmentation of flowers. Dihydroflavonol 4-reductase (DFR), an enzyme in the anthocyanin biosynthetic pathway, helps create a range of flower colors due to its ability to catalyze the reduction of dihydroflavonol substrates into the precursors of their respective anthocyanins. This enzyme has evolved to favor specific

substrates, leading to the different flower colors of different species. Biochemical analysis provides an additional perspective on the evolution of these secondary metabolites. It provides additional information on molecular functions that phenotypic analysis cannot. Therefore, several orthologous DFR enzymes from Amborella trichopoda, Cymbidium hybrida, Petunia hybrida, Iochroma baumii, Iochroma gesnerioides, and Arabidopsis thaliana were recombinantly expressed. Out of the six, four were successfully purified. In addition, enzymatic assays and crystallography were performed to further analyze their activities and substrate specificities. DFRs purified from Iochroma baumii, Petunia hybrida, and Amborella trichopoda all displayed preference for the substrate dihydromyricetin over dihydroquercetin. Initial DFR crystal screens were unsuccessful, therefore ThermoFluor assays were used to measure the stability of DFR in the presence of various substrates and a cofactor. NADPH does stabilize DFR, suggesting a cofactor is necessary for the enzyme to crystallize. With these findings, the kinetic assays and ThermoFluor assays will be repeated using NADP+, and new crystal screens will be reconstructed in hopes to obtain crystals for structural determination. Secondary metabolites are a unique class of compounds that provide an evolutionary advantage for flowering plants. By understanding these metabolites using a biochemical approach, we can unravel another perspective for their evolution.

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15

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Localization of the Gastrointestinal Sites of Action that Regulate Meal Size and Intermeal Interval by Gastrin Releasing Peptide in the Rat

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We have shown that gastrin releasing peptide (GRP), the mammalian homologue of the amphibian peptide Bombesin, reduces meal size and prolongs the intermeal interval. However, the sites of action for these feeding responses by GRP are not known. We hypothesized that Fos-like immunoreactivity will show the sites of action for GRP-27 and 29 in the stomach and upper Duodenum.

We utilized detection of Fos-like immunoreactivity (Fos-LI, Fos is the protein product of the immediate early gene c-Fos which is utilized as a marker for neuronal activation) in the enteric and hindbrain neurons in response to GRP-10, 27 and 29 (2.1 nmol/kg) given through the arteries supplying various portions of the gastrointestinal tract i.e. celiac artery (CA, supplying the stomach and upper duodenum), cranial mesenteric artery (CMA, supplying small and most of the large intestine) and femoral artery (FA, control) in Sprague Dawley rats.

The results show that GRP-27 and GRP-29 increased Fos-LI in the myenteric and submucosal neurons of the stomach and upper duodenum as well as the hindbrain neurons that control food intake e.g. area postrema, nucleus tractus solitarius and dorsal motor nucleus of the vagus. These results show that the sites of action for meal size and the intermeal interval for GRP-27 and 29 can be found in the stomach and upper duodenum. These results are essential in order for either of these peptides to be used as dietary supplements to reduce mealsize and prolong the intermeal interval. In the future, we plan on using this same method to test other common gut peptide hormones such as Cholecystokinin.

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16

Subcategory: Biomedical Engineering

Thermal Lesions Produced by Radiofrequency Ablation Differ at Various Output Powers

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Radiofrequency ablation (RFA) is a minimally invasive, nephron-sparing technique used to treat small renal masses (SRM). This modality creates heat by applying a high frequency current to tissue and induces cell death at 60 ºC. Current protocols for the Covidien CoolTip RFA system, given by the manufacturer, recommend using full power. However, their results are based on results from ex-vivo bovine liver, not the kidney. Varying the output power may allow RFA to be a more controllable procedure for the treatment of SRM, thus making RFA a more nephron-sparing method. The purpose of this experiment is to investigate the thermal distribution and lesion dimensions in ex-vivo porcine kidneys following RFA with a Covidien Cool-Tip RFA system at various output powers: quarter, half, three-quarter, and full power. It is hypothesized that greater output powers will achieve larger lesion sizes and higher maximum temperatures. Five ablations per output power were performed in ex-vivo porcine kidneys with a two-cm probe tip for 12 minutes in impedance mode. All ablations were performed with a kidney placed in a heat chamber to heat the kidneys to approximately body temperature prior to ablation. Eight fiber optic thermal

sensors were placed 5 and 15 mm from the probe axis. Temperature, power, current, and impedance were recorded during the ablations. After ablation, the kidneys were bivalved and gross lesion dimensions were measured using a caliper. Independent t-tests ($p<0.05$) were conducted in Origin on temperature and gross lesion dimensions. The lesions were ellipsoidal and average volumes were largest at 1/4 power (3.17±0.60cm), followed by 3/4 power (2.65±1.42), 1/2 power (2.31±1.00cm), and full power (2.17±1.24). Lesion widths were significantly greater at 1/4 power than at full power. Average temperatures exceeded 60ºC at 5 and 15 mm for all trials. Undesired carbonization around the probe tip was observed more frequently at greater output powers. Carbonization increases tissue impedance, which hinders heat transfer and current transfer, resulting in smaller lesion volumes. The results indicate that larger output powers can lead to carbonization, which would lead to smaller lesion volumes. Full power is not necessary to treat larger tumor volumes in a nephron-sparing manner due to the carbonization that occurs. Future research should be done in kidneys with blood perfusion as these experiments were performed in ex-vivo tissue.

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17

Subcategory: Biomedical Engineering

Maturation and Contractility of Induced Pluripotent Stem Cell-Derived Cardiomyocytes on Flat Surface Substrates

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Recent discoveries have proposed that induced pluripotent stem cell-derived cardiomyocytes (iPSC-CMs) can restore some level of heart function if they are implanted into a damaged heart. However, iPSC-CMs are characteristically round and produce weak forces, whereas adult cardiomyocytes cells have a rectangular morphology and create strong forces that are aligned along their long axis. It has been hypothesized that iPSC-CMs may require a growth environment that can mimic the stiffness and geometry of the native cardiac region in order to mature. Microcontact printing techniques have been used previously to encourage cardiomyocytes to elongate. Moreover, modifying the stiffness of the culture environment by changing the substrate material can be used to mature cardiomyocytes.

Here, we used microcontact printing to create lines of laminin on substrates made from different mixing ratios of polydimethylsiloxane (PDMS) to control substrate stiffness. When iPSC-CMs are cultured on these substrates, we find that they have an elongated morphology like mature cardiomyocytes. These cells appeared to be more structurally and contractually mature, and would perhaps serve as a better source of cells for regenerative therapies.

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18

Subcategory: Biomedical Engineering

Sequence Elements Required for the Insertion of Base J into DNA in Leishmania

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Flagellar kinetoplastid parasites such as trypanosomes and Leishmania cause diseases that include Chagas, African sleeping sickness, and leishmaniasis. These deadly parasites have an unusual DNA modification known as base J (glycosylated thymine). The absence of base J causes RNA polymerase readthrough and produces anti-sense RNA. The cells cannot live with large loss of J. Since humans do not have base J or the enzymes that synthesize J, the base is a potential drug target. The DNA sequence elements needed for the insertion of J are yet to be determined. Previously, a set of plasmids were used to find sequences that are modified with J. SMRT sequencing was used to determine the location of J. In this project, the first steps were taken to make a new set of plasmids. The sequences will then be shortened and/or mutated.The strategy for finding the sequences requirements for the insertion of J was creating plasmids, growing the plasmids in Leishmania, determining if J was added, and then shortening and/or mutating the sequences of the insert. Plasmid constructs were made using InFusion cloning followed by transformation into E. coli. The plasmids will be transfected into Leishmania cells and then the plasmids will be isolated. DNA immunoblot and SMRT sequencing will be used to determine the location of J. In this project, the vector fragment and insert fragment were prepared for InFusion cloning.

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19
Subcategory: Biomedical Engineering

Liposome-Microbubble Complexes for Administering Therapeutics Across the Blood-Brain Barrier

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The blood-brain barrier (BBB) isolates brain tissue from the blood. While necessary, the BBB hinders the delivery of most therapies for treating neurological disorders. Current methods for delivering therapeutics into the brain tissue are invasive, costly and risky. Recently, it has been demonstrated that the BBB can be temporarily opened by the cavitation of intravascular lipid-coated, gas-filled microbubbles using externally applied focused ultrasound (FUS). When FUS is applied at appropriate power, the microbubbles cavitate, temporarily opening the BBB where the FUS was deposited. Intravascular therapeutic agents can then cross the BBB. In this project, novel microbubble-liposome complexes are being designed to deliver therapy to targeted brain locations. Liposomes can encapsulate drugs into their aqueous core. Our hypothesis is that when the microbubbles cavitate and the BBB is locally opened, the contents of the conjugated liposomes will be efficiently transferred across the BBB. In order to test this hypothesis, proof-of-principle experiments were performed to construct these particles and confirm their structure using MRI and fluorescence imaging. Liposomes containing MRI contrast agent gadopentetate dimeglumine (Gd) were made by a freeze-thaw and extrusion process. Maleimide-containing lipid and lipophilic fluorescent dye were included in the bilayer of the liposomes. Perfluorocarbon gas filled microbubbles were generated with a lipid shell containing a conjugating agent (SPDP) to allow conjugation of liposomes to the microbubbles. Labeled liposome and microbubble solutions were combined and fluorescence microscopy was used to demonstrate successful conjugation of liposomes about the surfaces of microbubbles. As a control, SPDP-free microbubble and liposome solutions were combined and imaged. A 7T MRI instrument was used to measure T1 relation times to evaluate Gd concentration and successful liposomal encapsulation of Gd. A control sample containing Gd liposomes was heated to release encapsulated contents. This had a reduced T1 compared to unheated Gd-loaded liposomes confirming successful Gd loading and release.

The results indicate that the liposomes were successfully loaded and conjugated to microbubbles. Future directions will use these particles to demonstrate liposomal release via FUS in vivo with simultaneous BBB opening for targeted therapy of neurological pathologies such as Parkinson's and Alzheimer's.

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20
Subcategory: Biomedical Engineering

Delaunay Triangulation and an Algorithm for Automated Evaluation of Origami Folding Process

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Carol Livermore, Northeastern University, MA

The successful engineering of human tissue would play an immense role in improving the quality of life and survival rates of people suffering from serious conditions such as liver disease or Hepatitis C infection. The large number of affected people calls for immediate advances in the human tissue engineering approach. A technique combining cell-seeded, polymer-based scaffolds with origami-folding patterns is being developed [1] as a method for effectuating the native 3D structure of human liver tissue. The Miura fold has been chosen as the basis of a design for a 3D liver architecture. However, the success of the process depends on the effective folding of the scaffold into the desired configuration (e.g. without buckling or distortions), and this can only be confirmed through appropriate metrology. The central hypothesis to be tested in this research is that 2D digital images may be automatically evaluated by software algorithms to furnish information on whether and how the 3D folding performance deviates from the ideal folding behavior in order to enable its continued optimization and development.

In this research, a software algorithm is created in MATLab to automatically evaluate digital image data. Points are identified on the folding surfaces. Raw data is first collected using image processing tools to obtain the coordinates of each analyzed point. The Delaunay triangulation method is used to connect the points into a non-overlapping network of triangles. The positions of the points are tracked during the folding process, and the evolution of the triangles' perimeters, areas, and angle sizes are calculated. Fold angles are deduced from the geometric variations, and folding is considered successful when the evolution matches the design intent and neighboring points on a nominally rigid folding element evolve similarly. Results were obtained and were shown to vary depending on the folding pattern being analyzed, as expected. However, the results are consistent with the hypothesis that lower values of the coefficient of variation calculated from the triangles' evolution correspond to the better-behaved folding process. Coefficients of variation less than 5% were found to reflect a well-folded pattern.

As more complex folding patterns are employed for the tissue engineering process, further development of the algorithm may be needed to accurately visualize and predict the 3D folding behavior.

References: [1] P.J. Mehner, T. Liu, M. Bigdeli Karimi, A. Brodeur, J. Paniagua, S. Giles, P. Richard, A. Nemtserova, S. Liu, R. Alperin, S. Bhatia, M. Culpepper, R. Lang, and C. Livermore, "Toward engineering biological tissues by directed assembly and origami folding," submitted for review for inclusion in Origami6.

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21

Subcategory: Biomedical Engineering

Cryosurvival and Membrane Integrity of Cat Epididymal Spermatozoa Recovered by Slicing or Milking

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Testes of dogs and cats collected from spay and neuter clinics are invaluable resources that can be used to recover spermatozoa for the purpose of developing methods of cryopreservation. Different methods are available to recover spermatozoa, including: slicing of epididymis, flushing of vas deferens and cauda epididymis and squeezing or milking. Each method has its advantages and disadvantages. For example, the slicing method involves the use of large volume of an extender while squeezing exerts greater amount of pressure on spermatozoa within the duct system. Our hypothesis is that the method of sperm recovery affects the chilling sensitivity and cryosurvival of epididymal spermatozoa. Testes from tom cats older than six months in age were kept refrigerated for 1 to 2 days. The cauda and vas segment from the same male were processed at room temperature by either slicing or milking. In slicing, the tissues were placed in a petri-dish containing recovery medium and cut into pieces as small as possible before recovering the suspension. Milking involved using the blunt side of a scalpel blade to push out tubular contents by applying repeated milking-type pressure on the vas and cauda. The resulting string of semen was immediately pipetted out and stored. Samples were then evaluated for motility, membrane integrity and acrosome status before and after cooling/freezing and post-thaw. Refrigerated spermatozoa from both methods maintained similar motility for several days. The pre-freeze and post-thaw percent progressive motility of spermatozoa was not affected ($P>0.5$; t-test) by the method of sperm recovery, i.e. slicing (78.3±7.6 vs 56.7±5.8) and milking (73.3±5.8 vs 50.0±10). Similarly, the membrane integrity and acrosome status of pre-freeze samples were similar between the two methods; however, slicing produce proportionally more spermatozoa with intact membranes and acrosomes. Our preliminary results indicate that milking as a method of sperm recovery may compromise the integrity of cell membrane and acrosome.

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22

Subcategory: Biomedical Engineering

Patient Derived Biomaterials for Bone Regeneration

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One of the main challenges in tissue engineering is developing a biomaterial that is biocompatible and readily available. Bone and chondoral defects alone occur at a rate of 500,000 and 900,000 injuries per year, respectively. Therefore, there is an increasing demand for the development of intraoperative biomaterials. Patient-derived fibrin hydrogels can be developed and used as an intraoperative biomaterial for tissue engineering. Peripheral blood plasma (PB-plasma) is rich in both fibrinogen and prothrombin, the inactive precursors of fibrin and thrombin, respectively. Fibrinogen can be isolated from a patient's blood and cleaved by the enzyme, thrombin. The activation of prothrombin is triggered by the addition of $Ca2+$ ions, which serves as an integral step in the blood coagulation pathway. This work aims to find the optimal concentration of $CaCl2$ that is required for the gelation of PB-plasma derived fibrin hydrogel. Enriched human bone marrow mesenchymal stem cells (hBMSCs) were used to evaluate the intra-operatively derived fibrin hydrogel's ability to promote cell survival, proliferation and differentiation. Human PB was processed using Magellan automated device to obtain platelet poor plasma. To determine the optimal concentration of $Ca2+$ required for plasma gelation, different volumes of 50, 100, 200, 250, and 500 mM of $CaCl2$ (Sigma Aldridge) were added to 100 µl of plasma at 23˚C and at 37˚C. Cell survival, proliferation, and differentiation of hBMSCs encapsulated within a PB-plasma hydrogel were compared to TCPs and a commercially available fibrin hydrogel (Sigma Aldridge), (n=3). To analyze cell viability, a live/dead cell viability assay (Invitrogen) was performed and a confocal microscope (Zesis LSM 510 Meta, 10X) was used to image the cells within the hydrogels. For proliferation, PicoGreen dsDNA assay was performed to quantify the amount of DNA in each group. The differentiation of hBMSCs to osteoblasts was analyzed using alizarin red staining and quantification assay. In this study, we found that the optimal concentration of $CaCl2$ added to human PB-plasma for gelation to occur within 20 minutes was determined to be 40-50 mM at 37˚C. The proliferation data displayed that the PB-plasma hydrogel supported cell survival and proliferation throughout the course of three weeks. In the comparative differentiation study between TCPs, fibrin and PB-plasma hydrogels, the PB-plasma hydrogels exhibited the most calcified

matrix by Day 21, indicating that osteogensis occurred. Our study established the possibility of developing patient derived biomaterial for tissue engineering use. Fibrin hydrogel derived from the human PB supported cell survival, proliferation and differentiation in vitro to the same degree as a fibrin gel made from commercialized materials. Future work will include the implantation of fibrin and hBMSCs in a mouse calvarial defect model to assess the bone regeneration ability of the autologously derived biomaterial.

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23

Subcategory: Cancer Research

The Differential Expression of miRNAs in Triple Negative Breast Cancer Cells

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Breast cancer is a heterogenous disease that is the second leading cause of death amongst women in the United States. Triple negative breast cancer (TNBC) is a very aggressive subtype of breast cancer characterized by its loss of estrogen, progesterone and HER2 receptor expression which limits its targets for effective drug therapies. Micro Ribonucleic Acids (miRNAs) are a class of small, endogenous non-coding ribonucleic acids that seem to play an essential role in gene regulation. Changes in the patterns of miRNA expression profiles are serving as potential biomarkers for tumor diagnosis, prognosis of disease-specific outcomes, and the prediction of therapeutic responses in cancer. We analyzed miRNA array (Agilent) expression profiles in triple negative breast cancer cell lines (HCC70, HCC1806, MDA-MB-157) and non-cancerous (AG11132) African American women breast cell lines. We revealed that the TNBC cells exhibited a different miRNA expression pattern when compared to the normal breast cancer cell line. We analyzed the hybridization data files using standard Microsoft Excel techniques and verified our findings using PARTEK Genomics Suite. We combined the data sets from the TNBC cell lines and compared the miRNA array expression profiles to the normal control cell line AG11132. We revealed that there were significant dysregulation of miRNAs including those of the let-7 family, miR-16, miR-31, and miR-25b-1, miR34a, and miR-95 in the triple negative cells as compared to the normal cells. These miRNAs have been described in previous scientific studies to be associated with tumorigenesis in breast cancer. These studies are initial observations that we will follow up with molecular techniques such as real-time PCR, siRNA, and transfection studies to validate the results in order to establish more direct correlations to miRNAs and their roles in triple negative breast cancer.

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24

Subcategory: Cancer Research

Investigating the Role of the WNK1-OSR1/SPAK Signaling Pathway in Cancer

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With No Lysine [K] (WNK) belongs to a family of protein kinases that has a strong correlation with hypertension due to it regulation of ion cotransporters in the kidney, and also its mutation in a familial hypertension disorders. Several studies have shown that members of the WNK1 family and signaling pathway can play central roles in cancer. Among the WNK family members, WNK1 is ubiquitous and thus its deregulation can have major impact on a large variety of tissues. Previous studies have shown that WNK1 phosphorylates downstream counterparts, OSR1 (oxidative stress responsive 1) and SPAK (STE20/SPS1-related proline-, alanine-rich kinase). When OSR1 and SPAK are activated, Na+, K+, 2Cl- (NKCC1) is stimulated to promote Cl- and water influx into the cell. Recent research in the Cobb lab has aimed to dissect the role of WNK1 in a variety of tumors. As part of this project, the cervical carcinoma cell line, HeLa, a common model for cancer studies, was used to conduct experiments. The main hypothesis was that WNK1 is a tumor promoter in HeLa cells. The aim was to determine the role of WNK1 as an oncogene, defining the impact of WNK1 on the basic characteristics of these carcinoma cells: proliferation, viability, migration, and invasion. The impact of WNK1-downstream targets, OSR1 and SPAK, to help characterize the mechanism of WNK1 action in HeLa cells was also tested. During the research, normal HeLa cells served as the control. The ability of the HeLa cells to perform basic functions was tested under control conditions, as well as, with the knockdown of WNK1 and it's downstream counterparts, OSR1 and SPAK using siRNAs. The results from the proliferation assay, boyden-chamber assay, and qPCR showed the WNK1 as well as its downstream counterparts are needed for HeLa cells to perform their basic functions. Immunofluorescence staining of the HeLa cells under knockdown conditions also showed that the cytoskeleton is dependent on WNK1. The ability of HeLa cells to undergo their basic functions relies on the presence of WNK1. These studies can provide insight into mechanisms of tumor development, and set the WNK1 signaling pathway as a target for drug development.

References: Alessi, D. R., Zhang, J., Khanna, A., Hochdorfer, T., Shang, Y., & Kahle, K. T. (2014). The WNK-SPAK/OSR1 pathway: Master regulator of cation-chloride cotransporters. Science Signaling, 7 (334), 1-10.

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25

Subcategory: Cancer Research

Prostate Cancer Innervation: Development of an Experimental Model System

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Prostate cancer is the leading cause of cancer related deaths among men in developed countries. However, some aspects of prostate carcinogenesis are still unknown. For instance, the role of pf prostate innervation in cancer development and progression has not yet been investigated. The prostate gland, as almost all other internal organs and tissues, is naturally innervated by the autonomic nervous system, which controls the normal growth, development and secretory function of the prostate. But in prostate cancer, it is still unclear if the neuritis may be recruited and used to regulate the initial phases of survival, invasion, migration, and metastases of the tumor. Some studies have shown that innervations are increased in prostate cancer and might be associated with a bad prognosis. However, our evaluation of human specimens of resected prostate cancer revealed no visible neuronal-specific staining. The goal of this project was to evaluate the presence of neuronal tissue in the murine model of prostate cancer. First, we assessed potential innervation of RM1 and TRAMP-C2 tumors harvested from subcutaneous (SC) tumor-bearing mice using a specific immunohistochemistry staining for neurofilaments. While positive staining has been detected in TRAMP-C2 tumors, no neuro-specific staining has been seen in RM1 specimens. Next, to confirm these data in the orthotopic model we tested the presence of neurofilaments in prostate glands obtained from TRAMP mice that developed spontaneous prostate cancer. Analysis of prostate tissues from tumor-free and tumor-bearing mice at different time points of cancer development revealed positive staining in both normal and malignant tissues in mice at different age. Interestingly, the addition of RM1 conditioned medium to the mouse DRG cultures showed a significant inhibition of neuritis development in vitro. These data suggest that RM1, but not TRAMP prostate cancer cells may actively inhibit neoaxonogenesis both in vitro and, probably, in vivo. Our initial evaluation of different neurotropic factors expressed by RM1 and TRAM-C2 cells by RT-PCR revealed that TRAMP-C2, but not RM1 cells express high levels of the NGF genes. Although the biological significance of this fact has not been directly tested, we can hypothesize that the presence of NGF in TRAMP tumors may protect or support the innervation of this tumor. Future studies will include evaluation of different neuroattractive and neurorepelling factors produced by different prostate cancer cell lines and available tissues, and verifying their activity on neuronal growth utilizing the dorsal root ganglia (DRG) cultures in vitro.

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26

Subcategory: Cancer Research

Biological Evaluation of Novel Pyridine-Bridged Analogs of Combretastatin-A4 as Anti-Cancer Agents

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Inhibition of tubulin polymerization disrupts the information of tumor vasculature, making the microtubule cytoskeleton an effective target for cancer chemotherapy. A prototype agent called Combrestastatin-A4 (CA-4) was used to design analogs to disrupt vasculature. The compound attaches to the colchicine-binding site of tubulin to block assembly, and causes rapid vascular shutdown, which leads to cell death in tumors. Guangdi Wang and colleagues in the Chemistry Department of Xavier University developed, designed, and synthesized novel pyridine-bridged analogs of CA-4. We hypothesized that some of the compound analogs inhibited cell growth, arrested cell cycle, and blocked angiogenesis. Our lab tested the compound for their effectiveness of possible cancer treatment. We tested the compound in vitro and ex ovo for tubulin production and angiogenesis. Various assays like tubulin polymerization, anti-proliferation, cell cycle progression, and chick embryo chorioallontoic membrane assays tests to see if the compounds halt the production of tubulin and inhibit angiogenesis. We found two analogs 4hand 4s successfully inhibited tumor cell survival arrested cell cycle progression and blocked angiogenesis. Thus, these analogs may be potential cancer therapeutics for advanced stage cancer. Future directions will include testing the chick embryo assay of 4h and conducting analysis of 4s in cellular microtubule assay with HeLa and MDA-MB-231 cells.

Funder Acknowledgement(s): Louisiana Cancer Research Consortium (LCRC);Louisiana Biomedical Research Network (LBRN).

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27

Subcategory: Cancer Research

Nuclear Envelope Defects in Cancer

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Distorted and abnormal nuclear morphology is a frequently observed in malignant cells and is commonly used to identify and distinguish cancer cells from normal. The reductions in the expression of lamin A/C and lamin B have been found to be associated with nuclear abnormalities in a variety of cancers. It has also been speculated that nuclear protrusions and micro nuclei are responsible for chromosomal numerical instability, but the magnitude of the nuclear changes is not certain. We hypothesize that nuclear envelope defects would lead to aneuploidy and could be the result of nuclei protrusion and micronuclei formation. We investigated this phenomenon with immunohistochemistry analysis in an effort to examine the lamin A/C and lamin B expression levels in ovarian and breast cancer cells, and to quantitate nuclear abnormalities in a panel of breast and ovarian cancer cells as compared to normal cells. We observed that the degree of nuclear abnormality is very different in various cell lines, and the expression of lamin proteins is often heterogeneous within the cell population of the same line. Additionally there was a correlation between the reduced lamin proteins and the increased nuclear envelope abnormalities, particularly the increased presence of micronuclei. We conclude that micronuclei formation is a prevalent occurrence that we believe is highly associated with aneuploidy in cancer cells.

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28

Subcategory: Cancer Research

The Cytotoxicity of Nanoparticles Coated with Clostridium Perfringens Enterotoxin Treatment on Breast Cancer

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Many of the therapeutic drugs used today to treat cancer are toxic to normal cells. Therefore, it is critical to develop more target-specific drugs. Claudins are proteins that help maintain cell membrane integrity in the tight junctions. The abundance of caludin-3 and claudin-4 increase in some cancers, including most breast cancers. This overexpression makes these caludins possible targets for cancer drug development. The potential therapeutic drug we looked at is Clostridium Perfringens Enterotoxin (CPE), which induces apoptosis/necrosis pathways by binding to the claudin-3 and claudin-4 protein receptors. To improve drug specificity and delivery, we used the EDC-NHS reaction to coat the CPE onto singled-walled carbon nanotubes to help increase the binding and delivery of drug to the desired site. We verified the conjugation through Raman Spectroscopy. We compared the in vitro proliferation rates of breast cancer cells exposed to both CPE and CPE attached to nanoparticles. The conjugated CPE decreased the proliferation of breast cancer cells significantly. Next, we plan to utilize both fluorescence and SEM imaging to locate the drug-cell interaction and, perhaps, understand the mechanism of interaction.

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29

Subcategory: Cancer Research

Identifying Inhibitors of the LINE1 Endonuclease

Loryn Darthard, Xavier University of Louisiana

Long interspersed element-1 (L1) is the only currently active autonomous retroelement within the human genome. L1 replicates itself through a process known as retrotransposition, which requires the endonuclease and reverse transcriptase activities of the L1 protein ORF2. During retrotransposition, the L1 endonuclease recognizes an AT-rich target sequence loosely defined as 5'TTTT/AA3' ('/' denotes site of cleavage). After nicking of DNA by L1 endonuclease and reverse transcription of L1 RNA, a new copy of L1 is inserted into the genome. The complete details of L1 insertion are undefined, however, we know a double strand break (DSB) must occur during this process prior to integration of novel L1 elements. Further studies characterizing L1 function demonstrated that the endonuclease activities of the L1 protein ORF2 is responsible for the formation of DSBs. While L1 mutagenic insertion events have been associated with diseases such as breast and colon cancer as well as muscular dystrophy, the full effect of L1 endonuclease upon stability of the genome is undetermined. Only a small fraction of L1-induced DSBs results in a retrotransposition event suggesting that the damage from the L1 endonuclease activity may be greater than previously considered. Thus, we hypothesize that an inhibitor of L1 endonuclease would be beneficial for estimating L1-associated damage and to potentially minimize L1-related genetic instability. We have tested novel small molecules for

their ability to inhibit L1 endonuclease using in vitro endonuclease cleavage assays and cell based L1 retrotransposition assays. We have thus far identified a subset of small molecules that inhibit the L1 endonuclease. We are still in the process of confirming these inhibitors through additional testing and locating more inhibitors. Once the inhibitor is located we can begin to answer the real question. Does the DNA damage associated with the activity of the LINE1 endonuclease lead to mutation and disease?

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30

Subcategory: Cancer Research

Determining Dosing for Hepatocyte Damage and Prostate Cancer Chemotherapies

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Some therapeutics are known to cause hepatic toxicity. Our project assessed dosing of Acetaminophen and Troglitazone to achieve liver damage on fresh human hepatocytes in culture, and determined the optimal dosage of the chemotherapy drugs Cisplatin (Cis), Doxorubicin (Dox), and Camptothecin-11 (CPT) for the prostate cancer cell line PC3. Troglitoaone, an anti-diabetic and anti-inflammatory drug, and acetaminophen, a pain reliever and a fever reducer, are associated with liver toxicity. We treated hepatocytes with 600 µg/ml, 1200 µg/ml, or 2400 µg/ml of acetaminophen or 100 µM, 200 µM, or 500 µM of Troglitazone. Aspartate aminotransferase (AST) and alanine aminotransferase (ALT), two enzymes released when liver damage occurs, were assayed in the UPMC clinical chemistry laboratories. A blood urea nitrogen test was also performed in the clinical laboratories to analyze nitrogen levels, a measure of hepatocyte function via protein catabolism. We found that Troglitazone damaged the liver more than acetaminophen, and acetaminophen did not have a significant impact on hepatocyte protein catabolism. To determine the IC50 of Cis, Dox, and CPT for PC3 cells, we treated the cells in triplicate in a 96 well plate with drug concentrations ranging from 100µM to 100nM for 72 hours. We performed MTT assays to assess cell survival. The averages were analyzed and the IC50 values of CPT, Dox, and Cis were, 2.042 nM, 2.433 nM, and 3.644 nM respectively (n=2). These experiments suggest that PC3 cells are most sensitive to CPT since its treatment resulted in the lowest IC50 concentration. These data establish the ranges of a variety of chemotherapeutic drugs that can be used for prostate cancer therapy without damaging the hepatocytes.

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31

Subcategory: Cancer Research

Cigarette Smoking, Risky Sexual Behavior, and a Lower Degree of DNA Methylation are Associated with Cervical Intraepithelial Neoplasia in Younger Women

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In 2010, the American College of Obstetrics and Gynecologists (ACOG) recommended that cervical cancer (CC) screening should begin at age 21 years based on the very low incidence rate of CC among adolescents. However, higher grades of cervical intraepithelial neoplasia (CIN 2+), the precursor lesions for developing CC occur in adolescents. The ACOG guidelines are appropriate, provided that the medical community have safeguards in place in the absence of performing Pap test to identify young women at high risk for CIN 2+.

The purpose of this study was to identify demographic/ behavioral risk factors associated with the diagnosis of biopsy proven CIN 2+ in well characterized women aged 19-21 years who presented with an abnormal Pap.

The study included 32 women diagnosed with CIN 2+ (cases), and 98 women diagnosed with ≤ CIN 1 (non-cases). Information on demographics/lifestyle factors were obtained using validated risk factor questionnaire. The degree of methylation in long interspersed nucleotide element-1 (L1) of peripheral blood mononuclear cell DNA, a potential biomarker of CIN 2+ was determined using pyrosequencing assay. Unconditional logistic regression model was used to evaluate the determinants of CIN 2+.

Results demonstrated that women who smoked, had a higher number of sexual partners and had a lower degree of L1-methylation were significantly more likely to be diagnosed with CIN 2+. Our study identified specific modifiable risk factors associated with higher risk of developing CIN 2+ in younger women.

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32

Subcategory: Cancer Research

Benzoic Acid Effect on Production of β Carotene by Carrots, Daucus carota (L); A Focus on the Effect of the Acid on Plant Growth

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The goal of this research was to use Benzoic acid as a chemical elicitor to enhance the carotene content of carrot plants grown in the green house. β carotene is a carotenoid of increasing demand as a precursor of vitamin A and has also been ascribed a central role in cancer prevention and therapy. In plants benzoic acid and its derivatives are important building blocks in a wide spectrum of compounds varying from metabolites like cytokinin and salicylic acid to secondary products with pharmacological activities such as the anti-cancer agent taxol and the local anesthetic cocaine. Since salicylic acid (SA) is a well-known inducer of plant systemic acquired resistance (SAR) in plant –pathogen interaction and therefore a chemical elicitor of secondary metabolites, we choose to study Benzoic because of its chemical relationship with SA. Benzoic was added in 0.1µM, 10µM and 100µM concentration to the seeds overnight before planting. The same concentrations were applied to plants two times a week throughout the growing season of the plants. Benzoic acid treated seeds showed 100% germination rate. The plant growth characteristics measured as plant height throughout life of the plant had no significant difference from the control. Benzoic acid therefore has no negative effect on plant growth and is therefore a good candidate for chemical elicitation. Further work on the analysis of the enhancement of benzoic acid on total carotene production by HPLC is in progress and will be reported on a different paper.

Funder Acknowledgement(s): Anne Osano and Eric Bonsu,

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33

Subcategory: Cancer Research

A Study of the Effect of DHT on Retinoblastoma Protein Expression in a Human Castration Resistant Prostate Cancer Cell Line, C4-2

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Prostate cancer is a disease of aging males and is intimately associated with the hormone androgen. Retinoblastoma protein (Rb) is a key tumor suppressor frequently mutated in aggressive prostate cancer. Dihydrotestosterone (DHT), the most potent endogenous androgen, was applied to a castration resistant prostate cancer cell line, C4-2 cells. These cells were derived from androgen-sensitive LNCaP cells, which were originally isolated from a lymph node metastasis of a prostate cancer patient. Because prostate cancer is, in general, sensitive to androgen treatment such as androgen deprivation, LNCaP cells can be used as a model system. The C4-2 cells were originally made castration resistance by implantation of LNCaP cells in mice, followed by castration and the maintenance of the cell line in a male castrated host. Since a small portion of prostate cancer patients will eventually relapse and their tumors become castration resistant, the C4-2 cell line is a good model to analyze this condition. Androgens have been shown to modulate cell proliferation, and Rb plays a critical role in cell cycle progression. Rb has also been implicated in androgen regulated proliferation in LNCaP cells. However, it is less clear if Rb is still sensitive to androgen regulation in castration-regulated prostate cancer cells. Thus we decided to test the effect of androgen on Rb expressing C4-2 cells. In this study, changes in RB were evaluated at the protein level after treatment with 0, 1, and 10 nM of DHT. From the limited scope of our study, we found that Rb is not related to androgen action in castration-resistant C4-2 cells. Rb did not change and is therefore not involved in androgen action in this castration-resistant cell line.

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34

Subcategory: Cancer Research

Regulation of Steroidogenic Enzymes in Prostate Epithelial Cells by Prostaglandins

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Steroid hormone regulation of prostate cancer has been studied for many years. Past studies initially focused on the roles of androgens given their essential role in development and normal function of the prostate and stimulation of prostate cancer cell growth. However, a number of studies have also shown the importance of estrogen in regulating normal and cancerous prostate function. Androgens are able to perform biological activities in prostate cancer through activation of transcriptional activity by its receptor, the androgen receptor. The beta subtype of the estrogen receptor is primarily responsible for regulating prostate epithelial cell function and limiting prostate cancer cell

growth. Previous studies show that prostaglandin E2 (PGE2) is a major influence on epithelial growth factors and steroid hormone production in several cancers including prostate cancer. In this study we investigated regulation of expression of steroidogenic enzymes involved in androgen and estrogenic compound metabolism (AKR1C1and AKR1C2) by PGE2 and inhibitors of the PGE2 G-protein coupled membrane receptors, EP2 and EP4, in human prostate epithelial and cancer cell lines using quantitative RT polymerase chain reaction. PGE2 binds to EP2 and EP4 receptors leading to the enhanced production cyclic adenosine monophosphate pathway (cAMP), which in other tissues stimulates steroidogenesis. Our preliminary data show that PGE2 does not activate these enzymes through cAMP. In fact the steroidogenic enzymes tested were down regulated by PGE2 and induced upon inhibition of EP2 and EP4 receptors. Therefore, prostate epithelial and cancer cells may have a unique mechanism for regulating the production of androgen and estrogen metabolites.

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35

Subcategory: Cancer Research

Proteomic Characterization of Human Serine Palmitoyltransferase-1 and Protein Kinase B (AKT) One of the Members of the PI3K/AKT/mTOR Stress Response Signaling Pathway in Celecoxib Treated Cells

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The human serine palmitoyltransferase-1 (SPTLC1) is emerging as a stress responsive protein. The immuno-precipitation protocol performed on stressed cells showed that SPTLC1 interacts with other stress response proteins. Immuno-precipitation has also been used to corroborate that the human SPTLC1 protein interacts with the 90nkilo-dalton heat shock protein, Hsp90. Since Hsp90 is a central integrator of the function of proteins that play a key role in stress response, including members of the stress/survival PI3K/AKT/mTOR pathway, the observed interaction places SPTLC1 in a position for interaction or crosstalk with diverse stress response signaling proteins. Molecular characterization of SPTLC1 has identified functional domains, including SH3 and PDZ, which allow protein-protein interactions, but interaction with the stress/survival response proteins has not been examine. It was hypothesized that following exposure of inflammation associated cancer cells to the anti-inflammatory and anti-proliferation drug, Celecoxib, there will be detectable localization and interaction of SPTLC1 with AKT. The investigation therefore examines the localization and interaction of SPTLC1 in inflammation associated cancer cell lines following exposure to the anti-inflammatory and anti-proliferation drug, Celecoxib. Results show the translocation of SPTLC1 from a cytoplasmic domain to focal adhesion sites in Celecoxib treated brain cancer cells. In addition, comparative data is presented on AKT localization, expression and protein interaction in the same cell line following exposure to non-lethal doses of Celecoxib. Confocal microscopy and Western blot analysis were used to examine the localization and possible functional interactions of SPTLC1 and AKT in glioma cancer cell lines following exposure to Celecoxib. Data generated from this study provide new insight into validating a signaling role for SPTLC1 in stress response. Confirming such role may be found useful in the design of therapeutic approaches that target key stress response signaling pathways associated with the progression of cancer.

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36

Subcategory: Cancer Research

3D Printing Biomimetic In Vitro Bone Model for Breast Cancer Bone Metastasis Study

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Bone is one of the most prominent sites of breast cancer metastasis. Further exploration of effective therapeutics to address bone metastatic breast cancer requires clear clarification of the metastatic cascade from breast cancer to bone. Bone models are commonly used to facilitate the understanding of cancer bone metastasis/invasion. However, traditional in vitro and in vivo models contain many inherent limitations with regards to controllability, reproducibility, and flexibility of design. Therefore, in this study, we aim to develop a biomimetic in vitro bone model using a novel 3D printing technique to better study breast cancer cell metastasis and bone invasion.

We hypothesize that the 3D printed bone model can provide a biocompatible and biomimetic microenvironment for breast cancer cell growth and progression, and help evaluate the breast cancer bone metastasis cascade in a highly controlled manner.

A series of 3D bone models with square shaped pores and different channel size were fabricated by our tabletop stereolithography based 3D bioprinter. Printable hydrogel inks were composed of 40 w.t.% poly (ethylene glycol) (MW 300 kDa), 60 w.t.% poly(ethylene glycol) diacrylate (PEG-DA, MW 575 kDa) and 0.5

w.t.% photo initiator by weight of PEG-DA. In addition, nanocrystalline hydroxyapatites (nHA), a key mineral component in human bone, were synthesized and incorporated into the bone models in concentrations of 0, 2, 5 and 10 w.t.% to enhance the biomimetic properties. Scanning electron microscope (SEM) was used to image the morphology of models. Metastatic MDA-MB-231 breast cancer cell line was utilized to evaluate the cell response on varying printed bone models in vitro.

SEM images show printed models present well-defined 3D topography with interconnected channels. Breast cancer cell adhesion study reveals the cells can attach well on all models illustrating their excellent biocompatibility. Furthermore, 10% nHA containing bone models present significant improvement in breast cancer cell proliferation when compared to controls without nHA after 3 days of culture.

A variety of 3D bone models with biomimetic nano and micro features and biocompatible properties were successfully printed and can be used as a potential in vitro model for future studies of breast cancer bone metastasis, and new therapy discovery.

Funder Acknowledgement(s): NDDK STEP-UP

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37

Subcategory: Cancer Research

Plant Derived Analogues as Modulators of Multidrug Resistance in Cancer

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ATP-binding cassette (ABC) transporters such as ABCB1/P-glycoprotein and ABCG2/BCRP that function as plasma membrane efflux pumps are important factors that limit oral bioavailability, facilitate hepatobiliary elimination, and restrict penetration of cancer chemotherapeutics into the brain and fetus. For any new drug to be approved by FDA, just like cytochrome P450's, information about its interaction with ABCB1 and ABCG2 transporters must be disclosed to avoid side effects or drug-drug interactions. The multidrug resistance (MDR) phenotype caused by the overexpression of ABC transporters by tumor cells promotes the cellular efflux of a variety of anticancer drugs and may lead to cancer treatment failures (Tiwari et al., 2011). Based on our in silico screening and structure-activity relationship studies, we synthesized novel molecules to inhibit ABCG2 transporters. In our experiments, we found several of these molecules to be excellent reversal agents against ABCG2 transporters using cell-based MTT assays. These compounds potentiated the cytotoxicity of several ABCG2 substrates such as mitoxantrone and doxorubicin but not non- ABCG2 substrate cisplatin, and significantly reversed the MDR of cancer cells in a concentration -dependent manner. Moreover, they were shown to possess significant binding affinity towards ABCG2 binding sites as shown by homology modeling. Additionally, these molecules have limited PXR stimulatory effects. Further in vivo studies are required to implement these molecules for in clinic application against difficult-to-treat tumors.

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38

Subcategory: Cancer Research

Fusarisetin A: Prevention of Epimerization in Synthesis and a Biological Investigation

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Fusarisetin A is a recently isolated natural product that displays an unprecedented chemical motif and remarkable bioactivities as a potent cancer migration inhibitor. Recent efforts to identify potent inhibitors of cancer metastasis have led to the isolation of fusarisetin A from a Fusarium species. This compound was found to inhibit cancer metastasis in MDA-MB-231 cells, a particularly aggressive breast cancer cell line. Specifically, fusarisetin A was found to inhibit acinar morphogenesis (IC50 ca 77 μM), cell migration (IC50 ca 7.7 μM) and cell invasion (IC50 ca 26 μM) in these cell lines without any significant cytotoxicity in concentrations up to 77 μM. We describe here our studies leading to an efficient and scalable total synthesis of fusarisetin A. Essential to the strategy was the development of a new route for the formation of a trans-decalin moiety of this compound and the application of an oxidative radical cyclization (ORC) reaction that produces fusarisetin A from equisetin via a bio-inspired process. CAN-induced and metal/O2-promoted ORC reactions were proven to be useful. Epimerization was avoided through manipulation of base and reaction temperature to optimize amount of product. LiHMDS and less sterically hindered bases optimized synthesis. Biological screening in vitro confirms the reported potency of (+)-fusarisetin A. Importantly, ex vivo studies show that this compound is able to inhibit different types of cell migration. Moreover, the C5 epimer of (+)-

fusarisetin A was also identified as a potent cancer migration inhibitor, while (−)-fusarisetin A and equisetin were found to be significantly less potent. The optimized synthesis is applicable on gram scale and provides a solid platform for analogue synthesis and methodical biological study. We hope to develop studies to further elucidate the roles of fusarisetin in its aims to slow down metastasis.

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39

Subcategory: Cancer Research

The Effect of Chemopreventative Agent Withaferin A (WA) on Proto-Oncogene c-MYC in Bladder Cancer Cells

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The root and leaf of Withania somnifera, a plant commonly used in Indian Ayurvedic medicine for the past millennium, has been shown to exhibit anti-cancer effects. The main chemical components responsible for the anti-cancer effects of this plant are steroidal lactones. One of the steroidal lactones derived from this plant is withaferin A (WA), a possible chemopreventative drug. WA has been proven to display anti-cancer effects, both in vitro and in vivo, by inhibiting proliferation and cell cycle progression , inducing apoptosis as well as autophagy, and suppressing oncogenic signaling pathways such as Signal Transduction and Activator of Transcription factor 3 (STAT3). This drug uses ROS-signaling (Reactive Oxygen Species) to selectively kill only cancer cells—making it a good candidate for chemoprevention. However, no study has been done on the effect of WA on bladder cancer. Bladder cancer is the second most common form of urological cancer in the United States and usually has a high recurrence rate. In spite of reduction in cigarette smoking, which is the major risk factor of this malignancy, the incidence of bladder cancer did not decrease. Some risk factors including age are not modifiable. In addition, medical expenses for managing this disease require extremely high costs; therefore prevention strategies are desirable. In our study we used two human bladder cancer cell lines—representing different stages of bladder cancer—to examine the effects of WA; RT4 cells (superficial papillary urothelial carcinoma cells) and T24 cells (muscle invasive carcinoma cells). Because c-MYC, a proto-oncogene, is overexpressed in bladder cancer, this will be a valuable target for prevention of bladder cancer. In present study, WA treatment decreased the expression level of c-MYC protein as evidenced by immunoblotting. Downregulation of c-MYC protein by WA treatment was due to repression of its mRNA level confirmed by quantitative real-time PCR (polymerase chain reaction). So far WA shows promising chemoprevention effects in human bladder cancer cells. Further investigations need to be done looking into this drugs effect on MYC levels and the mechanisms by which WA is exerting this effect.

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40

Subcategory: Cancer Research

The Role of Transforming Growth Factor Beta 1 and Epidermal Growth Factor (EGF) in Regulation of Cathepsin L Activity in Human Prostate Cancer

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Epithelial Mesenchymal Transition (EMT) is the process by which epithelial cells gain migratory and invasive properties, thus transitioning into mesenchymal cells. The transition from epithelial cells to mesenchymal cells can be induced by growth factors such as transforming growth factor-beta1 (TGF-β1) and epidermal growth factor (EGF), and is characterized by the loss of E-cadherin expression and increased expression of vimentin and Snail. This allows the mesenchymal cells to invade across the basement membrane and metastasize to distant sites. Cathepsins are enzymes that can help degrade the basement membrane and we have been studying the role of Cathepsin L (CatL) in prostate cancer progression. The hypothesis is that TGF-β1 and/or EGF can increase CatL activity and that growth factor-mediated EMT can be antagonized by CatL inhibitor. As a cell model, we utilized ARCaP E prostate cancer cell line that represents an epithelial cell line and treated with 4 ng/ml TGF-β1 and/or 50 ng/ml EGF to induce EMT. These experiments were done in the presence or absence of CatL inhibitor (5 μM Z-FY-CHO). We subsequently examined EMT marker expression by western blot analysis and immunofluorescence, and CatL activity by zymography. Western blot and immunofluorescent analyses showed that treatment of ARCaP E cells with both TGF-β1 and EGF decreased E-cadherin, and increased Snail and vimentin expression indicative of EMT; this was inhibited in the presence of CatL inhibitor. Zymography results showed that ARCAP E cells that had been treated with both growth factors exhibited an increase in CatL activity which was antagonized by CatL inhibitor. In conclusion, these results indicate that when ARCAP E cells are dually treated with TGFB1 and EGF the cells are pushed through EMT and Cathepsin L activity is increased.

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41
Subcategory: Cancer Research

Inhibitory Effect of Amygalin on Human Prostate Cancer In Vitro: A Dose Response Study

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All replicating cells require energy in the forms of ATP and row material to reproduce. Cancer in a human body generally is the most energy consuming foci; therefore, it will be logical to down regulate the highest energy output pathways that do not harm the human being treated for a cancer. One of the most prevalent cancers in men is that of prostate adenocarcinoma. I utilized one human prostate cancer cell line LnCap to study the cancer onhibitory capacity of Amygdalin - a naturally occurring chemical. Amygdalin (D-mandelonitrile-β-gentiobioside) is a major component of the seeds of prunasin family plants, such as peaches, apricots, almonds, apples, and other rosaceous plants. It has been used as a traditional drug because of its wide range of medical benefits, including its use in cancer treatment and prevention. I evaluated the optimal dose that can inhibit LnCap replications.

In this study, we prepared the amygdalin solution by dissolving amygdalin tablets in warm phosphate buffered Saline. We then investigated whether this solution inhibits cell replication and apoptosis in LnCap cell lines. Based on observations of the effects of serial dilutions of amygdalin on the prostate cell lines, there were obvious morphological changes that were consistent with cell apoptosis of the prostate cancer cells, these included: reduced size and number of cell processes with increase in concentration of amygdalin, and deformation of and rupturing of cell membranes to include nuclear leakage and cytoplasmic fluid loss. In this study we have shown that Amygdalin induces apoptosis in LnCap prostate cells and significantly inhibits cancer cell replication.

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42
Subcategory: Cancer Research

Pancreatic War

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The pancreas has two major functions, producing exocrine enzymes used to break down fats and proteins and producing the endocrine hormone, insulin to maintain blood sugar levels. Pancreatic carcinoma occurs when abnormal cells within the pancreas grow in an uncontrollable way, resulting in yellowing of the skin and whites of the eyes, and pain in the abdomen, along with other side effects. It has a high mortality rate along with a very low survival rate. The research for pancreatic cancer is definitely important and finding a cure is highly needed as it is extremely hard to use any type of treatment available so far without damaging the good cells. Pancreatic cancer cells growth depends on the temperature and length of heat exposure. Therefore we are trying to find a new treatment using heat from a laser to kill tumor cells, and we want to know how much heat will be required for the treatment to work. We exposed the mouse pancreatic ductal adenocarcinoma cell line, PAN O2 cells, to 30 minutes of increased temperatures prior to growth for 24 hour at 37°C. We used trypsin blue to differentiate the live from the dead, in total viable cell counts. Our results showed that under normal conditions (37°C) the number of cells doubled in about 24 hours with 80% viability. However, the total cell number and cell viability decreased after a 30 minute incubation at 40°, 45°, 47°, 50°, 52°, and 60°C. At 60°C there were only about 20% viable cells, which is a great improvement. We concluded that PanO2 cells are affected in a temperature dependent manner, starting at 47°C and continuing on to 60°C. Additional studies will determine how long is required for cell death at various temperatures.

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43
Subcategory: Cancer Research

The Role of Collagen on Mesenchymal to Epithelial Reverting Transition in Prostate Cancer Cells

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During metastasis cancer cells become immune to chemotherapy and apoptosis, which increases the likelihood of relapse and the cancer to reoccur. The extracellular matrix by way of its integrins is shown to contribute to cancer survival. In the Wells lab prostate cancer cells were previously co-culture with hepatocytes to induce carcinoma cells MErT, and it was observed that there were high levels of collagen 1 in the liver. After these findings we wanted to know the role of the extracellular matrix on MErT. The ECM plays a crucial role in the normal development and differentiated phenotype of cells and tissue. The engagement of the ECM molecules by cells through surface receptors,

including integrins, results in the activation of signaling pathways along with specific changes in gene expression. Intracellular signals direct proliferation, survival, migration, invasive potential and differentiation. Prior research demonstrates that type 1 collagen serves as an adhesive substrate for numerous cancer cells and may influence adhesion and retention of metastatic cells in the skeletal tissue. Up-regulation of collagen 1 in metastatic prostate cancer is mainly derived from tumor stroma and is responsible for the increases stiffness of the tissue. This lead to the question, what role does collagen play in MErT in prostate cancer cells. We hypothesized that if mesenchymal PCa cells are able to revert to epithelial cells then ECM molecules plays a role in cell survival. To understand this we seeded DU145 cells on 1%, 5% and 10% collagen coated plates overnight. Cells were then treated with PD153035 for 48 hours. After 48 hours cells were then either harvested for Western Blot or fixed for Immunofluorescence. We saw that the control cells that were seeded with collagen re-expressed E-cadherin. The cells that were treated the EGFR inhibitor and seeded in collagen expressed E-cadherin at a much higher level. From this we can conclude that collagen 1 and the ECM does play a role in metastatic seeding.

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44

Subcategory: Cancer Research

Annotation of SPTLC1 Open and Alternate Reading Frames in Inflammatory Cancer Cell Lines

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The human Serine palmitoyltransferase 1, SPTLC1, is a highly conserved protein that is emerging as a novel stress responsive protein. The gene locus at 9q22.2 is in a target region with one of the most common genetic alterations sufficient to modify cellular behaviors and phenotypes associated with cancers of different tissue origins. Expression of mutated forms of the gene in humans has been linked to aberrant development and chemosensitivity, while in vitro, SPTLC1 recombinant cells appear to acquire a multidrug resistance phenotype. Emerging and compelling evidence from immuno-cytochemical and functional association studies implicate C-terminal modified SPTLC1, probably through aberrant protein interactions, in altered stress response signaling events relevant to proliferation and death. Using so-called inflammatory cancers of the bladder, brain and prostate, this study examines the molecular status of the SPTLC1 open- and alternate-open reading frames in parental and SPTLC1 recombinant cells. These sequences were found to be differentially expressed in the parental cell lines, suggesting differences in copy numbers and/or in mechanisms regulating the gene expression. Bioinformatics analysis indicates the presence of SPTLC1 functional domains that allow for novel protein interactions and the expression of the out-of-frame alternative reading frame which may result in multiple protein functions. In view of the emerging and novel biological capacities, such differential gene expression has important implications for the etiology, progression and design of therapeutic interventions for human cancers. Hence, it is necessary to redefine SPTLC1 function in terms of non-enzymatic contribution to regulating important aspects of cell function, particularly as it relates to its role in stress response mechanisms important to human health.

Funder Acknowledgement(s): Title III

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45

Subcategory: Cancer Research

The Role of Kaiso in the Progression of PC3 Prostate Cancer Cells

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Primary tumors of prostate cancer, as with all other cancer types, first begin with cellular mutations that allow for uncontrolled cell growth. From critical analysis of this uncontrolled cell growth researchers have observed that, as these tumors become more aggressive, there is a decrease in E-cadherin. E-cadherin, a transmembrane glycoprotein, is specifically involved in epithelial cell-to-cell adhesion. This decrease in E-cadherin results in a phenotypic cellular change referred to as epithelial to mesenchymal transition (EMT), where the cancer cells transition from an epithelial phenotype to a mesenchymal phenotype and in the process increases invasiveness of these cancer cells. These epithelial cells from the primary tumor are then able to escape their original environment (metastasis), migrate through barrier matrices, pass through capillary beds and eventually establish themselves into a new secondary site location. Once these cells arrive to this new site, which could be the liver or bone marrow for prostate cancer patients, they may become dormant with little proliferation and undergo a re-expression of E-cadherin, a process referred to as mesenchymal to epithelial reverting transition (MErT). During this period there is no clinical effect, but once the cells emerge from this dormancy to proliferate, the metastases usually lead to death. To determine what might influence prostate cancer to become seeded in a microenvironment, escape dormancy and start to proliferate, our experimental approach was to determine whether inhibiting the ex-

pression of Kaiso, a p120 catenin-binding protein, would prevent the seeding and metastatic growth of the PC3 cancer cells. In addition, we wanted to determine what could allow them to escape dormancy. To accomplish this, we have created an in vitro 2D cell culture to co-culture HS27A bone marrow stromal cells with cells from the human prostate cancer cell line, PC3 there were transfected with sh-Kaiso and sh-Scr as control. Both sh-Kaiso and sh-Scr PC-3 cells were co-cultured cells and pre-stressed for 24 hours with lipopolysaccharide (LPS; 1μg/mL; an anti-tumor agent that naturally arises from the gut microbiome or epidermal growth factor EGF; 20nM a ubiquitous growth factor. The co-cultures were then imaged on days 2, 4 and 7 in order to determine whether the PC3 cells were seeded within the bone microenvironment, or escaped dormancy due to a regain of proliferation. Our findings indicate that both sh-Kaiso and sh-Scr PC3 cells seeded the bone microenvironment, however sh-Kaiso cells failed to proliferate after EGF or LPS treatment compared to sh-Scr PC3 cells. Although preliminary, these results suggest that Kaiso has a role in the maintenance of tumor dormancy within the bone microenvironment.

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46

Subcategory: Cell and Molecular Biology

Producing Pinene Through the Genetic Modification of Cyanobacteria

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Dimerized pinene, synthesized from two pinene monomers, shows promise as a renewable jet fuel. Cyanobacteria, a robust prokaryote, naturally contains most of the metabolic pathway to produce pinene. With the insertion of two genes – GPP synthase and pinene synthase – we can extend cyanobacteria's natural metabolic pathway to produce pinene. Two plasmids were created using Gibson Assembly, one containing the GPP synthase and one containing both GPP and pinene synthases. Both plasmids contained a lac repressor (for controlled repression of the plasmid). We created several strains of cyanobacteria with successfully integrated GPP synthase, but none of the plasmids containing both GPP synthase and pinene synthase were able to integrate. This might be due to an unusually high intracellular toxicity, or the depletion of GPP. Future work could entail up-regulating GPP production or adding additional copies of the lac repressor gene to ensure the repression of prinene production. Toxicity tests were also performed to determine cyanobacteria's level of viability in varying concentrations of pinene. β- and α-pinene showed different viability limits. α-pinene is viable up to 1 mM, while β-pinene is only viable up to 0.5 mM. Pinene synthase produces a mixture of both isomers.

References: Ducat, Daniel C., Jeffrey C. Way, and Pamela A. Silver. 'Engineering Cyanobacteria to Generate High-value Products.' Trends in Biotechnology 29.2 (2011): 95-103. Web.
Meylemans, Heather A., Roxanne L. Quintana, and Benjamin G. Harvey. 'Efficient Conversion of Pure and Mixed Terpene Feedstocks to High Density Fuels.' Fuel 97 (2012): 560-68. Web.

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47

Subcategory: Cell and Molecular Biology

Ameliorating Decreased Ligament Function Due to Estrogen Levels

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Female athletes are 4-times more likely to rupture ligaments, such as the anterior cruciate ligament (ACL), found in the center of the knee, than male athletes. The rise in ACL injuries in women corresponds with the point of highest estrogen levels in the blood. Estrogen levels in women rise from ~50pg/ml early in the follicular phase to ~500pg/ml prior to ovulation. Using an in vitro engineered ligament model, we have recently shown that the increase of estrogen decreases the stiffness and strength of ligaments. The purpose of the current research is to determine whether simple strategies might be used to counteract the effects of the estrogen on ligament stiffness. Ligament stiffness is determined by two primary factors: collagen content and collagen crosslink density. Collagen content within a ligament is not altered by a short period of high estrogen. In contrast, the key enzyme regulating collagen crosslinking, lysyl oxidase (LOX), is inhibited 75%. LOX is a copper (Cu)-dependent enzyme that links the ε-amino groups of lysine residues in neighboring collagen molecules, increasing the stiffness of collagen and strength of ligaments. Because LO is a Cu-dependent enzyme, Cu can increase LO activity and the crosslinking of collagen. This study determined the effect of CU on ligament stiffness and the effects estrogen on ACL mechanics.

Funder Acknowledgement(s): University of California, Davis College of Biological Sciences

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48

Subcategory: Cell and Molecular Biology

Tissue Specific Alternative Splicing in C.elegans: How are Alternative 3' Splice Sites Chosen?

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Introns are regions of genetic material that are removed from the transcribed pre-mRNA by the spliceosome, a macromolecular complex consisting of hundreds of proteins and 5 snRNAs. The 5' and 3' splice sites define the boundaries of an intron. Alternative splicing is the usage of multiple 5' and 3' splice sites to produce a variety of mRNAs from a single genetic locus. Alternative splicing is regulated and has been shown to contribute to the development of specific tissues, and errors in this process may lead to tissue-specific diseases as well as developmental defects. In this study, we sought to identify genes that are responsible for tissue-specific alternative splicing in C.elegans. We have identified hundreds of examples of tissue-specific alternative 3' splice sites ≤18nt from each other. In germline cells, the 3' splice site closer to the 5' splice site is used more often, while in somatic cells the 3' splice site further from the 5' splice site is overwhelmingly preferred. We hypothesize that splicing factor proteins expressed in one cell-type or the other may be contributing to this tissue specificity and the goal of this project is to identify these factors. To do this, we constructed two transgenes that contain the N-terminal portion of the atx-2 gene, which has tissue-specific alternative 3' splice sites 8nt apart and in different translational reading frames. We fused green fluorescent protein (GFP) to one transgene in frame with the somatic splicing product and red fluorescent protein (RFP) to the other transgene in frame with the germline isoform. Results of the construct sequencing confirmed proper sequence and these plasmid constructs will be co-expressed in C.elegans allowing us to visually monitor the alternative splicing difference in the tissue types by whether the cells express the green or the red protein. With this tool in hand, we will perform an RNAi screen of candidate splicing and RNA-binding factor genes that may contribute to these tissue-specific splicing patterns. By developing our fluorescent reporter screen to visualize alternative splicing, we hope to be able to learn more about how the splicing machinery is regulated to control 3' splice site choice and therefore overall gene expression.

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49

Subcategory: Cell and Molecular Biology

Molecular Interaction of Human Serine Palmitoyltransferase-1 and PI3K in Stress Response Signaling During Cellular Response to Celecoxib

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The role of several proteins in the highly conserved stress response signaling pathway mediated through the PI3K/AKT/mTOR protein network is integrated by the 90 kiloDalton molecular chaperone known as Heat shock protein 90 (Hsp90). The role of phosphoinositide 3-kinase, PI3K, and interaction with Hsp90 has been extensively studied in neoplastic and normal cells responding to diverse environmental stress stimuli. More recently, the human serine palmitoyltransferase-1, SPTLC1, has emerged as a stress responsive protein also capable of interacting with Hsp90. SPTLC1 expression in recombinant cells has also been found to modulate cellular behavior to stress and may contribute to the acquisition of a multidrug resistance phenotype. It is hypothesized that Hsp90 interaction places both SPTLC1 and PI3K in a position for functional crosstalk in cells responding to stress. In the study reported here, the sub-cellular localization of SPTLC1 and PI3K in cultured cells responding to chemical stress was examined by confocal immunofluorescence microscopy. Preliminary results show SPTLC1 localized to focal adhesion sites in Glioma cells exposed to Celecoxib. We also report here comparative localization that is complemented by Western blot analysis to quantitate protein expression in inflammation associated human cancer cells exposed to Celecoxib, an anti-inflammatory drug recently found to have anti-cancer properties. It is known that the up-regulated expression of PI3K contributes to human pathologies such as cancer and chronic inflammation; hence, its interaction with SPTLC1 may have functional implications in cellular behavior and the process of cancer progression.

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50

Subcategory: Cell and Molecular Biology

Expression, Purification and Characterization of EC1 Domain of VE-cadherin

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Vascular endothelial (VE)-cadherin is a calcium-binding protein found predominantly in endothelial cells and plays a major role

in cell-cell-adhesion in biological barriers such as the blood-brain barrier. The extracellular domain of VE-cadherin consists of five repeats, EC1-EC5 domains, that have been suggested to be involved in homophilic interactions. Understanding VE-cadherin interactions is essential in designing molecules that can modulate vascular permeability and help drug absorption through biological barriers. The objectives of this work were to express the EC1 domain of VE-cadherin and determine its structural properties. The EC1 domain of VE-cadherin was subcloned into pASK-IBA6 vector and expressed in Escherichia coli. Cell pellets containing EC1 domain of VE-cadherin were lysed and purified using a Strep-Tactin affinity column. However, this protein was found to be unstable and contained additional peaks. Therefore, further purification was accomplished with anion exchange chromatography using a salt gradient on a Q sepharose HP column. SDS-PAGE and mass spectrometry data showed successful expression and purification of EC1 domain of VE-cadherin. The conformation of this protein were evaluated using CD spectroscopy.

Funder Acknowledgement(s): National Institute of Health

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51

Subcategory: Cell and Molecular Biology

In Vitro Effects of Zinc and Cobalt on Expression of the Zinc Transporter Zip 1

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Zinc is necessary for many functions, including fertility in males because it is required for the growth and development of sperm throughout the process of spermatogenesis. However, high concentrations of Zn or Co ions can cause toxicity. Sertoli cells are very involved with the regulation of the process of spermatogenesis. The role of Sertoli cells became the focus in evaluating the zinc transporter Zip 1 exposed to metal ions in culture. Cells were treated with a wide range of concentrations of zinc chloride (0-µM, 1-µM, 10-µM, 100-µM, 500-µM, and 1000-µM) and were incubated and collected at different time points (0hr, 2hr, 4hr, 8hr, 12hr, 24hr). For the zinc only treatment, >100-µM Zn was lethal to Sertoli cells at > 8hrs. Exposure to Zn-1 and Zn-10 µM showed a slight trend towards a decrease in Zip 1 expression. The same procedure was used for the Zn + Co experiment, except the concentrations of metal ions used were 0-µMCo, 10-µM Co, 100-µM Co, 0-µM Zn, 10-µM Zn, 100-µM Zn, 10+1-µMZn+Co, 100+10-µMZn+Co). For the zinc and cobalt experiment, each of the individual concentrations seems to decrease expression of Zip 1 over time. Presence of both ions did not show an interaction between their respective toxicities on Zip 1 expression in vitro, in contrast to the in vivo experimental results in mice. The exact effect of these ion concentrations could not be analyzed for physiological significance, since the intracellular concentration is not known. If the intracellular concentration is known, then the effects of zinc and cobalt can accurately be determined. Knowing how much of the metal ions are being transported to the cell normally can help figure out the exact amount of toxicity that will cause cellular disruption.

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52

Subcategory: Cell and Molecular Biology

The Role of Enhancer of Zeste (EZH2) and Polo Like Kinase 1 (PLK1) in 293 Human Embryonic Kidney (HEK) Cells

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The Polycomb repressive complex 2 (PRC2) maintains the repressed state of chromatin by methylating histone three (H3) on lysine (K)27. PRC2 complex is comprised of three essential protein subunits, namely SUZ12, EED and EZH2. EZH2 or enhancer of zeste is the enzyme that catalyzes the trimethylation of H3K27. Recent studies have shown that polo-like-kinase 1 (PLKI) down-regulates the suppressor of zeste 12 (SUZ12) subunit of the PRC2 complex. The main focus of this study is to determine whether PLK1 regulates the stability of EZH2, by analogy to SUZ12. If there is a substrate/ enzyme correlation between EZH2 and PLK1, then the Western Blot will display reduced level of EZH2 with expression of PLK1CA. The plasmid DNA encoding EZH2 and various forms of PLK1 were introduced by transfection in human HEK293T cells. Specifically, EZH2 was co-expressed with constitutively active PLK1 (PLK1CA) or kinase dead (inactive) PLK1KD into the 293 HEK cells. Western Blot of whole cell extracts from transfected cells was used in order to detect the protein expression between EZH2 and PLK1. The results showed that there was protein expression of EZH2, and there was no change in EZH2 protein level by co-expression of PLK1CA. However, more studies are needed to see if there is substrate/enzyme relation between PLK1 and EZH2. In the next experiment, pcDNA3 will be used as an empty vector control for EZH2. In addition the effect of inhibition of PLK1 by addition of the PLK1 inhibitor B12536 will be tested to determine if there is a difference in protein expression.

References: Boyer, Laurie A., Kathrin Plath, et.al. *'Polycomb Complexes Repress Developmental Regulators in Murine Embryonic Stem Cells*.' Nature. Nature Publishing Group, 19 Apr. 2006. Web. 23 June 2014.

Margueron, Raphael, and Danny Reinberg. 'The Polycomb Complex PRC2 and Its Mark in Life.' Nature. Nature Publishing Group, 19 Jan. 2011. Web. 23 June 2014.
Wang, Wen-Horng, Leo L. Studach, and Ourania M. Andrisani. 'Proteins ZNF198 and SUZ12 Are Down-regulated in Hepatitis B Virus (HBV) X Protein-mediated Hepatocyte Transformation and in HBV Replication.' National Center for Biotechnology Information. U.S. National Library of Medicine, 1 Apr. 2012. Web. 23 June 2014.
Andrisani, Ourania M. 'Deregulation of Epigenetic Mechanisms by the Hepatitis B Virus X Protein in Hepatocarcinogenesis | HTML.' Viruses. MDPI AG, 18 Mar. 2013. Web. 23 June 2014.

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53

Subcategory: Cell and Molecular Biology

Human Adipose-derived Stem Cells and Their Characteristics

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Adult human adipose stem cells (hASCs) primarily consist of two immunophenotypically distinct cell types, pericytes (CD31-/CD45-/CD34-/CD146+) and adventitial cells (CD31-/CD45-/CD34+/CD146-). Both cell types can be prospectively isolated from the perivascular niche of human lipoaspirates by Fluorescence Activated Cell Sorting (FACS), and each participates in tissue regeneration. Interestingly, studies enlisting populations of adventitial cells have reported some differences in their properties suggesting these populations are not homogeneous, and clonal studies are beginning to confirm the heterogeneity of these cells. We are exploring unique subsets of adventitial cells to determine differences in proliferation rate, differentiation potential, morphology, surface marker expression, and trophic factor secretions. The analyses of two clonal populations, consisting of pericytes and adventitial cells respectively, have revealed a difference in the expression of VEGF, a key trophic factor in angiogenesis, as well as differences in morphology and surface marker expression. Since cell aging is one hypothesis that could explain these differences, we examined subsets of cells that have evolved after 5 passages in culture from one clone, 109A. Cells expressing less CD-A, surface markers, were more adipogenic and more proliferative than cells derived from the original clone. CD-B low expression cells were compromised in their colony forming ability, a property associated with regeneration. These results suggest that differences in the clonal populations may be due in part to changes as the cells age. Further studies are now looking for markers that might predict desirable properties in freshly isolated hASCs that could allow clinicians to enrich for regenerative subsets which are most potent for specific regenerative applications.

Funder Acknowledgement(s): University of California, Los Angeles

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54

Subcategory: Cell and Molecular Biology

The C. elegans Microtubule Minus-end Capping Homolog, PTRN-1, Stabilizes Synapses and Neurites

Centennial Day, Harris Stowe State University
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The nervous system functions by making connections to other neurons or muscle cells at sites called synapses. The cellular microtubule cytoskeleton functions in neuronal path-finding during development and in moving material to synapses. The role of regulators of microtubule minus-end dynamics in neuronal function remains largely unexplored. In epithelial cells, CAMSAP proteins cap microtubule minus ends, and are important for the stability of cell adhesions. Our hypothesis is the C. elegans CAMSAP homolog (ptrn-1) affects the overall stability of axons and synaptic specializations, neurotransmission, and body movements.

We used microscope observations of wild type worms and ptrn-1 mutants and found neuromuscular defects in locomotion and reversal frequency and morphological defects in neuron shape. We also tested neurotransmitter communication using an aldicarb assay; our preliminary data indicate that ptrn-1 mutants have small defects compared to wild type worms.

Our results suggest that destabilization of microtubule structures caused by loss of ptrn-1 leads to changes in neurite morphology and have effects on behavior. We propose a model whereby local minus-end microtubule stabilization mediated by a functional PTRN-1 is necessary for normal behavior and maintenance of neuron shape. Future research will investigate the molecular role of PTRN-1 in cytoskeletal structures.

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55

Subcategory: Cell and Molecular Biology

Proteomic Evaluation of Potential Stress Induced Interaction Between Serine Palmitoyltransferase-1 and SYK Genes of Proximate Cytogenetic Loci In Human Chromosome 9

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The adaptive survival of cells in response to toxic insult to prevent cell death, involves complex interaction between proteins that may have diverse origin and homeostatic functions to stress. The human serine palmitoyltransferase-1, SPTLC1, is emerging as a stress responsive protein and has been reported to bind an increasing variety of stress response proteins, including the 90 kiloDalton heat shock protein, Hsp90 molecular chaperone. This chaperone is a central integrator of the function of proteins that play key roles in stress response. Interestingly, the SPTLC1 gene at 9q22.2, is located proximate and distal of disease genes on human chromosome 9, that also encode proteins involved in the regulation of cellular response to stress. One such protein is spleen protein-tyrosine kinase, encoded by the SYK gene at the 9q22 cytogenetic band, which is capable of modulating epithelial cell growth and suppressing tumor growth. Syk is also thought to play a role in intracellular signal transduction induced by oxidative stress, possibly through interaction with Hsp90 and protein kinase B, AKT. However, the possible interaction of SPTLC1 and Syk, or the consequence of such interaction on stress response has not been examined. In this report, we use confocal microscopy and Western blot analysis to examine the localization and possible functional interactions of SPTLC1 and Syk in inflammation associated cancer cell lines following exposure to the anti-inflammatory/-proliferation drug, Celecoxib. Our result shows the translocation of SPTLC1 from a cytoplasmic domain to focal adhesion sites in Celecoxib treated Prostate cancer cells. In addition, a comparative data is presented on Syk localization, expression and protein interaction in the same cell line following exposure to non-lethal doses of Celecoxib. This report begins to help shed new insight into possible signaling role for SPTLC1 in an interaction network that may include Syk, during cellular response to stress.

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56

Subcategory: Cell and Molecular Biology

Creb1 and Akt2 Expression in Adult Mice with Chronically Activated α1A Adrenergic Receptors

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Previous studies have shown that the G-protein coupled α1A Adrenergic Receptor plays an important role in many beneficial phenotypes, such as increased rates of adult neurogenesis and higher cognitive function. The aim of the current study is to examine expression differences in gene expression in Creb1 and AKT2, in mice with constitutively active mutant- α1A Adrenergic Receptors (CAM- α1AARs). Through quantitative polymerase chain reaction (qPCR) methods, relative levels of CREB1 and AKT2 expression were observed, when α1AARs are made constitutively active; this was achieved by comparing expression levels of CAM- α1A-AR mice to WT mice. Results were inconclusive for both CREB1 and Akt2 data due to the lack of consistency in correlation in the samples tested. Further research is needed to elucidate whether there is a correlation between α1AAR activation and expression of Creb1 and Akt2.

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57

Subcategory: Cell and Molecular Biology

Engineering of Escherichia Coli's TesA Thioesterase for Production of Lauric Acid

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Over the past decade, fatty acid prices have more than quadrupled. These useful chemicals are the primary building blocks of personal hygiene consumer products and precursors to renewable biofuels. Thioesterases in E. coli are used to overproduce fatty acids. Specifically, we are interested in the production of medium chain fatty acids synthesized by TesA (a native thieoesterase in E. coli). The objective was to modify the struc-

ture of the enzyme for overproduction of lauric acid (12:0) and decreased interaction with the C14 Acyl-ACP. We hypothesized that the alteration of a few specific amino acids near the active site of TesA would change substrate specificity. Mutants were created through the use of genetic engineering techniques and confirmed by DNA sequencing. Then, fatty acid production of the mutants was tested. This was done by fatty acid extraction, methylation, and GC/MS analysis. The fatty acid profile of the generated mutants was compared with regards to an internal standard to the fatty acid profile of the control wild type TesA. Protein analysis was conducted by using protein extraction and confirmation of TesA by SDS-PAGE. Through this study, a mutation was found that resulted in higher levels of lauric acid, and an important residue for the thioesterase activity was identified. This suggests that specific amino acids can be targeted for future protein engineering efforts. Further work includes modifications and testing of future TesA mutant predictions and application of knowledge to other industrially relevant thioesterases.

References: Lennen RM, Pfleger BF. 2013. Modulating Membrane Composition Alters Free Fatty Acid Tolerance in Escherichia coli. PLoS One 8:e54031.
Lennen RM, Braden DJ, West RA, Dumesic JA, Pfleger BF. 2010. A process for microbial hydrocarbon synthesis: overproduction of fatty acids in Escherichia coli and catalytic conversion to alkanes. Biotechnol. Bioeng. 106:193-202.
Lennen, R. M., Politz, M. G., Kruziki, M. A. and Pfleger, B. F. (2013). Identification of transport proteins involved in free fatty acid efflux in Escherichia coli. J Bacteriol 195(1): 135-144.

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58

Subcategory: Cell and Molecular Biology

At the Heart of Microtubule Nucleation: Elucidating the Interface Between α- and γ-tubulins

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Microtubule nucleation and assembly are accomplished via the interplay of two factors: the α/β-tubulin heterodimer, which polymerizes to form microtubules, and the γ-tubulin ring complex (γTuRC), which nucleates microtubule formation. Based on structural studies of microtubules and the γTuRC, microtubule nucleation is proposed to occur by a direct interaction of γ-tubulin with α-tubulin, however this interaction has never been experimentally confirmed. The objective of this study was to definitively show that γ-tubulin and α-tubulin interact and additionally to identify the residues involved in this interaction. To this end, we made use of the yeast two-hybrid system along with site-directed mutagenesis of key residues in Xenopus γ-tubulin proposed to be involved in this interaction (D176A, E177A, M178R, S179A, and V182R). Additionally, we used error-prone PCR to make random mutations and thus, discover additional residues that may be involved in this interaction. Using the yeast two-hybrid system, we have shown that γ-tubulin and α-tubulin interact. This system is now being used to test which mutants of γ-tubulin were still capable of interaction with α-tubulin. By identifying the domains in γ-tubulin required for interaction with α-tubulin, further studies can be conducted to specifically address how disruptions in microtubule nucleation affect cell physiology and division.

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59

Subcategory: Cell and Molecular Biology

Untangling Amoeboid Diversity Using DNA Sequencing and Bioinformatics

Lydia Gorfu, Spelman College

The diversity of microbial organisms are poorly known due to their small size, culturing difficulties and paucity of diagnostic phenotypic variations (Tekle 2014). Based on light microscope morphology and genetic data, a potentially new species of amoeba belonging to the genus Cochilopodium have been investigated. The Genus Cochlipodium (Hertwig and Lesser, 1874) is a group of amoebae characterized by lobose, discoid shape outlined with a flexible layer of minute scales termed tectum. Stationary Cochliopodium are described as having a central granuloplasmic mass surrounded by a narrow hyaloplasmic border, while locomotive Cochliopodium displayed an oval or triangular central granuloplasmic hump narrowing from its anterior to posterior end (Bark, 1973; Krudryavstev, 1999). The amoeboid genus Cochilopodium has become of increasing interest its rather unique morphology and peculiar cell fusion behavior (Tekle et al. 2013). Presently, there are around 20 published and formally recognized species of Cochliopodium, varying in size from <20µm to more than 80µm in length (Kudryavtsev 2000, 2006). A new lineage of amoeba labeled as 'Con1' is isolated from mixed culture and grown monoclonally. The identity of this isolate is confirmed using molecular genetics. Using bioinformatics tools and newly generated morphological characters including light microscope and cytoskeletal features obtained using immunocytochemistry methods, the new amoeba is described as a new member of the genus Cochilopodium.

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60

Subcategory: Cell and Molecular Biology

Differential Responses to Insulin in Young and Old Human Cardiac Cells

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Insulin resistance plays a causative role in various age-related conditions and potentially contributes to cardiovascular morbidity in the elderly. Cardiac insulin resistance is defined as defects in insulin-induced responses in the heart cells. As of today, limited studies address the role of the insulin receptor and its downstream pathways in cardiac aging.

We hypothesize that there will be a difference in insulin receptor signaling in young hearts as compared to old hearts. To study insulin responses in young and aged hearts, we analyzed the non-myocyte population of cardiac cells obtained from two subjects. These isolated cells actively proliferate in culture and can be used for the experiments in vitro. In order to compare young and old cells from the same heart, we induced cellular senescence in a sub-population of cells from each subject using a short exposure to a low dose of doxorubicin. We employed established phenotypic markers to confirm by confocal microscopy the development of the senescent phenotype in doxorubicin-treated cells (old), as opposed to the untreated population (young). The Insulin Receptor (IR) isoforms, IR-A and IR-B, have different effects on cell proliferation and metabolism, and the expression of these isoforms in young and old hearts has not been studied before. We examined the expression of IR-A and IR -B in young and old cells by real-time RT-PCR analysis. We then studied the IR signaling in young and old cells in response to 15 minute stimulation with 10 nM insulin. We performed immunoblot to evaluate the relative level of activation of Erk1/2, Akt and FOXO3a in young and old cells in basal conditions and after insulin treatment. We found that 72 hours after the challenge with doxorubicin, the old myocardial cells exhibit senescent phenotype: proliferative arrest, induction of persistence DNA-damage responses, and an increase in the percent of cells expressing a cell-cycle inhibitor specifically associated with the cellular senescence. The basal level of the phosphorylation of Erk1/2, Akt and FOXO3a was substantially higher in the old cells comparing to young cells. Unlike in young cells, the treatment of old cells with insulin did not promote further activation of these signaling effectors.

Our data suggest that the activation of insulin receptor signaling is impaired in the old cardiac cells. This may provide an insight on the molecular mechanism leading to the deterioration of the heart function with age.

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61

Subcategory: Cell and Molecular Biology

Is Microglial Morphology Impacted by Inhaled Particulate Matter?

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Geological samples were collected from two different surface types ("map units") of the Nellis Dunes Recreation Area (NDRA), an area outside of Las Vegas, NV. The unit known as CBN1 consists of sandy soil whereas the unit known as CBN3 consists of rock-covered soil. When people recreate in the NDRA, which is typically done with off-road vehicles (ORVs), dust is released to the air. These dusts are thought to be hazardous to the people who recreate at the NDRA and to people in the city of Las Vegas because they contain heavy metals.

To determine if the dusts influence inflammatory processes in the brain, we evaluated microglial morphology as a marker of neuroinflammation in brains of mice dosed with 0-100 mg/kg of dust from CBN1 or CBN3. Six mice per dose group for each map unit were dosed once/week over a 28-day period. After removal, fixation, and paraffin embedding, brains were sliced into 10 micron sections using a microtome. Brain sections were stained immunohistochemically with a primary antibody against ionized calcium binding adapter molecule 1 (Iba-1), an antibody specific to microglia. One slide/dose/map unit contained sections that were not stained with Iba-1, to serve as negative controls. After staining, the total number of amoeboid and ramified microglia were counted in each section. An amoeboid morphology is indicative of activated microglia and therefore a marker of inflammation; a ramified morphology indicates microglia in the sensing state. Within each map unit, microglial morphology did not differ by dose.

However, overall, CBN1 had more amoeboid microglia than CBN3 at every dose, and this difference was statistically and significantly different at doses of 0.01 and 1 mg/kg. These results indicate that either the inherent geomorphology of the

dust or the pattern of metal concentration contributed to the observed differences in microglial morphology between map units and may be subject to further research.

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62

Subcategory: Cell and Molecular Biology

Microtubule Severing and Mechanosensation in C.elegans

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The ability to transform or "transduce" physical force into useful biological information (mechanosensation) is of fundamental importance to living things. The nematode C. elegans has proven to be an especially useful model system in the area of mechanosensation due to its unique, densely packed, large-diameter microtubules (MTs); laser ablation of the six Touch Receptor Neurons (TRNs) illustrated that they are needed to perceive gentle touch to the animal's body (1). Mutagenesis has identified a handful of genes needed for proper TRN function and development (2). The unique TRNs MTs therefore provide a useful in vivo model for the study of MT dynamics and function. Of particular interest are the two known MT severing enzymes katanin and spastin. MT severing enzymes modulate MT dynamics across eukaryotes in multiple contexts including cell division and neuronal development (3).

The MT severing enzymes are emerging as important regulators of MT dynamics and function. Examination of the role of MT severing enzymes in the TRNs will contribute to the greater understanding of MT dynamics and clarify their role that in turn will contribute to a better understanding of a large group of neurodegenerative disorders such as Hereditary Spastic Paraplegia, Tauopathies, Amyotrophic lateral sclerosis (ALS), Parkinson's disease and others that are associated with microtubule severing.

The aim of the experiment was to assess mechanosensory phenotypes of MT severing enzymes and associated proteins. Preliminary data indicate that mutations in the C. elegans homolog of katanin, mei-1, result in mechanosensory defects by an unknown mechanism. We hypothesized that MT severing enzymes and proteins which influence their function may be needed for normal post-mitosis TRN function and development. We addressed this hypothesis by using behavioral analysis of mutants and RNAi feeding targeting genes of interest.

The experiment demonstrated that 43.3% of mei-1 and 78.3% of spas-1 in comparison to 96% N2 wild type animals responded to touch. Therefore, 56.7% of mei-1 and 21.7% of spas-1 in comparison to 4% N2 wild type animals had defect in mechanosensation. Our preliminary results demonstrated that the MT severing enzymes katanin and to a lesser extent, spastin are needed for proper TRN function. In continuation of the project, it is important to examine interaction between MT severing and tubulin post-translational modifications in the TRNs.

References: 1. Chalfie, M. 'Organization of Neuronal Microtubules in the Nematode Caenorhabditis Elegans.' The Journal of Cell Biology 82.1 (1979): 278-89.
2. Chalfie, M., J. Sulston. 'Developmental genetics of the mechanosensory neurons of Caenorhabditis elegans.' The Journal of Cell Biology 82.2 (1981): 358-70.
3. Sharp, D. J., and J. L. Ross. 'Microtubule-severing Enzymes at the Cutting Edge.' Journal of Cell Science 125.11 (2012): 2561-569.

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63

Subcategory: Cell and Molecular Biology

Impact of Mitosis Inhibitors on Neural Stem Cell Division During Mammalian Corticogenesis

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Genesis of the maturating mammalian cortex requires proper division of neural progenitors. Neural stem cells (NSC) undergo asymmetric and symmetric division generating intermediate neural progenitors and neurons with the aid of proteins such as MAGOH. However our understanding of NSC division remains unclear. Our lab aims to understand the molecular mechanisms underlying formation and preservation of neural stem cells and their impact on neurodevelopment disorders such as microcephaly, where overall brain size is smaller. The phenotypic behavior of NSCs observed in the microcephaly model Magoh+/- led to the hypothesis that Mitosis delay leads to the production of aberrant neurons in the expense of intermediate progenitors. To test this hypothesis, mitosis progression of neural stem cells was delayed in brain slices and the consequences on cell division were analyzed 14h later in mouse embryonic brain slices. The

chemical inhibitors STLC and nocodazole were utilized to induce mitotis delay. The two inhibitors had slightly different effects on the output of cell division. Nocodazole and STLC-treated precursors both generated more neurons. However STLC-treated precursors gave rise to a significant fraction of apoptotic cells but not nocodazole-treated ones. To uncover the reason of these differences, the kinetics of the mitotic delay was analyzed in slices treated with the two drugs. Immunofluorescence staining on the treated slices using the cell cycle markers EdU and PH3 shows that nocodazole-treated NSCs recover from mitosis inhibition quicker than STLC-treated ones. Altogether, these results point to a correlation between the duration of mitosis delay in NSCs and the severity of the effect in the progeny.

Funder Acknowledgement(s): Duke University

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64

Subcategory: Cell and Molecular Biology

Maternal Smoking and Hyaluronic Acid Degradation in the Developing Lung

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Maternal smoking is a major risk factor for pediatric lung disease, especially asthma. Because of the oxidation generated from tobacco toxins, direct smoke exposure disrupts the extracellular matrix, which leads to the degradation of hyaluronic acid. Hyaluronic acid is a component of the extracellular matrix, and once it is degraded, the breakdown products act as chemoattractants for leukocytes, creating an inflammatory infiltrate.

In the developing lung, exposure to tobacco toxins is transplacental, and therefore it is unclear if maternal smoking causes the identical breakdown of hyaluronic acid in the developing lung. We tested our hypothesis that hyaluronic acid degradation would be detected in the lungs of neonatal mice with tobacco toxin exposure as in adult tobacco-toxin-exposed mice. Female C57Bl/6 mice with/without exposure to mainstream cigarette smoke (3 research cigarettes a day, 5 days a week) were mated to nonsmoking males. Exposure to cigarette smoke continued throughout the pregnancy. The lung tissues were processed for histology and stained for hyaluronic acid breakdown products. The lung tissues of neonatal mice with tobacco toxin exposure (N = 2) showed a trend toward greater hyaluronic acid intensity compared to the staining in the tobacco- naïve mice (N = 3, P = 0.1). Negative control slides had minimal staining.

These findings indicate that exposure to tobacco toxins in the developing lung via maternal smoking has the same effects as direct cigarette smoke exposure in the adult lung as regards to hyaluronic acid degradation. Future research could involve understanding other factors that mediate later heightened immune responses in offspring who are exposed to tobacco toxins via maternal smoking. This research would further determine the factors that contribute to pediatric lung dysfunction.

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65

Subcategory: Cell and Molecular Biology

Examining the Effects of Egfl7 Overexpression in Placental Vasculature

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The placenta is an essential organ needed during mammalian gestation. It acts as an intermediate between the fetal and maternal environments where it facilitates the exchange gases, nutrients, and waste products. A properly functioning placenta is vital to the development of the fetus. Any abnormalities can lead to birth defects in the fetus and lethality of the mother and fetus. EGFL7 is a protein that was originally identified by its endothelial-restricted expression at high levels in proliferating endothelial cells during fetal development and during vascular regeneration (reviewed in Nichol and Stuhlmann, 2011). Egfl7 plays a role in both physiological and pathological angiogenesis. Transgenic mice that overexpress Egfl7 (Tie2-Egfl7) start to show angiogenic defects beginning at embryonic day E12.5 (Nichol et al., 2010). In addition, about 20% of the transgenic mice embryos die around E12.5 (Nichol et al., 2010). The same study also showed that EGFL7 modulates Notch signaling, a key signaling pathway during vascular development. Since proper placental development is vital to embryogenesis, overexpression of Egfl7 may affect proper development of the placenta, which may lead to fetal defects and fetal lethality. To test this, I examined the placentas of a Tie2-Egfl7 transgenic group and a control group at embryonic days (E) 8.5, 10.5, and 12.5 to determine if Egfl7 has an effect on normal placental development. Histological analysis, immunostaining, and RT-PCR was used to determine morphological differences of the mutant placentas and to quantify the expression levels of Egfl7 and Notch target genes. We were able to determine that Egfl7 overexpression does affect the development of the placenta. Though histological analysis and immunostaining we were able to see that phenotypes in the placenta are apparent as early as E8.5 but are more prevalent in the later time point of E12.5. Using RT-PCR we were able to determine that Egfl7 is significantly overexpressed in the trans-

genic placentas. We were also able to determine that Hes1, a notch target gene, is significantly down regulated in transgenic placentas. Future experiments would include redoing previous experiments in larger quantities. Quantifying the levels of other genes associated with Egfl7. Also, looking at the placental development during later time points such as E14.5 and E18.5. These experiments would help strengthen our preliminary findings.

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66

Subcategory: Cell and Molecular Biology

Establishing a Co-culture Between Pseudomonas Aeruginosa and IB3-1 Epithelial Cells for Evaluation of New Treatment Strategies

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Pseudomonas aeruginosa, a pathogen common to cystic fibrosis (CF) lung infections, is known to activate a pro-inflammatory immune response in resident epithelial cells through the nuclear factor-kappa light chain enhancer of activated B cells (NF-kB) signaling pathway. Recent research has demonstrated that polysaccharide nanoparticles coated with NF-kB decoy oligonucleotides (ODNs) possess anti-inflammatory activity, as indicated by a reduction in the secretion of pro-inflammatory mediators when IB3-1 CF epithelial cells were pre-treated prior to stimulation with lipopolysaccharides or interleukin 1-B. To further demonstrate the capacity of the NF-kB decoy ODN-coated nanoparticles to reduce inflammation, an in vitro model that more accurately portrays CF lung inflammation and infection is necessary. We hypothesize that the coated nanoparticles will function in a P. aeruginosa-IB3-1 epithelial cell co-culture to further mitigate inflammation. The immediate goal of this study was to establish a P. aeruginosa-IB3-1 epithelial cell co-culture. As a first step, P. aeruginosa (PA01 strain) was grown in LHC-8 media without gentamicin at 37°C with shaking, and a dilution series was prepared. IB3-1 epithelial cells were cultured in LHC-8 complete growth media in collagen-coated flasks at 37°C, 5% CO2. Initially, IB3-1 cells were passaged into a collagen-coated well plate and grown to confluency. PA01 were added to transwell inserts at concentrations of 500,000 to 50 CFU/mL and placed in indirect contact with underlying IB3-1 cells. After 24 hours, visual inspection revealed only a minor amount of cell death. To establish a direct contact co-culture, the bacteria dilution series will be added to the wells containing confluent IB3-1 cells. After incubation for 1 hour, the supernatant will be replaced with LHC -8 complete growth media supplemented with 4% arginine. At 5, 23, and 47 hours, live/dead staining will be performed, and supernatant will be collected to analyze secretion of pro-inflammatory mediators. Once an optimal concentration of P. aeruginosa has been identified, as indicated by maximum secretion of pro-inflammatory mediators by IB3-1 cells without induction of apoptosis, studies will be continued in the presence of NF-κB decoy ODN-coated nanoparticles. Thus far, we have demonstrated that an applicable model of CF infection and inflammation can be established.

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67

Subcategory: Cell and Molecular Biology

Comparing the Apoptotic Response of a Triple Negative Breast Cancer Cell Line to Chemotherapeutics

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Breast cancer is a heterogeneous disease that primarily affects women resulting in 230,000 new cases and 40,000 deaths each year. Paradoxically, while Caucasian-American women are diagnosed with breast cancer at higher rates than African-American women, African-American women have a higher mortality rate when compared to other ethnic groups resulting in a health disparity believed to be due in part to an increased incidence of the triple negative breast cancer (TNBC) subtype. Triple negative breast cancer is characterized by its high growth rate, increased incidence of metastasis, and increased recurrence rate. Another characteristic of TNBCs are their lack of estrogen receptor (ER) and progesterone receptor (PR) expression along with low human epidermal growth factor receptor 2 (HER2) expression. The ER, PR, and HER2 receptors are targeted by designer drugs thereby decreasing the mortality rate of other breast cancer subtypes that express these receptors; however, there are no targeted therapies against TNBC. Our lab is interested in discovering biomarkers for the triple negative breast cancer phenotype which could potentially lead to targeted therapy, therefore, we need to characterize the ability of TNBC cells to undergo apoptosis. Here we investigate the apoptotic response of the TNBC cell line HCC1806 to the chemotherapeutic drugs doxorubicin and staurosporine. The cells were exposed to the same concentration of chemotherapeutic drugs, and then we compared the response of the HCC 1806 cells and revealed light

microscopy and PARP cleavage that staurosporine elicited significantly more apoptosis than doxorubicin. We established that the TNBC cell line HCC1806 was able to undergo apoptosis even though it reportedly has frameshift p53 mutation. We plan to determine whether p53 pathway network proteins or another apoptosis response pathway is responsible for the cell death response. These results and future directions will provide a baseline characterization of the ability of TNBC cells to undergo apoptosis for drug targeted therapies.

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68

Subcategory: Cell and Molecular Biology

Aging-associated Paneth Cell Increase in the Jejunum and Mislocalization in the Ileum

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The small intestine (SI) is key in nutrient absorption and forming a barrier between the body and luminal contents. Aging affects the SI and can lead to decreased nutrient absorption efficiency, degraded barrier function and small bowel bacterial overgrowth. The SI houses a diverse population of cells including intestinal epithelial stem cells (IESCs) which differentiate into specialized cell types including the secretory Paneth cells. Paneth cells provide support for IESCs by secreting growth factors and help to maintain a stable microbiome by secreting antimicrobial factors into the lumen. Compared to the proximal SI, the ileum has an increase in bacterial load and an increase in Paneth cells. Previous studies in our lab have shown that aged animals have more IESCs and Paneth cells in the jejunum compared to young animals.

We hypothesize that aging alters the number and/or function of Paneth cells. SI from young (2-4 months) and old (18-24 months) mice was stained for markers of Paneth cells including lysozyme and phloxine tartrazine/alcian blue. Aged mice had significant increase in the number of out of place lysozyme positive Paneth cells compared to young animals. There was no difference in average number of Paneth cells per crypt between groups. Significantly more Paneth cells were present in the ileum compared to the jejunum in both young and old animals and no difference was seen in the fold increase between the groups. Intermediate cells were observed throughout the crypts of both groups. The granule size in all intermediate cells is smaller than those in the Paneth cells .

Misplaced lysozyme positive cells may represent a defect in migration and/or differentiation in the ileum of aged animals. The decreased granule size in intermediate cells compared to Paneth cells suggests a potential difference in secretory contents. Paneth cells are key to maintaining a stable microbiome which is often affected in aging populations. Understanding the mechanism behind Paneth cell increase and mislocalization with aging and the function of intermediate cells may allow development of therapeutics for aging-associated diseases.

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69

Subcategory: Cell and Molecular Biology

Developmental Dynamic Expression of Corticotrophin Releasing Factor Receptor 1 in the Cochlear Nucleus

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The hypothalamic pituitary adrenal axis (HPA) mediates a systemic stress response that includes behaviors such as the fight vs. flight response that is triggered when a person is afraid. Activity of Corticotrophin Releasing Factor (CRF) binding to its receptors initiates this flight or fight response, but in the central nervous system, CRF and its receptors function to modulate neural activity in ways unrelated to the HPA function. My project was to investigate the development of CRFR1 expression in the cochlear nucleus.

The objective of this study is to look at CRFR1 receptor distribution within the cochlear nucleus and to examine how the cochlear nucleus develops without CRFR1.

Our working hypothesis is that CRFR1 expression occurs in the cochlear nucleus in a dynamic stereotypic pattern reflecting its maturational processes.

Brain sections from a CRFR1-GFP transgenic mouse line were obtained by using a microtome; immunohistochemical staining of GFP was used to determine the localization of CRFR1; immunoflourescent microscopy was used to document results. By immunohistochemical staining cochlear nucleus of different ages, we determined that in younger animals, expression of CRFR1 is different than in older animals. At post natal day 90, CRFR1 cells are localized within the cochlear nucleus in what was determined to be a mature expression pattern. We also examined two younger ages, post natal day 7 and 18. At P7, CRFR1 was localized within the molecular and granular cell layer, areas that do not express CRFR1 in the mature cochlear nucleus. At P18, molecular and granular cell layer expression was still evident and there was up regulation of cells within the ventral cochlear nucleus. Because of this dynamic expression, we were

interested in examining how the cochlear nucleus develops without CRFR1. We used a mouse line that does not express CRFR1. Our data showed that the cells were organized differently in the knockout mouse, especially within the ventral cochlear nucleus where regions are less cellular than the wild type mouse.

There is differential expression of CRFR1 within the cochlear nucleus sub domains during development. Without the function of CRFR1, there are changes within the cochlear nucleus. Together these findings suggest that CRFR1 could be necessary for the migration and positioning of neurons in the mature cochlear nucleus and required for normal auditory function.

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70

Subcategory: Cell and Molecular Biology

Photoautotrophic Production of L-Lactate in Cyanobacteria

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The benefits of cyanobacterial biorefineries include: remediation of wastewater, synthesis of biofuels from biomass, and production of commodity chemicals. The target chemical of this project, L-lactate, is a renewable material that can be polymerized to create a biodegradable replacement for conventional plastics. To achieve greater L-lactate yield, growth conditions were optimized and the metabolic pathways of Synechococcus PCC 7002 (PCC 7002) were altered. Previous work has improved L-lactate production in Synechocystis PCC 6803(PCC 6803)1. However, PCC 7002 grows more rapidly and therefore has potential to produce target chemicals at a greater rate, but L-lactate production has never been demonstrated in this host strain. PCC 7002 cultures were grown in tubes containing medium A+ at 38˚C, under 200 µmol photons m-2 s-1 illumination, and sparged with 0.4% (v/v) CO2 in air. Growth with different nitrogen sources was performed in modified medium A. NaNO3 and NH4Cl were compared as nitrogen sources to simulate dairy wastewater, a low-cost feedstock, and to determine if a more reduced form of nitrogen would improve growth. Three IPTG concentrations were compared for induction of lactate production. L-Lactate was quantified using an enzyme assay kit and verified by an analytical HPLC system. We have demonstrated that PCC 7002 can synthesize large quantities of lactate upon the introduction of an engineered and over-expressed lactate dehydrogenase, reaching a final titer of 3.7±0.4 mM L-lactate in 120 hours, while the WT PCC 7002 produced no detectable quantities. Consistent to the difference in growth rate between the two strains (≈2.8X faster) PCC 7002 produced L-lactate at a higher rate than PCC 6803. Increasing IPTG concentrations above 0.5 mM may create more enzyme for lactic acid production, but compromised growth rate and lactate production. It was revealed that when using NH4+ as a nitrogen source, pH control is needed to prevent decreased growth and lactate production rates. It is theorized that if the external pH is close to the cytosolic pH of ≈7, lactate cannot be properly excreted in to the media2. This research adds to the knowledge-base of metabolic pathway design that can be applied to produce other high-value chemicals. Future work will be done to increase the amount of CO2 going to lactate production by over-expressing enzymes for the formation of precursor metabolites to lactate formation.

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71

Subcategory: Cell and Molecular Biology

Overexpression of CAH1 in Chlamydomonas Reinhardtii

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Algae hold great promise as a potential source for renewable liquid fuels, with most current research focused on increasing lipid content of natural or genetically engineered species. However, another important strategy for developing algae as a platform for biofuels production is to improve their growth rate. Our immediate goal is to determine if we can increase the growth rate of model organism Chlamydomonas reinhardtii through targeted genetic modifications, and our long-term goal is to apply successful modifications to other algae that naturally produce large amounts of lipids. Like many other phototrophs, Chlamydomonas has evolved a trait to survive under low carbon dioxide (CO2) levels in the atmosphere. The CO2 concentrating mechanism (CCM) works to accumulate inorganic carbon inside the chloroplast in the form of bicarbonate (HCO3-) at a much higher concentration than atmospheric CO2 levels. We aim to repurpose the CCM to function with greater efficiency and under high CO2 conditions to stimulate rapid growth in Chlamydomonas. Within the CCM, we are targeting a carbonic anhydrase

gene (CAH1) for overexpression. The CAH1 enzyme is located in the periplasmic space and is the first enzyme of the CCM to handle the conversion of CO2 to HCO3-. To prepare our overexpression construct we cut our gene synthesized CAH1 coding sequence out of a pUC57 vector and ligated it into our nuclear expression vector pUC-ARG. Using the ARG7 gene as our selection marker, we performed a nuclear transformation of Chlamydomonas. Next, we will analyze transformants by western blot to determine if any overexpress CAH1. Any such transformants will subsequently be analyzed for growth rate and biomass production. If this effort is successful, the next step will be to generate a vector that overexpresses additional CCM genes in hopes of improving growth rates even more.

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72

Subcategory: Cell and Molecular Biology

Testing Possible Treatments for Androgenic Alopecia in a Cell-Based Assay System

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Androgenic Alopecia is a condition affecting 60-70% of the population worldwide. It is characterized by hair loss and thinning in the scalp, and is far more prevalent in men than in women. It is caused by the enzyme 5α-reductase converting the androgen testosterone into its far more potent form, 5α-dihydrotestosterone (DHT). The dermal papilla is a small projection at the bottom of the hair follicle that contains the germinal matrix, which is where mitosis to produce keratin cells (i.e., the building blocks of hair) occurs. It is here that excess DHT disrupts hair growth and causes alopecia. The experiment was run using immortalized human hair dermal papilla cells (HHPDC) that did not have alopecia. Research prior to this study determined that an extract of the plant Avicennia marina known as Avicequinone C inhibited 5α-reductase by 48% at 10 µg/ml. This experiment extrapolates on that research using Avicequinone C as the basis for synthesis and testing. The intention was to see how normal cells reacted to the different substrates tested and to measure how much 5α-dihydrotestosterone (DHT) an unafflicted cell produced. In order to measure this, it was necessary to create a standard TLC plate to which future plates could be compared; this is known as the standard curve. TLC is a process used to separate compounds and to determine the amount of the compound (DHT) on the sheet using ultraviolet absorbance values. For this experiment, a 96 well plate with 10,000 HHDP cells per well is used to test the cell viability of different substrates that are related to Avicequinone C and their effectiveness at reducing DHT production. The substrates are as follows: plumbagin, naphthoquinone, juglone, anthraquinone, isoflavone, beta-naphthol, lapachol, coumarin, WNK-2, Avicennia marina (AM), AM at a higher concentration (1 mg/ml), dutasteride (the positive control), and dimethyl sulfide (the negative control). These are pipetted at 1 µg/ml in duplicate onto a 96 well plate that contains HHDPC and media. After incubation for 48 hours, the media is removed and centrifuged. The supernatant is then removed, dried, and resuspended with methanol. The resuspension is dotted onto a silica aluminum plate using a TLC machine at 4 µl per spot. After running it through the 8:2 toluene-acetone mobile phase, the plate is dried, dipped in a 42.5% phosphoric acid solution, dried again, and heated at 120ºC for 20 minutes. The resulting plate is then placed in a machine and scanned. At the time of this study, the standard curve was incomplete, therefore, the only conclusions possible were regarding cell viability. Our results indicate that only anthraquinone, isoflavone, naphthol, lapachol, and coumarin have future use in research into treatments for androgenic alopecia because they had high cell viability. By using the completed standard curve, it would be possible to determine which substrate produced the least amount of DHT. This is the future goal of the study.

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73

Subcategory: Cell and Molecular Biology

Defining Kinase-Dependent Interactors of the Parkinson's Disease Protein LRRK2

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Parkinson's disease (PD), a neurodegenerative disease that occurs in 2% of people older than 65 years, causes progressive motor symptoms, including tremor and difficulty walking and speaking. Mutations in leucine-rich repeat kinase 2 (LRRK2) are the most common cause of familial PD and are also thought to contribute to some cases of sporadic PD. LRRK2 is a complex multi-domain protein whose cellular functions and role in PD are not yet well understood. However, LRRK2 mutations that lead to PD, such as the G2019S mutant, occur in the kinase domain of the protein and lead to increased LRRK2 kinase activity. Therefore, it appears that upregulation of LRRK2 kinase activity somehow leads to neurodegeneration; how this occurs is not known. Potential kinase-dependent protein-protein interactors of LRRK2 were identified through affinity chromatography and mass spectrometry using wild type LRRK2, LRRK2 G2019S, and LRRK2 D1994A (a kinase-dead mutant). Next, we tested the interac-

tions of LRRK2 with these candidate interactors through co-immunoprecipitation experiments ("pull-downs") and Western blotting. Preliminary results show that LRRK2 interacts with proteins including the 14-3-3 family and synapsin. 14-3-3 proteins are regulatory molecules that bind to numerous signaling proteins and are known LRRK2 interactors. Synapsins are a family of proteins important in synaptic neurotransmitter release. It is interesting to note that LRRK2 did not interact with Parkin, another genetic cause of Parkinson's Disease. Future directions include kinase assays to determine whether interactors are LRRK2 kinase substrates.

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74

Subcategory: Cell and Molecular Biology

A Novel Role for Cypin as a Proteasome Inhibitor

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Neurological and cognitive disorders are marked by many structural and functional abnormalities in the nervous system, including alterations in the dendritic tree and spine morphology. Cypin (cytosolic PSD-95 interactor) is an abundant protein in some regions of the brain that increases dendritic branching. It was originally discovered as a binding partner of postsynaptic density protein-95 (PSD-95), a synaptic signaling and scaffolding protein found in the postsynaptic density of neurons. When cypin is overexpressed in hippocampal neurons, synaptic targeting of PSD-95 is disrupted, but global PSD-95 levels increase. Previous work in the Firestein laboratory confirmed that cypin binds to a subunit of the proteasome, leading us to hypothesize that cypin might inhibit proteasome-mediated degradation of PSD-95. To test this hypothesis, we co-transfected COS-7 cells with a proteasome sensor and either wild type cypin or one of two cypin mutants with a protein domain deletion. The proteasome sensor encodes for an unstable fluorescent protein, ZsGreen, which is rapidly degraded in the presence of active proteasomes. We used immunostaining and fluorescence microscopy to image cells and compared resulting ZsGreen intensity between experimental conditions. Our results show an increase in ZsGreen intensity in cypin-expressing cells, suggesting that cypin inhibits degradation of ZsGreen. The same result was found when each of the cypin mutants was expressed, indicating that this effect is not dependent on either of the protein domains tested. Further studies will focus on elucidating if other protein domains are necessary for cypin to inhibit ZsGreen degradation, as well as testing our hypothesis in hippocampal neurons.

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75

Subcategory: Cell and Molecular Biology

Delivery of a Constitutively Active Mutant of the Netrin-1 Receptor, Deleted in Colerectal Cancer (DCC) to Promote Corticospinal Tract Regeneration Following Spinal Cord Injury

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Millions of Americans are currently living with traumatic spinal cord injury (SCI) often resulting in paralysis and sensory loss. One of the most important tracts affected by SCI is the corticospinal tract (CST)- whose functional pathway is responsible for fine motor control in humans. To date, attempts to enhance CST regeneration have met with very limited success. We have recently reported successful implementation of neural stem cell (NSC) transplantation for SCI. These grafts proliferate into mature neurons, sending long-distance axonal projections throughout the CNS. Moderate CST regeneration into this NSC graft has been demonstrated; however, no improvement on motor tasks was observed. Our ultimate goal is to combine NSC grafts with gene therapy to enhance the intrinsic regenerative capacity of CST neurons. DCC is a Netrin-1 receptor that enhances axon outgrowth upon homodimerization. Previous work by our group identified Netrin-1 as a repulsive signal present spinal cord. Deleted in Colorectal Cancer (DCC) is a receptor for netrin-1 that mediates both attraction and repulsion in developing axons in the spinal cord (Löw et al., Journal of Neuroscience, 2008). A mutant form of DCC (myrDCCdP1) that cannot dimerize with the repulsion-mediating receptor family Unc5 has been shown to enhance axon outgrowth by forming attraction-mediating DCC-DCC homodimers (Gitai et al. 2003). We hypothesize that overexpression myrDCCdP1will enhance CST regeneration into permissive neural stem cell grafts placed in sites of SCI. To test our hypothesis we have generated two novel viral constructs to overexpress DCC. We have designed AAV viral vectors expressing myrDCCdp1 along with the robust reporter gene, superfolder GFP (Pedelacq et al 2006) that labels fine axonal processes in the spinal cord at a much higher robustness than previously possible with traditional tracers. We are currently testing the effects of this construct on DRG neurons in vitro, IPC derived neural stem cells in vitro and animals in vivo for CST regeneration. We will assess the effects of DCC overexpression on neurite outgrowth in vitro by transducing DRG neurons and IPSC-derived neurons. Next we will assess the ability of myrDCCdp1 overexpression in vivo to promote regeneration of the cortico-

spinal tract. One week after delivering a spinal cord CST lesion and concomitant NSC graft, we transduced corticospinal motor neurons with myrDCCdp1 and control virus; 4 weeks later, growth of GFP+ axons into the graft are being assessed. Positive results will provide a novel and promising new strategy to enhance regeneration in CST. Moreover, using this approach, and upon a correct hypothesis will result in the identification of a novel therapeutic target to enhance regeneration of this notoriously refractory and functionally important tract (CST), and, additionally, gain a greater understanding of the intrinsic molecular mechanisms that that can enhance regeneration of adult, injured CNS axons.

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76

Subcategory: Cell and Molecular Biology

Developing a Novel Method for Generating Recombinant Adenovirus

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Genetic heart conditions also known as cardiomyopathies have been etiologically linked to mutations in sarcomeric proteins. There is a need to understand how these mutations affect functional aspects of the sarcomere which eventually lead to disease. β-myosin is the main isoform in cardiac tissue and 40% of heart disease-causing mutations occur in the β-myosin motor domain. The current system used to express the recombinant human β-myosin motor domain is long and cumbersome with a low yield due to a reliance on homologous recombination and the toxicity of the protein to adenoviral growth.

However, we have streamlined this process by exploiting site-specific recombinant processes to develop a faster and more efficient system for myosin production. By using FLP/FRT and multiple Cre/lox recombination mechanisms, we engineered a shuttle and used recipient virus to produce high levels of adenovirus that synthesize the myosin motor protein much faster than the current system. Preliminary results show that the sites for recombination are functional and myosin production will be inducible in the presence of the recombinases. Our hope is that this process could also be used to synthesize other disease-related proteins so that they may be studied more easily.

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77

Subcategory: Cell and Molecular Biology

Calphostin C Inhibits Angiogenic Activity in HESC Cells

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The critical role of endometrial angiogenesis related to decidualization, early placentation, and embryo survival is widely accepted. Coordinated vascular development needs to occur on both maternal and fetal sides of the unique implantation interface. Dysregulation of these processes can result in defective implantation and early miscarriage. However, even if miscarriage is averted, failure of normal angiogenic growth factor production in early pregnancy is associated with subsequent pregnancy complications including preeclampsia and fetal growth restriction. The exact mechanism(s) underlying regulation of VEGF and other angiogenic factor production during this crucial period of development is unknown. Previous studies done in our lab showed that retinoic acid (RA), in the presence of transcriptional activators of VEGF (such as tetradecanoylphorbol acetate, TPA; TGF-β), augments VEGF secretion in human endometrial stromal cells. To elucidate which kinase pathway is involved in this phenomenon, we tested multiple kinase inhibitors in our experiments. In this study, we hypothesized that Calphostin C (Cal C), an upstream protein kinase C (PKC) inhibitor of VEGF production, will specifically inhibit RA+TPA induced VEGF production. For this experiment we used HESC cells, which were treated with the following concentrations of reagents: 1uM of all-trans RA, 50nM of TPA, and 0.5uM and 1uM of Cal-C. The various combinations of treatments (in duplicates) are as follows: no treatment, RA (1uM), TPA (50nM), RA combined with TPA, RA combined with TPA and Cal C (1uM), and finally RA combined with TPA and Cal C(0.5uM). VEGF ELISA and IL-6 ELISA assays were used for quantification with results expressed in pg/ml. Based on our results, in human endometrial stromal cells, the PKC inhibitor, Cal C, specifically inhibits RA induced VEGF secretion and has what appears to be little effect on IL-6 production. We anticipate that the positive effect of RA on VEGF secretion from ESC observed in the present report will prevail as a contributor to implantation site vascularization.

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78

Subcategory: Cell and Molecular Biology

Quantifying Lipid Contents of Liposomes with Plasmonic Nanoparticles Using UV-Vis Spectrometry

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Phosphatidylserine (PS) and monosialotetrahexosylganglioside (GM1) are examples of two host-derived lipids in the membrane of enveloped virus particles that are known to contribute to virus attachment, uptake, and ultimately dissemination. PS has been shown to facilitate apoptotic mimicry and enhance glycoprotein- independent uptake of Vaccinia, Ebola, HIV, and Dengue viruses. Besides, GM1 enable the glycoprotein-independent binding of HIV-1 particles to mature dendriticcells (mDCs) through CD169 receptor.

We used gold nanoparticles (NPs) as bright plasmonic labels for targeting PS and GM1 on the surface of a set of liposomes with known compositions. The higher concentration of target leads to a higher density of GNPs on the surface of liposomes; therefore, it creates stronger plasmon coupling and a red-shift of extinction spectra. These lipids were, then, quantified by characterization using UV-Vis spectrometry, and verification through scanning electron microscopy (SEM), and Inductively-coupled Plasma mass spectrometry (ICP-MS). The obtained data supports our hypothesis that GM1 binding of gold NPs has a higher affinity than PS binding. This is due to lower dissociation constant for cholera toxin-GM1 binding than annexin-PS binding. Liposomes with 20% PS show up to 3 nm red-shift of plasmonic extinction peak, while for 10% GM1 liposomes up to 6 nm. Changes in the concentration of these lipids in viral envelope can change the virulence. The performed studies can provide a simple method to be used to quantify the unknown concentrations of lipids. Therefore, we'll apply it on virus-like particles with unknown lipid compositions in future research.

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79

Subcategory: Cell and Molecular Biology

Regulation of CD44 Alternative Splicing by TDP-43

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The CD44 gene encodes a cell membrane receptor involved in multiple cellular functions in normal physiology as well as in disease. It exists in a variety of isoforms (i.e., CD44 variants) mainly due to the alternative splicing of 9 of its 19 exons. Some CD44 variants are known to correlate with diseases such as cancer and multiple sclerosis. Therefore, CD44 pre-mRNA processing is key in its functional association with disease. TDP-43, a protein involved in mRNA splicing and causative of Amyotrophic Lateral Sclerosis (ALS) when mutated, theoretically can bind to the CD44 pre-mRNA intron between exons 13 (v9) and 14 (v10), where we found a UG-rich TDP-43 binding consensus sequence. Therefore, we hypothesize that TDP-43 can regulate the alternative splicing of CD44 and thus the expression of specific CD44 isoforms. Upon transfection of CD44-positive cells (expressing multiple CD44 variants) with a wt TDP-43-expressing construct the alternative splicing pattern of CD44 exons 13 and 14 was altered compared to a mock transfection control and a mutant TDP43-expressing construct control. This finding is consistent with a novel mechanism potentially relevant to ALS in which the alternative splicing of CD44 is regulated by TDP-43 to promote the expression of putative disease-associated CD44 isoforms. Future experiments will be focused on detecting the binding of TDP43 to its putative consensus sequence on CD44 intron 13-14 by RNA pull-down assays.

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80

Subcategory: Cell and Molecular Biology

Establishing a Connection Between Rippling and Development in Myxococcus Xanthus

Marguerite Smith, Syracuse University

Myxococcus xanthus is a gram negative soil bacterium that grows as a biofilm called a swarm and exhibits coordinated multicellular behavior in response to environmental stress. As part of its response to starvation stress, an M. xanthus swarm will sometimes create a series of waves called ripples. M. xanthus ripples are unique because they are the first observed instance of non-zhabotinsky waves in a biological system; cells align into alternating regions of higher and lower density, and then coordinate reversals to create a dynamic pattern that appears to be two sets of opposing traveling waves. Ripples are produced in part through a contact dependent extracellular signal (C-signal), which is mediated through local changes in cell density and alignment. C-signaling is part of a cascade that coordinates the temporal and spatial movement of cells across a swarm. Under starvation conditions, this signaling cascade controls a developmental process that ultimately transforms an M. xanthus swarm

into multicellular structures called fruiting bodies. The relationship between rippling and fruiting bodies is not known. Sometimes M. xanthus cells appear to be forming fruiting bodies and rippling simultaneously, but other times fruiting bodies appear to form in the absence of rippling. This observation makes it unclear as to whether or not the behaviors are connected. Both development and rippling require cell motility, and so if they are functionally connected, then mutations that prevent development without impairing motility would also be more likely to prevent rippling. To determine if such a correlation exists, we have identified 30 mutant strains (including csgA) that have no significant motility defect but fail to form fruiting bodies. We have also developed a microcinematography assay that tests for rippling, and we are in the process of characterizing rippling behavior in these 30 strains. If a statistically significant correlation exists, we intend to examine the behavior of individual cells within these mutant swarms, to see how they differ from wild type with respect to quantifiable metrics, such as alignment, speed, and reversal frequency. Our eventual goal would be to identify changes in the movement of individual mutant cells that can be extrapolated to explain how rippling and development might be connected.

Funder Acknowledgement(s): NSF

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81

Subcategory: Cell and Molecular Biology

Purification of Cyanobacterial RNase Proteins

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Cyanobacteria are photosynthetic microbes that can be used to produce green chemicals and renewable biofuels. However, expressing heterologous biochemical pathways in cyanobacteria remains challenging. mRNA are intermediates that can be degraded by RNases controlling the protein production, but this process is not well understood. Therefore, we are examining the mechanism of mRNA turnover in cyanobacteria by expressing and purifying the RNases III in E. coli. E. coli cultures, one expressing the TEV-GFP protein and another three expressing the different RNase III fusion proteins, were used to inoculate 0.5 L cultures for protein production overnight. Protein expression was induced with isopropyl β-D-1-thiogalactopyranoside (IPTG). When the culture reached an OD 600 nm of 0.5 and the cells were shifted to 30˚C for 3 hours, then lysed and purified using Immobilized Metal Affinity Chromatography (IMAC). The RNase III fusion proteins contain 6-Histidine, sfGFP, and a TEV cut site that it is used to separate the RNase from GFP via TEV reaction. Electrophoresis gel test showed purified TEV protease of approximately 28 kDa. After E. coli induction the correct band size of the three different RNase III proteins were observed. SDS-PAGE showed that TEV protease cleaves the protein and the RNases were collected after the elution. Western Blot membrane was probed with an α-HIS antibody recognizing the band that were expected at 57 kDa and multiple smaller bands that could be the result of protein degradation. These results indicates that all three cyanobacterial RNase III homologs can be expressed as GFP fusion proteins in E. coli and can be further purified using IMAC. They also indicate that the TEV protease was purified and shown to be functional removing the GFP fusion tag from the RNase III. Future research involves identifying the in vivo targets of RNase III in cyanobacteria. This research will lead in a better understanding of the biochemical composition of cyanobacteria.

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82

Subcategory: Cell and Molecular Biology

Building a Brain Atlas for the Larval Zebrafish

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In 2013, the Brain Initiative was launched by the Obama administration with the goal to identify all neuronal cell types, map their connections and study their activity in the human brain. The human brain has 109 neurons, making this a daunting task. The larval zebrafish is a powerful model for addressing the relation of structure to function in a vertebrate brain. Owing to their small size and transparency, it is possible to perform whole brain imaging and monitor the activity of all 100,000 neurons in a live larva. Many transgenic lines are also available in zebrafish, which label known and unknown neural populations with fluorescent proteins. By mapping the location of neuronal populations and incorporating this information into a brain atlas, we have begun to generate a useful reference for neuroscience researchers. The computational analysis of whole brain imaging between larvae with different patterns of labeled neurons will allow comparisons with known neurotransmitter pathways and provide new information on neuronal identity and function.

The goal of my project was to add new data sets to the brain atlas by performing confocal microscopy of immunolabeled wild type and transgenic larva followed by image registration to the reference brain. Using antibody staining, each larvae was dual

stained for a neural pathway of interest and acetylated tubulin. By first registering acetylated tubulin to the reference the data achieved allowed for the pathway of interest to be registered as well. Well known pathways such as glutamate and somatostatin were the first to be imaged and incorporated into the atlas. Following these, a transgenic genetrap line of larva that produced multiple patterns was imaged and incorporated as well. In the future it is the hope to continue to add both known and unknown pathways to the atlas to shed new light on neuronal populations with unknown function and identitiy.

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83

Subcategory: Cell and Molecular Biology

Lnc RNA, LL18/NANCI as an In Vitro Tool in Nkx2-1 Induction in ESC-derived Anterior Foregut Endoderm

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Long non-coding RNAs (lncRNAs) are indicated to play a role in regulating gene transcription; however, the specific mechanisms of action of lncRNAs are unclear. Recently, the lncRNA LL18/NANCI (Nkx2.1-associated noncoding intergenic RNA) which is 2.5kb downstream from thyroid transcription factor-1 (Nkx2-1, a homeodomain transcription factor) was shown to act upstream of Nkx2-1 and regulate lung endodermal differentiation in vivo. Nkx2-1 is the earliest known marker of lung development and has important roles in lung function postnatally. To further investigate lncRNA NANCI, we amplified plasmids for NANCI shRNAs (NANCI shRNA 7, NANCI shRNA 1, pIKO-GFP Scrambled (control)), NANCI overexpression (pLenti7.3/v5 NANCI) and Empty Vector (control) and packaged them in 293T cells and the resulting lentiviruses were titered using Fluorescence-activated Cell Sorting (FACS). Additionally, in a preliminary directed differentiation experiment, Nkx2-1GFP mouse embryonic stem cells (mESCs) were transduced with a mCherry-expressing lentivirus and then underwent directed differentiation over a period of two weeks to produce Nkx2-1GFP-positive lung/thyroid progenitors. Control conditions included mock-transduced cells and non-transduced cells and then was FACS-sorted and analyzed via qPCR to see if transduction with a mCherry-expressing lentivirus affects the gene expression profile of Nkx2-1GFP positive lung/thyroid progenitors compared to control conditions. The differentiation was successfully completed as demonstrated by similar Nkx2-1GFP positive cells for all conditions and by up regulation of Pax8 (thyroid marker), and SPB (distal lung marker) in Nkx2-1GFP-positive samples. The results that were based on the titering experiments indicated that the plasmids were successfully prepared using a maxi prep protocol, and that lentiviruses were successfully packaged. The latter will be used to analyze NANCI gain- and loss-of-function conditions in future experiments. Additionally, successful derivation and differentiation of Nkx2-1GFP positive lung/thyroid progenitors following lentiviral transduction indicated that the mCherry virus does not interfere with the ESCs differentiation.

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84

Subcategory: Cell and Molecular Biology

Effects of Dia2 Degradation on Checkpoint Recovery in Saccharomyces Cerevisiae

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Accurate DNA replication is essential for cell viability. During this process, cell division can be blocked by replication stress. This occurs after DNA damage has been encountered by the replication complex, which initiates a fork stall that causes activation of a checkpoint kinases cascade. When this takes place, a higher probability of accumulating mutations exists, which may transmit defects to daughter cells. The S. cerevisiae F-box protein Dia2 is involved in the degradation of a checkpoint protein, Mrc1, after checkpoint activation during recovery. Since the Dia2 protein has multiple roles in the cell cycle, we needed an approach to remove Dia2 function specifically in checkpoint recovery. We hypothesized that a Dia2 degron strain would delay checkpoint recovery by failing to target Mrc1 for degradation after checkpoint activation. Studying this process would help achieve better understanding of the importance of an F-box protein during recovery. The generation of a Dia2 degron strain was done with the addition of a Myc9 tag and Auxin Inducible Degron to the DIA2 gene via PCR amplification. The purpose was to control protein expression of the Dia2 protein with the exposure of auxin. In the future, the insertion of our product will be done into dia2Δ strain to ensure the only copy of DIA2 in the genome is the degron-tagged version. After verifying that the strain functions correctly, cells can be tested during checkpoint

recovery in order to observe the effects of the absence of Dia2 in the system.

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85

Subcategory: Cell and Molecular Biology

Effect of Curcumin on Endothelin-1 Mediated c-Jun Expression in Hippocampal Neurons

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Alzheimer's disease is a progressive neurodegeneration disease. It is a common form of dementia, general term for memory loss and other intellectual abilities serious enough to interfere with daily life. Endothelin-1 (ET-1) is a vasoactive peptide whose level is elevated in the circulation in a number of cardiovascular pathologies. Recent studies also suggest that levels of ET-1 are also increased in the brain tissue of Alzheimer's patients. It is possible that ET-1 may be a contributor to the pathology of Alzheimer's disease. Curcumin found in the spice turmeric, has been shown to have anti-inflammatory, anti-cancer and neuroprotective effects. However, the mechanisms underlying some of these beneficial effects are not completely understood. We hypothesized that curcumin prevents activation of the immediate early gene, c-Jun, that contributes to neuronal death caused by ET-1 treatment in primary hippocampal neurons. Primary hippocampal neurons from rat pups were isolated using a published protocol. The purity of the culture was checked by immunocytochemistry using a β-tubulin III antibody. Immunoblot analysis was performed to investigate the status of c-Jun expression in hippocampal neurons treated with ET-1 alone or a combination of ET-1 and curcumin. The purity of primary hippocampal neuronal cells in culture was found to be greater than 95%. Treatment of hippocampal neurons with ET-1 produced a 2-fold increase in the levels of c-Jun as determined by an immunoblot analysis. Curcumin treatment alone did not appreciably alter c-Jun levels. Co-treatment of curcumin with ET-1 significant attenuated the ET-1 mediated increase in c-Jun. This data suggests that one mechanism by which curcumin protects against ET-1 mediated cell death is through blocking c-Jun activation in hippocampal neurons.

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86

Subcategory: Cell and Molecular Biology

Can Interspecific Fusion Explain the Discordance Between Morphology and Genetics in Cochliopodium?

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The genus Cochliopodium includes diverse groups of amoebae characterized by a dorsal scale. They inhabit both marine and freshwater environments. Their classification is mainly based on morphological characters related to their shape and scale. However, recent genetic comparison revealed species with different morphology share identical genetic sequences. The primary purpose of this study is to investigate the discordance between morphology and genetic data observed in members of the genus. Cochliopodium species are known to undergo close cell-to-cell (intraspecific) interaction leading to cellular fusion. In this study, we investigate if cellular fusion could occur among different species (interspecific fusion) of cochliopodiums. In order to test occurrence of interspecific fusion we grew two morphologically distinct species (Cochliopodium pentatrifurcatum and Cochliopodium minutodium) and mixed them in live cultures. These cultures were closely observed using light microscope for interspecific fusion and further studied using immunocytochemistry methods to detect specific cellular components such as nucleus, mitochondria and cytoskeleton. Preliminary data indicates that there were close interactions between these species leading to interspecific fusion. Our findings suggest that interspecies fusion might explain the discordance observed between morphology and genetic data in cochliopodiums. The genetic similarity might result through exchange or mixing genetic material and organelles mixing after the two species with different morphology are fused.

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87

Subcategory: Cell and Molecular Biology

Regulation of Pore Dilation of an ATP-Gated Ion Channel Through an Interaction with Fe65

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The object of this research was to identify the Fe65 binding domain of an P2X ion channel. ATP is a well-known energy source for cells. Less recognized is its ability to carry information between cells When ATP is released from healthy or damaged cells, it binds to P2X receptors, causing a conformational change in the channel that allows large cations to enter the cell. We

used YoPro, a fluorescent DNA dye, to measure the pore dilation that underlies the cation entry. Our results show that there is a strong relationship between the protein Fe65 and the P2X channels. Fe65 inhibits pore dilation by binding to a specific domain of the P2X channel protein. Cells are first transfected with a reporter protein, AS red. The circled cells are the regions of interest. After acquiring three minutes of control data, we applied ATP which resulted in an increase in fluorescence as YoPro enters the cell and binds DNA. Only the transfected cells took up the YoPro. We have identified regions of interaction between Fe65 protein and P2X2 channels. Mutating the interaction domains for Fe65 disrupted the domains where the proteins interact. This also happened with mutating the wildtype P2X2.

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88

Subcategory: Cell and Molecular Biology

Binding Behavior and Mobility of Tau Mutants on Microtubules

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Microtubules are dynamic cytoskeletal filaments that play important roles in intracellular transport and cell division. In cells, they are often stabilized by tau, a neural microtubule-associated proteins that are abundant in axons and critical for maintenance of a healthy nervous system. Several dementia disorders have been linked to mutations in the tau genes. In many cases these tau mutants fail to bind to and stabilize microtubules, causing filament disintegration; however, there is a subclass of tau mutants that maintain strong microtubule binding, yet still cause neurological diseases. The mechanical effects of this subclass on microtubules are unknown. In order to gain a fundamental understanding in tau related neurological diseases, extensive studies on how tau mutants, particularly those mutants with strong binding, modulate microtubules are necessary.

It has been recently observed that tau proteins diffuse along microtubules and this has been proposed as a mechanism for tau proteins to be distributed along axons. In this study, we label tau mutants with fluorescent dyes and monitor their binding to and diffusion along microtubules with laser-induced total internal reflection fluorescence microscopy in vitro. This approach allows us not only to significantly reduce the experimental noise that could arise from an excess of labeled tau proteins in solution, but also to monitor the motions of single microtubule-bound tau proteins. We find that tau mutants have a dissociation constant (K_d) in the range of 10-15 nM, which closely matches with the K_d reported for wild type tau proteins in the literature, that the binding is mildly cooperative, and that the diffusion coefficient measured for tau mutants is significantly lower than that reported for wild type tau proteins. The cooperative binding behavior and small diffusion coefficient could suggest that tau mutants are not distributed homogeneously across microtubules, perhaps promoting the formation of tau aggregates. This result may explain the potency of these mutants to cause neurological diseases. Since it has been reported that tau diffusion is sensitive to the ionic strength of the solution due to electrostatic interactions of tau with microtubules, future research will investigate the effects of varying the solution ionic strength.

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89

Subcategory: Climate Change

Determine Relative Susceptibilities of Resistant Snails Maintained Either at Room Temperature or at Elevated Temperature (30˚C)

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Schistosomiasis is a tropical disease that affects over 200 million people in the tropics and sub-subtropics. The trematode parasite, Schitosoma mansoni, causes the disease in the Western Hemisphere. The freshwater snail, Biomphalaria glabrata is the obligate intermediate host for this parasite. Previous studies have shown that elevated temperature reverses the normal resistant phenotype of the BS90 B. glabrata snail stock. On the basis of these previous data, we hypothesized that maintaining resistant BS90 snails for several generations at a non- lethal elevated temperature of 30˚C would render their progeny snails susceptible to S. mansoni infection. Thus, BS-90 snails were maintained either at room temperature (25˚C) or at 30˚C. F2 progeny BS90 snails collected from those maintained at 30˚C were exposed as juveniles to S. mansoni miracidia and compared to progeny snails collected from those maintained at room temperature (25˚C). As control, the susceptible B. glabrata NMRI strain was also exposed, in parallel, to the same number of miracidia. Parasite- exposed BS90 snails maintained, either at the permissive (30˚C) or non-permissive (25˚C) temperature, were examined after 30 days for cercarial shedding. Results showed that BS90 progeny (F2) snails maintained at room tem-

perature were resistant to infection while those maintained at the elevated temperature were susceptible. We conclude that climate change involving global warming has the potential to impact the spread of schistosomiasis.

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90

Subcategory: Climate Change

The Effects of Simulated Acid Rain on Web-spinning Spider Assemblages in the Luquillo Experimental Forest

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The island of Puerto Rico is exposed to long-range transport wind masses from North America that carry acidic gases, which are responsible for cloud water pH fluctuations in the Luquillo Mountains (Gioda et al. 2009). In the Luquillo Experimental Forest, the average pH of rainfall has been lowering and now has an approximate pH level of 5.2. Due to their physiology, arthropods are especially susceptible to changes in their surrounding climate, and therefore can be better models for environmental monitoring when compared to vertebrate species (Peckmezian, 2009). This study provided an opportunity to discern spider responses to a small-scale simulated acid rain treatment in a subtropical forest in NE Puerto Rico. It was expected that the abundance and diversity of web-spinning spiders would decrease when exposed to simulated acid rain. We conducted a field experiment in which areas (quadrats) in the rainforest were sprayed with water with various pH levels for two lengths of time, six days (Treatment 1) and twelve days (Treatment 2). Both treatment locations were within 30 meters of each other, to ensure similar canopy cover, vegetation height and type. The manipulated quadrats, along with the control quadrats in which no treatment occurred, served as the predictor variables for the diversity of web-spinning spider assemblages; richness and evenness. At the end of both treatments, all web-spinning spiders were caught and placed into a vial containing ethanol, and later identified to the lowest possible taxonomic level. In both treatments, the average abundances of spiders declined with the declination of pH of the water. However, over twice as many spiders were collected from Treatment 2, in which the quadrats were sprayed for twice as long as in Treatment 1. Despite these patterns, when the data was statistically analyzed, no significant differences were found in the assemblages between quadrats nor between quadrats and Treatments. In further experiments, I recommend larger spatial and temporal scales, along with an additional comparative multi-species study.

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91

Subcategory: Ecology

Recent Thermal History Determines Microalgal Response to Acute Temperature Stress on Rocky Shores

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In addition to increases in average temperature, global climate change is also predicted to result in higher thermal variability, increasing the risk that species' tolerance limits will be exceeded. Nevertheless, our current knowledge about the effects of increasing climatic variation on natural ecosystems is generally quite poor. Our study was designed to determine how prior thermal history and the intensity of an acute high temperature challenge affects post-stress photosynthetic performance of microalgae on rocky shores. During daytime low tides, benthic marine microalgae are frequently exposed to extreme conditions that include high temperature and desiccation stress. At our study site, Stanford University's Hopkins Marine Station (HMS) in Pacific Grove, CA, there is a strong negative correlation between maximum temperature and microalgal biomass across the intertidal zone, suggesting that microalgal communities may exhibit reduced rates of photosynthesis following exposure to high peak temperatures during emersion. To test this idea, we manipulated temperature variability on artificial substrata in the mid-intertidal zone by bolting 10 cm-diameter, 12 mm-thick aluminum plates covered with gray 3M Safety-Walk tape either directly to the rock (natural variability), with a thermal barrier of 1 cm-thick closed-cell foam insulation between the aluminum and the rock (high variability), or to a 25 cm-long aluminum rod cemented into a 10 cm-diameter hole in the rock (low variability). Microalgae were allowed to settle naturally from the ocean for at least one month before the plates were collected and brought back to the lab. We then measured community-level microalgal net photosynthetic rate (NPR) for each plate under benign conditions with a LX-1600 LICOR Portable Photosynthesis System, before and after exposure to one of five peak temperatures (18, 24, 28, 32, and 36 °C) during a 4.5-hour simulated low tide. Mean differences in NPR among treatment groups were evaluated with Split-Plot ANOVA. The more extreme the acute temperature challenge, the more negative the effect on post-exposure NPR. Surprisingly, microalgae grown on low variation plates in the field were twice as vulnerable as microalgae on normal and high variability plates.

Our current plan is to use scanning electron microscopy (SEM) to analyze changes in the identity and relative abundances of microalgal taxa for indications of variation in microalgal functional group composition and diversity.

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92

Subcategory: Ecology

Differences in Prey Items Within Sagebrush and Agricultural Hunting Territories of American Kestrels

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Several wildlife species thrive in both wild and rural areas; however, there may be trade-offs associated with living in wild or human-dominated areas. We hypothesized that habitat type and/or preference would drive prey selection of a generalist predator. In this study, we analyzed the diet of breeding American Kestrels (Falco sparverius) in southwestern Idaho to evaluate and effects of nesting habitat and prey availability on diet composition and breadth. Kestrels are known to be non-specialist hunters and consume various prey species such as grasshoppers, voles, mice and small birds.

We used infrared motion-sensing cameras installed in several nests boxes in either sagebrush (n = 3) and or agricultural areas (n = 2), to record specific prey items brought into the nests. We identified mammals based on tail length, size, and color. Birds were identified based on feathers and anisodactyl feet and we used size, color, wing length, leg length, presence of antennae to classify invertebrates. We calculated an index of diet breadth, the Shannon Index, to assess diet biodiversity and compared biodiversity indices between irrigated and non-irrigated sites using a t-test. We found that Kestrels in non-irrigated habitats had significantly more diet breadth than kestrels nesting in irrigated habitats (t = 3.75, P= 0.03).

Finally we used information from small mammal trapping and grasshopper surveys to inform a correspondence analysis that compared prey availability and diet composition. We found that American Kestrels were consuming grasshoppers in a much higher proportion than their availability, were not taking mice in proportion to their availability, and were taking voles in proportion to the total availability of small mammals. Results supported our hypothesis that habitat effects diet breadth and composition, and that preferences may contribute to a high proportion of insects in kestrel diets. Further, by developing a way to study the diets of these birds, future research can investigate the various effects of anthropogenic changes to natural systems; nest success based on location, possible pesticide contamination of prey in irrigated areas, and shifts in diet composition correlated to crop rotations.

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93

Subcategory: Ecology

Environmental Stress Elevates Recombination Near Telomeres Causing Changes to Yeast Cell Growth Rates

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Telomeres protect chromosome ends from recombination, but this capping is postulated to be relaxed in stressful environments in a way that might foster evolution of subtelomeric genes. We used the yeast Kluyveromyces lactis that contained a URA3 gene inserted into a subtelomeric region to measure homologous recombination near telomeres. These cells were exposed to different stresses including salt and arsenate, and then diluted and plated onto 5-FOA to select for recombination events deleting URA3. We found that both 1 M NaCl and 0.5 mM sodium arsenate led to elevated rates of subtelomeric recombination. During these experiments, we also noticed that the arsenate-exposed K. lactis were converted at very high frequency (> 50%) to two other cell types with discretely slower growth rates. These slow growing forms were metastable, sectoring back at high frequency to the normal fast-growing form.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.

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94

Subcategory: Ecology

Screening for Puccinia Graminis Suppressors of Hypersensitive Response in Tobacco

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Stem rust has emerged as a catastrophic fungal disease threatening cereal crops in vast regions throughout the world. Puccinia, the genus of the fungi, is a major pathogen of the wheat plant, which contains over 4,000 species. Puccinia graminis is the first sequenced representative of the wheat rust fungi, and is an epidemic spreading across Africa, Asia, and the Middle East which has raised concerns for the extensive amount of people in these areas depending on wheat productions for means of sustaining life. In this study, the goal is to screen for suppressor genes of HR in tobacco plants. Suppressors are vital because they help the infection take place. When the fungus infects the plant it puts out a haustorium, which serves to acquire nutrition from the plant and put out distinct effector proteins that mediate infection. Primers were designed for genes that are highly expressed in the haustorium of these fungi. These genes would be cloned into an Agrobacterium based vector and expressed to produce proteins in tobacco. The identification of suppressor genes would help to understand the biology of the disease and management systems in the future.

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95

Subcategory: Ecology

Cross-disciplinary Skills Identify and Differentiate Morphologically Analogous Characteristics in Two Similar Species of Freshwater Crawfish (Cambarus)

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In this project we explore how to address the issue of documenting morphologically similar species in scientific papers using illustration techniques. Two very similar sister species of crawfish, Cambarus halli and Cambarus englishi, were chosen to demonstrate the use of illustration in highlighting subtle differences between the two species. To accurately illustrate each species, first a precise outline was created for each specimen. Each outline was shaped using an iterative process of measurement, pencil drawing, photographing, and inking until an accurate representation of both species was created. The next step in illustration was to add detailed coloring to these outlines using Adobe Photoshop and a tablet as a painting median. Color and detailing were key in enhancing the differences between the two organisms in ways that photograph documentation could not have done. For example, we paid close attention to detail in the color of the antenna and the tapering of the rostrum, as those features were particularly important in distinguishing the differences between the two species. Here we show illustration can be useful when documenting species in scientific papers and articles. Using the illustrations of Cambarus halli and Cambarus englishi, we discuss the divergence of these two species and why, although morphologically similar, they are classified as two distinct species.

Funder Acknowledgement(s): AASD-STEM program

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96

Subcategory: Ecology

Analysis of Interspecies Attraction Using Extracted Pheromones from Ithomiine Butterflies

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Male Ithomiine butterfly consume pyrrolizidine alkaloids of the dead shoots of Heliotropium indicum L.and other species for mating, defense, and chemical communication purposes. Pheromones, derived from pyrrolizidine alkaloids, are released through androconial hairs. During a lek, or at a multi-species aggregation, males display these hair pencils to attract a mate. Females must be able to locate and distinguish their own species from mimics and similar species to reproduce. Due to a high abundance of mimics, conspecifics must be able to communicate chemically. I hypothesize that Ithomiine butterflies that are distantly related will be able to distinguish conspecifics from heterospecifics through pheromone recognition and will visit the conspecifics' pheromone at a higher rate than the heterospecifics' pheromone.The purpose of this study was to determine if different species of the Ithomiine butterfly tribe differentiate each other by scent.

Ithomiine butterflies were caught at the Las Cruces Biological Research Station in Costa Rica. Male Ithomiine butterfly pheromones of conspecifics and heterospecifics were extracted from androconial hairs with hexane. With butterflies of both genders, a choice test was conducted with pheromones from conspecifics and heterospecifics. Results reveal that butterflies were more likely to be in the area of the enclosure where pheromones from the same species were released than the heterospecifics' pheromone($p < 0.0001$). Interactions with both distant and closely related species pheromones were not as common as conspecifics interactions. Further research should include more abundance of butterflies being tested, and also include a visual stimulus with the pheromone. This research will increase the overall scientific knowledge of the Ithomiine butterfly tribe, contribute to the total awareness of the use of pheromones within the Ithomiine tribe and mimics, provide information about behaviors exhibited by Ithomiine butterflies towards their

species and other species, and help understand how mimetic butterflies communicate.

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97

Subcategory: Ecology

The Identification of Rotifers in Aquatic Environments

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The objective of this study was to survey localities in the Tidewater region of Virginia to identify rotifers in fresh- and marine-water systems. Rotifers are micro-metazoans that comprise of phylum Rotifera. They are distinguished by their ciliated corona, mastax, and elongated body, which elongate and contracts. Water samples were collected in plastic containers and transferred to the laboratory where the samples were examined under a microscope. Ecological data was recorded to understand the water conditions in which the rotifers inhabit. Eight (08) rotifers were identified: Adineta sp., Bdelloidea sp., Brachionus sp., Keratella sp., Lecana sp., Cephalodella sp., Notholca sp., and Philodina sp. The freshwater rotifers were Brachionus sp., Cephalodella sp., Keratella sp., Lecana sp., and Philodina sp. The marine water rotifers were Adineta sp., Bdelloidea sp., and Notholca sp. One (01) specie was identified in Hampton. Three (03) species were identified in Norfolk. Four (04) species were identified in Suffolk. Cephalodella sp. was not found in previous research and has been added to the list of taxonomy for rotifers in the tidewater area. A new locality record has been established for Suffolk. Future research consists of discovering more rotifers that have not been found in the tidewater region.

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College of Science, Engineering, and Technology at Norfolk State University.

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98

Subcategory: Ecology

Hydrodynamics Behavior and Velocity Changes of Ophiuroidea (Brittle Stars)

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When brittle stars fall through the water column they shift the position of their legs in a characteristic fashion, reconfiguring their shape, and becoming more hydrodynamic. The increased rate of descent presumably reduces exposure to predation and wave action. Very little is known about the falling behavior of brittle stars and the hydrodynamics of their movement in water. This research compares the hydrodynamic behaviors in three species of brittle stars from Cabo Blanco Absolute Reserve on the Pacific coast of Costa Rica: Ophiocoma aethiops (Black Spiny Brittle Star), Ophiocoma alexandri (Alexander's Brittle Star), and Ophioderma teres (Smooth Brittle Star). Brittle stars were released at the surface of the water in a cylindrical test chamber and allowed to fall freely through the water column. The behavior of each brittle star was noted, and measurements were made of the distance and speed at which the brittle star fell in both its natural and reconfigured, hydrodynamic form. Reconfiguration behavior and the resulting shapes differed among the three species: Black Spiny brittle stars raised the legs above the central disk to form a teardrop shape, Alexander's pulled the legs in laterally to form a flat disk, and Smooth brittle stars brought the legs together to form a tight sphere. Although there is no difference in the rate of descent between any of the three brittle stars in the reconfigured, hydrodynamic shape, the rate of descent in the natural form is greater in the Black Spiny than in the Alexander's. Black Spiny brittle stars have higher body mass and greater leg length than Alexander's brittle stars, but neither character influences rate of descent. Additionally, rate of descent did not differ between dead brittle stars and live brittle stars which had not reconfigured their shape, indicating that brittle stars falling in their natural shape do so passively and do not expend additional movement or energy.

Further studies to better understand the hydrodynamic behaviors of brittle stars would include a detailed analysis of biomechanical factors such as drag and fluid flow, and testing for the effect of fatigue or stress on hydrodynamic behavior. Studies of other species of brittle stars could elucidate the distribution and evolution of this behavior within the Ophiuroidea.

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99

Subcategory: Ecology

Spore Persistence in the Environment Drives Infection Dynamics of a Butterfly Pathogen

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Environmentally transmitted parasites commonly infect humans and wildlife. Environmental transmission is particularly important for insect pathogens, yet the factors affecting the persistence of infectious stages in the environment are poorly under-

stood. Monarch butterflies are commonly infected by Ophryocystis elektroschirrha (OE); recent years have seen an increase in pathogen prevalence at the same time monarch populations in eastern North America have declined. OE is transmitted both vertically (from infected females to their progeny) and environmentally (when infected adults scatter spores onto milkweed leaves that are consumed by unrelated larvae). By using a combination of a mathematical model and an experimental study, we examined (1) how environmental conditions affect persistence of a free-living stage pathogen and (2) how pathogen shedding rate and environmental persistence time affect pathogen prevalence and host population size during the summer breeding season. We found that increased time spent fully exposed to environmental conditions (sun, rain, heat) reduced average infection severity induced by parasites, but did not reduce the fraction of monarchs infected by spores; therefore, parasites were able to remain viable after 15 days outdoors. Consistent with the experimental results, modeling findings showed that parasite spores must persist for at least 20 days, in combination with a high shedding rate onto host plant leaves, for predicted prevalence to match the minimum prevalence observed in prior field studies.

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100

Subcategory: Genetics

Development of a Stable GFP-tagged Cytomegalovirus

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Human cytomegalovirus (hCMV) can be transmitted to the fetus causing microcephaly and sensorineural hearing loss. Guinea pig cytomegalovirus (gpCMV) is used as an animal model for hCMV. The main goal of the research was to construct a green fluorescent protein (GFP)-gpCMV that would be useful in studying CMV pathogenicity in vivo in the guinea pig, through the use of fluorescence microscopy. To construct a recombinant GFP-GPCMV, plasmid pKTS866 was cloned with a GFP cassette flanked by the Hind III "N" region of the gpCMV genome, which contains no essential ORFs for viral replication or pathogenicity. The resulting clone was used to transfect guinea pig lung fibroblasts. Thus, the transfected cells were infected with salivary glands gpCMV under metabolic selection with mycophenolic acid and xanthine, facilitating the homologous recombination necessary for selection of a modified virus.

We report here the successful generation of an infectious GFP-gpCMV. Recombinant virus replication was examined by fluorescence microscopy in transfected/ GPCMV-infected cells. High levels of GFP were detected after 96 hours post-inoculation. For in vivo analyses of recombinant virus replication, guinea pig will be inoculated with GFP-expressing virus and cryostat sections of cochleas will be analyzed for GFP expression, corresponding to actively replicating virus as confirmed by tissue culture. A fluorescent virus would be useful in determination of specific information related to reactivation, localization of virus, and pathways of infection. One reason for the need for a stable GFP-gpCMV is to study hearing loss due to CMV. Currently, the exact mechanism of congenital hearing loss remains unclear. The detection of the virus is not possible in patients and limited information is available. Therefore, the localization of GPCMV-infected cells in the cochlea remains unknown. A GFP-gpCMV virus will provide an improved tool for studying pathogenicity of infection in guinea pigs. This could lead to better identification of vaccine targets for hCMV to eventually develop a preventative measure that protects babies from acquiring CMV congenitally.

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101

Subcategory: Genetics

Low Level of Chytrid Fungus Found on the Island of St. Thomas

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Major insect predators such as frogs, function in maintaining a balance in the insect food chain. Populations of these amphibians are declining worldwide. A contagious fungus known as Batrachochytrium dendrobatidis (Bd) has been affecting frogs by disrupting their respiration and/ or osmosis regulation. When the frog loses its ability to breathe, death is inevitable, and this contributes to the drop in amphibian populations. The decline has already been noted in the Caribbean, primarily in Puerto Rico. Recent studies were done on the island of St. Thomas in 2011 where three out of one hundred amphibian samples tested positive for the fungus. Therefore, the aim of this study is to learn whether the Chytrid fungus is still active, and how it may negatively affecting the amphibian population on St. Thomas. We predict the 2014 study to yield similar, if not heightened results. To test this, frogs of the Eleutherodactylus coqui (E.coqui) and Eleutherodactylus antillentis species were cap-

tured from various sites and swabbed to collect any possible fungus present on the skin. After acquiring the possible Bd DNA, the frogs were released. Any DNA present on the swabs or on the frog collection bags were extracted. Lastly, PCR was done to amplify any possible Bd DNA. One sample yielded a very low positive result which contradicts the hypothesis and showing that the frogs here are not as infected as the E. coquis in Puerto Rico. The seasonal time of testing may have possibly affected the results so further testing will be conducted in other seasons and results will be compared to that of the summer of 2014.

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102

Subcategory: Genetics

Screening for Mutations in PIEZO2 that Cause Distal Arthrogryposis Type 5

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Distal Arthrogryposis Type 5 (DA5) is an autosomal dominant disorder that is characterized by distinct facial features, congenital contractures of the hands and feet, hypoplastic flection creases of the phalanges, and restricted eye movement. Mutations in the gene PIEZO2 have been previously reported in families to cause DA5 and similar disorders. PIEZO2 encodes piezo-type mechanosensitive ion channel component 2, which functions in transducing mechanical forces into biological signals. Screening for mutations in PIEZO2 that cause DA5 would help in diagnosing, preventing, and developing treatments for the disorder.

One individual affected with DA5 from each of five families and one unaffected control sample was Sanger sequenced to search for mutations. Exons 15, 20, 43, 45 and 52 of the PIEZO2 gene were amplified via polymerase chain reaction and product sizes were verified using gel electrophoresis. The amplicons were sequenced using di-deoxy chain termination sequencing and chromatograms were generated using an automated DNA sequencer. The sequences were aligned and examined using the computer program CodonCode.

Two mutations in exon 15 were found for two separate families. The missense mutation c.2134A>G, p.(Met712Val) was found in Family A, and the missense mutation c.2136G>T, p.(Met712Val) was found in Family B. Both mutations are likely to cause DA5 because all the affected family members carried a mutation. Furthermore, the same mutation found in Family A was previously reported in two families with DA5. The fact that both mutations affect the same codon makes it very likely that the mutation found in Family B is also causal. For the three families in which mutations were not found, the remaining coding exons of PIEZO2 will be sequenced.

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103

Subcategory: Genetics

The Phylogenetic Utility of EPIC DNA Sequences in the Tribe Cecropieae

Liam Beckman, University of Oregon

The study of mutualism involving neotropical trees of the genus Cecropia and their associated ants could provide insights into their coevolutionary relationship. Distinctive features shared by Cecropia species—glycogen-rich Müllerian food bodies and internodal prostomata enabling ant queens to nest in the hollow stems of the plant—suggest that the mutualism evolved in the common ancestor of members of the genus. We aimed to investigate phylogenetic relationships within the tribe Cecropieae of the plant family Urticaceae in order to identify the closest relatives of Cecropia. Previous work estimated the phylogeny based on 26S ribosomal DNA and ndhF chloroplast DNA sequences but results were not robust. In order to improve our understanding of the origin of the ant-Cecropia mutualism, we investigated the utility of EPIC DNA sequences had on for resolving and supporting phylogenetic relationships within the tribe. The five genera of Cecropieae are distributed in either the neotropics of Central and South America (Cecropia, Coussapoa, Porouma) or the afrotropics (Musanga, Myrianthus).

The study examined the effect of including an exon-primed intron-crossing (EPIC) marker on resolution and support for Cecropieae phylogeny. Mutualisms, interactions between species that are beneficial to both partners, are useful systems for investigating how interactions may affect the evolution and diversification of lineages. Interactions between ants and plant species of the genus Cecropia are a classic example of mutualism but the origin and evolution of the mutualism is poorly understood. We examined whether the inclusion of an exon-primed intron-crossing (EPIC) marker could improve our understanding of Cecropiaeae phylogeny. We performed a Bayesian phylogenetic analysis of 15 species from which EPIC sequences were obtained. By comparing clade support from analyses with and without EPIC, we concluded that the addition of a third gene region strongly supports the hypothesis that the Afrotropical

and antless genus Musanga was derived from a Cecropia ancestor and is most closely related to the antless neotropical species C. sciadophylla. Future work is suggested in furthering support for the overall phylogeny.

References: Yao, Xiaohong, Chenhong Li, and Christopher W. Dick. 'Exon-Primed Intron-Crossing (EPIC) Markers for Evolutionary Studies of Ficus and Other Taxa in the Fig Family (Moraceae).' Applications in Plant Sciences 1.10 (2013).

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104

Subcategory: Genetics

Investigating the Functionally Important Disease Linked SNPs in Type 2 Diabetes Risk Gene CDKAL1

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Type 2 diabetes (T2D) is the most common form of diabetes. Approximately 29.1 million Americans are affected by this disease. The gene CDKAL1 has been linked to type 2 diabetes by previous genome wide association studies (GWAS). CDKAL1 contains a dozen of intronic single nucleotide polymorphisms (SNPs) that have been strongly associated with increased risk of developing T2D. Although many risk-associated SNPs have been identified in CDKAL1, it is unknown which SNPs contribute to T2D. For my summer research project in the Banks Lab, we focused on identifying which SNP or SNPs in CDKAL1 have functional importance for T2D disease development.

To identify which CDKAL1 SNPs are critical, we first defined twenty 1-2 kb promoter bash regions (PBR) in CDKAL1 introns. These PBRs contain the different SNPs linked to T2D. We ran PCRs to make copies of different PBRs from the genomic DNA of five human adipose tissue samples. Next, we cloned the PBR segments in TOPO cloning vectors. We used restriction digest to cut the PBRs out of the TOPO cloning vector. Then, we performed DNA sequencing on the PBR segment in the TOPO vector to determine if it contained the reference or T2D risk-associated SNPs. The PBR segments were then cloned into a Nanoluc reporter vector.

We have successfully cloned reference and risk alleles of four PBRs into Nanoluc vectors. These Nanoluc vectors with PBRs cloned into them will be transfected into HEK 293 cells. Using a dual luciferase assay we will evaluate which PBR segments affect luciferase expression. We hope to identify if the risk allele of any PB segment fragment shows effects on gene expression as reported by luciferase expression.

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105

Subcategory: Genetics

Overexpression of Fructose Bis-Phosphate Aldolase in Chlamydomonas

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Algae hold great promises for production of liquid fuels but current yields are not high enough to compete with fossil fuels. Therefore there is a need to engineer algae to accumulate more biomass more quickly. Chlamydomonas reinhardtii is the E. coli of algae—many molecular genetic tools have been developed to manipulate it and its genome is sequenced and well characterized. In this study we are focusing on the Calvin cycle, a photosynthetic pathway localized to the stroma of the chloroplast that fixes carbon dioxide and produces sugar. The enzyme fructose bis-phosphate aldolase (FBA) is believed to carry out a key control step in the Calvin cycle. FBA combines glyceraldehyde-3-phosphate and dihydroxy acetone phosphate to form fructose-1,6-bisphosphate, a precursor to the 5-carbon sugar ribulose bisphosphate (RuBP) that must be regenerated in each round of the Calvin cycle. The main aim of our study is to determine whether we can increase the growth rate of C. reinhardtii by increasing the expression of FBA. To that end we have gene synthesized the coding sequence for C. reinhardtii FBA using C. reinhardtii chloroplast codon bias and are subcloning this sequence into our chloroplast transformation vector. Progress toward this goal will be reported. After transforming and selecting for spectinomycin resistant colonies we will use western analysis to determine protein expression and growth curve and dry weight analyses to determine whether FBA-expressing transformants are able to grow faster than wild type C. reinhardtii. Future work might involve overexpressing FBA together with other Calvin cycle enzymes.

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106

Subcategory: Genetics

The Effect of the Overexpression of the CZF Transgene on Spermatogenesis in Mice

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A sequential process of mitosis, meiosis and cellular differentiation takes place within the seminiferous epithelium, beginning with the spermatogonia and ending with spermatozoa. Success of this life long process in men is essential for the production of sperm and more importantly the preservation of a species. This research seeks to understand consequences of the overexpression of CZF (CTCF zinc finger protein) in mice testis. It is hypothesized that overexpression of CZF will disrupt differentiation of spermatids. We found that average weight of testis in adult mice bearing the CZF transgene was 0.0657g, approximately half of the control, weighing 0.1025g. Consistent with this decrease in testis weight , CZF caudal sperm number was 3x106 sperm, while the control contained a substantial 21x106 sperm. This data confirmed a defect in spermatogenesis. We directed our focus to post-meiotic germ cells, and analyzed testes at postnatal day 24, a time when round spermatid differentiation begins. Average weight of day 24 testis showed a decrease from 0.0486g in control to 0.0256g in CZF mice (p-value= 0.0067). Using immunohistochemistry with an antibody specific to the acrosomal protein sp-10, we observed that germ cell production progressed normally in CZF mice up to round spermatid formation.

We conclude that overexpression of the CZF transgene has a direct effect on the ability of round spermatids to differentiate into spermatozoa. Through further research on the specific pathway of spermatogenesis that this overexpression affects, we hope to be able to aid in discovery of novel treatments for men diagnosed with oligospermia.

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107

Subcategory: Genetics

DNA Methylation Patterns During Embryonic Development in Annual Killifish Austrofundulus Limnaeus

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DNA methylation is an epigenetic mechanism that plays a crucial role in heritable gene expression. Although there is still much to be learned about DNA methylation, increased levels of genomic DNA methylation are usually associated with gene silencing and previous studies have linked errors in methylation to several human diseases. DNA methylation is primarily found at cytosine nucleotides, which are converted to 5-methylcytosine (5mC) by DNA methyltransferases. This process is particularly dynamic during embryonic development. Global genomic 5mC levels measured during zebrafish development show a pattern of low 5mC early in development followed by elevated 5mC as the embryo nears hatching. However, it is not yet known how well embryonic 5mC patterns might be conserved across taxa with unique embryonic development. The focus of our study was to examine DNA methylation patterns during the embryonic development of Austrofundulus limnaeus, an annual killifish endemic to northern South America. As a result of seasonal desiccation, embryonic A. limnaeus spend considerable time in developmental arrest, in a stage known as diapause. Owing to this unique feature of A. limnaeus embryonic development, we hypothesized that DNA methylation patterns during A. limnaeus development would differ from those found in zebrafish.

Global DNA methylation of A. limnaeus was determined through an enzyme linked immunoabsorbent assay (ELISA), which utilizes an antibody that specifically recognizes 5mC in single-stranded DNA. A secondary antibody conjugated to alkaline phosphatase then recognizes the 5mC antibody, and relative 5mC abundance is calculated by measurement of total alkaline phosphatase activity using a color-forming substrate. To obtain a broad view of methylation patterns during embryonic development, DNA was extracted and assayed from 15 embryonic stages. Our results showed that 5mC levels in A. limnaeus are low immediately following fertilization but peak during the first half of development. Interestingly, 5mC levels are lower during the second half of development, including during diapause, which contrasts with the pattern found in zebrafish. Therefore the results of this study support our initial hypothesis and suggest that A. limnaeus embryos may have unique methylation patterns during embryonic development compared to other taxa.

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108

Subcategory: Genetics

Seeds to Fuel the Future

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With many economic and environmental stresses being put on consumers, it is becoming increasingly important to find more sustainable methods for producing necessities such as food and energy with the smallest carbon footprint. Cultivation of bioenergy crops typically creates competition for land resources between plants produced to make biofuel and plants used to produce food products. However, in the case of Camelina sativa, competition remains scarce due to its ability to grow in marginal lands, with fewer economic inputs. Camelina is also considered carbon neutral because it captures as much carbon as it releases while producing biodiesel. As an oil-seed crop, Camelina has an inherently high oil content, making it an attractive biodiesel feedstock. With two consecutive years of funding from the National Science Foundation's REU program, work has been done to optimize the process of leaf-based organogenesis with respect to genetic variability, as well as with the concentration and ratios of plant growth hormones BAP and NAA. Current research is concerned with identifying the most viable method of chloroplast transformation in Camelina using biolistic particle bombardment on leaf explants. Chloroplast transformation is attractive compared to floral dip-based nuclear transformations due to containment of the transgene in a field setting and because of extremely high expression with up to 10,000 chloroplast genome copies per cell. Presently, the over-exposure of Camelina to growth hormones in MS media seems to be fatal to the plant tissue so as research continues, we are limiting the time that the leaf explants are being cultured on media with exogenous hormones. Once a suitable chloroplast transformation procedure is found for Camelina, work can be done to increase the appeal of the plant with regard to cost and energy efficiency.

Funder Acknowledgement(s): National Science Foundation; Department of Energy

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109

Subcategory: Genetics

Predicting Novel Genes Associated with Longevity in Saccharomyces Cerevisiae Using Support Vector Machine (SVM)

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Baker's yeast also known as Saccharomyces cerevisiae is a unicellular model organism for systems biology and has recently proven to be a successful model for cellular aging. We hypothesize that cellular aging is an emergent property of gene networks and are therefore associated with many genome-wide characteristics, such as fitness and morphological plasticity. Here we explore whether these genome-wide characteristics can predict novel candidate genes associated with longevity. We trained a support vector machine (SVM) using the genomic features of a list of genes with measured life span. We partitioned the genes with known life span into three categories: "long", "short" and "neutral" for training SVM models. Correlated genomic features were converted to principal components and were then used to train SVM. The false positive rate of the trained SVM is 6.5 percent. A total of 43 novel genes were predicted to be associated with long replicative life span (RLS). These novel candidates include genes in known pathways associated with cellular aging, such as chaperone pathways, ribosomal machinery, cell cycle, and chromosomal silencing. They also include genes in unknown pathways or pathways that have not been previously associated with cellular aging. This study shows that SVM is a useful approach to predict novel genes associated with longevity. Future work will include using a similar approach to predict novel genes in other model organisms.

Funder Acknowledgement(s): National Science Foundation

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110

Subcategory: Genetics

Studying the Genetic Connectivity of the Culturally Significant Sea Urchin, Colobocentrotus Atratus, in Hawaii, USA

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Population genetics is the study of allele and genotype frequencies in a given population. The use of population genetics to monitor target species in ecologically sensitive areas is an effective management tool for understanding the structure of those populations. Understanding the genetic connectivity of separate populations will aid in the development of proper management plans for that species. In the Hawaiian Islands, management practices specific to many of our culturally important marine invertebrates are minimal or non-existent, and as a result, overharvesting can be a common and growing problem for these species. This study attempts to elucidate the population structure of the marine invertebrate species Colobocentrotus atratus, also known as the shingle or helmet sea urchin or Haʻukeʻuke in Hawaiian. Haʻukeʻuke inhabit wave-swept, rocky intertidal shores throughout the Hawaiian Archipelago where it is recreationally harvested for consumption of its gonadal tissues, also known as uni. Culturally, the Haʻukeʻuke is mentioned in the Kumulipo: (the Hawaiian chant of creation) as one of the

first organisms to be born. It is not only harvested for its delicious taste but also as bait for fishermen, and for its medicinal properties. Tissues from multiple individuals along four different shorelines (north, west, east, south) from four different main Hawaiian Islands were collected to determine the level of genetic connectivity within and between populations using a fragment of the Cytochrome Oxidase I (COI) mitochondrial gene. Previous research on taxonomically and ecologically diverse species shows genetic barriers between islands. Therefore, due to a relatively short larval duration (typically one month), we hypothesized that C. atratus would show low or absent gene flow between the different island populations. We hope our investigation into Haʻukeʻuke population structure throughout the Hawaiian Islands will lead to better management practices for this important cultural resource.

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111

Subcategory: Genetics

Yeast Cell Recombination for Genetic Fitness and Transgenic Stability

Stephen Kinunda, Davenport University

Transgenesis is a process that involves adding foreign genes to an animal's DNA. The technology began in the 1980s with the implication to plants. The majority of transgenes is used for research purposes. Transgenic biotechnology allows us to test a given gene either by turning it on for a long period or controlling its gene expression. After, knowing the function of a gene, cross-pollination can be done to identify the presence with the assistance of (MAS) marker assisted selection. The selection of choosing interested genes to be passed on to the next generation.

A diverse set of yeast strains was given a gene knockout; the strains were mated to generate recombinants' to screen for healthy progeny. The lab strain that contained the knockout gene was (Tryptophan 1) which cross mated with eight wild type strains (4 clinical, 2 vineyards, 2 oak). After the eight strains had sporulated, the zygotes were picked through tetrad dissection then verified by PCR. A plate transformation was done onto a "drop out" media plate lacking tryptophan, and growth plates were made from recombinants. The following recombination were found to grow with little tryptophan: T34,T35, T38, T45, T47, T48, T56, T67, T345, T68, T34568, T4678, Tmix. In conclusion, growth of T35 in the transformant plate and T56 in the no tryptophan plate confirms recombination. A mix of two proved to be more effective than multiple ones.

Yeast genetics may be used in many various areas of studies including, agriculture and industrial technology. Yeast plays a major role in making quality wines, use of probiotics, and biofuel production. If we can answer the following question, Can we congregate for the deleterious mutation through recombination? Highly resistant medicine and organ transplants can be easily made and delivered to patients.

Funder Acknowledgement(s): SROP- Beacon

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112

Subcategory: Genetics

Identification of a CYP4V2 Gene Mutation in a Bietti's Crystalline Dystrophy Patient

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Bietti's Crystalline Dystrophy (BCD) is a disease that affects the retina and/or cornea of the eye. The hallmark of BCD is accumulation of yellow/white crystalline deposits in the retina, which are thought to be composed of lipid-protein complexes that are localized to the retina and/or cornea1. The end stage of the disease is blindness; however, the symptoms do not start appearing until adulthood, typically in 3rd to 4th decade of life. The early symptoms include a decline in central vision, night blindness, and gradual constriction of the visual field1. The negative effects caused by BCD are associated with gene mutations in CYP4V2, resulting in non-functional enzyme2.
In this project, DNA of a particular patient diagnosed with BCD was extracted for characterization. The key question was to see if this patient had a mutation in CYP4V2, or if something else causes the disease. To solve this question the lab sequenced the 11 exons of the gene of the patient. After the gene sequencing on the patient was done, the lab determined if the patient had a specific mutation in CYP4V2. We identified in exon 9 a C>T homozygous point mutation. This mutation results in an amino acid change of arginine to cysteine at codon 400 (pR400C). To date, there have been 60 other mutations identified in the gene, spanning all exons 1 through 11 and the identification of this mutation has shown the lab that there are other point mutations that can cause the illness. The long term goal of this research is to understand the essential function(s) of CYP4V2 so that we can develop pharmacotherapies to treat patients afflicted with BCD. Our findings are unique in that this is the first case of a BCD patients who is homozygous for a non-synonymous coding mutation which results in the clinical phenotype of BCD.

References: 1. Kelly, Edward J., Mariko Nakano, Priyanka Rohagti, Vladimir Yarov-Yarovoy,and Allan E. Rettie. 'Finding Homes for Orphan Cytochrome 450s.' (2011): 124-32. Print.
2. Nakano, Mariko, Catharine M. Lockhart, Edward J. Kelly, and Allan E. Rettie. 'Ocular Cytochrome P450s and Transporters: Roles in Disease and Endobiotic Xenobiotic Disposition.' Drug Metabolism Reviews. 46.3 (2014): 247- 260

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113

Subcategory: Genetics

Pigmentation Pattern Formation in Spotted and Striped Zebrafish

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In this research, we examine the development of stripes and spot pigmentation by comparing and contrasting WT fish (striped) with fish carrying the leopard mutation (spotted). We tested the hypothesis that there would be differences between the WT and leopard fish during larval and juvenile stages. This hypothesis is not supported. We found that the pigment formed complex but ordered patterns in both striped and spotted zebrafish. Further, both striped and spotted fish looked the same at 4 weeks. During seven to eight days post fertilization, both striped and spotted zebrafish had lines of dark pigment cells, melanocytes, on the dorsal, ventral and lateral sides. Some zebrafish had two lines in the lateral side while others had one. At week 7, the WT and leopard fish looked different. Both strains had two lines along the lateral sides. However, in the WT fish, the lines of melanocytes are contiguous and defined. In the mutant fish, the lines have gaps with no black pigment between cells or groups of cells. Between week 7 and adulthood, we predict that the lines in the leopard mutants will gradually disappear and will be replaced by spots.

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114

Subcategory: Genetics

Investigating Genetic Basis of Migratory Timing Using Circadian Clock Genes in Spring Chinook Salmon (Oncorhynchus Tshawytscha)

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In many salmonid fishes, timing of migration to the spawning grounds has been linked to variation at genes associated with circadian rhythm. Spring Chinook salmon exhibit pronounced variability in return time to the spawning grounds, with arrival times ranging from May through October of each year. I evaluated variation at four genes, Clock1b, Cryptocrhrome2b.3, Fbxw11, and Ots515, associated with circadian rhythm in two populations of spring Chinook salmon. First, having classified spring Chinook salmon in two rivers and two years into early, middle, and late return times, I analyzed allele frequencies at these four genes. From the pairwise comparisons, I discovered multiple significant differences between years and populations, but the three return time groups were not significantly different. Second, I evaluated allele frequencies on a continuous scale using Julian date of return and mean allele length. Mean allele length (MAL) is the sum of an individual's allele lengths divided by two. ANOVA models were run to examine relationships between MAL at Clock 1b and genotype at Fbxw11 and return time (Julian date). Fbxw11 genotype was a significant predictor of migration timing in these populations, with heterozygous individuals of genotype 176-178 returning later than individuals of other genotypes. With this information we can now determine the extent to which adaptation is affecting circadian clock genes and migration timing. This project further supports a role for genetic factors to the migration timing of salmon.

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115

Subcategory: Genetics

Metabolic Mechanisms of Cold Tolerance in Drosophila Melanogaster

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Drosophila melanogaster (fruit fly) is widely used in biological research. This fruit fly usually accumulates around rotten fruit.

The objective of this project is to identify metabolic mechanisms of cold tolerance in Drosophila melanogaster using metabolomics. We conducted a preliminary experiment to test cold shock tolerance between -1°C and -7°C in 20 isogenic lines from the Drosophila Genetic Reference Panel (DGRP). Among these lines there was considerable variation in cold tolerance; the best-performing lines showed little to no mortality until -6°C, while lines at the other extreme showed considerable mortality at temperatures as high as -1°C. Lines from each end of the cold tolerance distribution will be used for metabolomics experiments to identify metabolic features that correlate with cold tolerance.

Funder Acknowledgement(s): DMR1157490, National Magnetic Field Laboratory, University of Florida

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116

Subcategory: Materials Science

A Study of Surface Energy Effects on Spider Silk Adhesion

Drew Finton, Duquesne University

Larinioides is a genus of orb weaving spider found in the Akron area. Like all orb weavers, Larinioides uses a variety of different types of threads in building its web. This study focuses on the aqueous glue droplets found on viscid silk used in prey capture. The prey capture process involves a flying prey encountering Larinioides' web, making contact, and adhering to the web. The adhesion must last long enough for the spider to come and immobilize its prey. Emerging research has focused on the effect of temperature and humidity on silk glue adhesion, but this study investigates the role that surface energy plays in glue droplet adhesion.

Two different surface energies were tested. The first was a plain glass coverslip that is hydrophilic in nature with a water contact angle of 30 degrees, and the other was a 1H, 1H, 2H-Perfluoro-1-dodecene plasma coated glass coverslip with a water contact angle of over 90 degrees. These two extremely different surface energies were chosen to examine how glue droplet adhesion functions in nature, where a great diversity of surfaces may be encountered.

To quantitatively study adhesion energy, an MTS NanoBionix tensile testing machine was used. This machine, sensitive to the micronewton level, measures the work required to remove the silk sample from contact with one of the two glass surfaces. To investigate the results of the NanoBionix testing, high speed video analysis was done on silk as it came into contact, and subsequently was removed from, the two glass surfaces.

A significant difference was seen in adhesion energy between the first and second contacts with the hydrophilic surface, yet no such result was seen upon repeated contacts with the hydrophobic surface. A potential explanation is that upon repeated contacts with a hydrophilic surface, the glue droplets do not spread evenly, and thus are not able to generate the same adhesion. This explanation was suggested by the high speed camera video analysis. Future work will investigate a potential change in bulk glue properties by further observing peeling dynamics of the second contact and removal from the hydrophilic substrate. Furthermore, Raman spectroscopy will probe possible changes in the secondary protein structure in the glue droplets after multiple contacts. Finally, the glue droplet spreading and peeling rates will be analyzed to interpret the viscosity of the glue at different humidity levels.

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117

Subcategory: Materials Science

An Assessment of the Biocompatibility of Cerium Oxide Nanoparticles Synthesized Using a Hydroxide Mediated Approach

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Nanoparticles are utilized for a variety of purposes ranging from biomedical applications, such as the targeting of cancer cells, to the removal of harmful reactive oxygen species (ROS) in the catalytic converters of cars. As a result, nanoparticles are at the forefront of research to find more effective ways of manufacturing and implementing them. Furthermore, cerium oxide is a unique material that can act as an antioxidant by absorbing ROS such as oxygen ions and peroxides. Cerium oxide nanoparticles were synthesized using a hydroxide-mediated approach in order to find an effective method to synthesize nanoparticles. The nanoparticles synthesized were characterized using FESEM, EDX, and UV-vis to verify the creation of cerium oxide by examining surface and morphological features as well as elemental makeup. After characterization the synthesized nanoparticles were tested for biocompatibility using the HaCaT cell line as an invitro model system in which an MTT assay measured the cell proliferation after the exposure of nanoparticles. An ROS assay was utilized in order to measure the amount of stress induced when the cells are exposed to these nanoparticles. Based on the two functional assays the cerium oxide was found to be biocompatible.

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118

Subcategory: Microbiology/Immunology/Virology

In Vitro Assessment of Stingless Bee Hive Products' Antimicrobial Properties in Ghana

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Recent studies have shown that honey and propolis from stingless bees has antimicrobial properties against common infectious bacteria that are rapidly developing antibiotic resistance such as Pseudomonas aeruginosa. The antibacterial activity of propolis, mostly attributed to its flavonoid content, is also well documented and an alcoholic extract of propolis has fungicidal effects against Candida sp. and Aspergillus sp. While the products of stingless beehives have been used to cure various infections, no definitive studies have been carried out to determine the effect of these products on a range of pathogens in Africa.

The objective of this study was to investigate the in vitro antimicrobial activity of honey and propolis of two stingless bee species namely Meliponula ferruginea and Meliponula bocandei. Ten bacterial species and two fungal isolates were used in the study. The bacteria were Salmonella typhi, Salmonella typhimirium, Salmonella adabraka, Salmonella spp., Escherichia coli, hemolytic Escherichia coli, Klebsiella pneumoniae, Staphylococcus aureus, Bacillus cereus, and Bacillus sp. The fungi were Candida albicans and Aspergillus niger.

Honey from both species was effective against all gram-positive and gram-negative bacteria at 10% concentration in the media incorporation test. However, at 5%, the honey from the M. bocandei was more effective at inhibiting bacterial growth than honey from the M. ferruginea. This study confirmed the findings of previous studies that honey can inhibit both gram-positive and gram negative bacteria in vitro—but not fungi. It also demonstrated the limited antimicrobial effect of the propolis.

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119

Subcategory: Microbiology/Immunology/Virology

Prevalence of Antibodies to Leishmania Spp. in Coyotes and Foxes from Pennsylvania and Tennessee

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Leishmaniasis is a zoonotic disease of humans and canines caused by hemoflagellated parasites in the genus Leishmania. Wild and domestic canines are reservoir hosts for human infections with Leishmania spp. In the United States, canine leishmaniasis has recently been recognized in the foxhound population, but it is currently unknown if Leishmania infects wild canine species. The present study examined the seroprevalence of Leishmania spp. in 267 coyotes and foxes from Pennsylvania and Tennessee. Sera from 256 coyotes (Canis latrans) and 11 red foxes (Vulpes vulpes) were tested by immunochromatographic strip assays (ICT). Antibodies to Leishmania spp. were detected in 5 of 251 (2%) of the wild canids from Pennsylvania, but none were detectable in Tennesee wild canids. Leishmania antibody-positive wild canids included 4 coyotes and 1 red fox. Our results indicate that wild canids are exposed to Leishmania spp. in Pennsylvania, but not in Tennessee.

Funder Acknowledgement(s): Johnson C. Smith University, Smith Institute of Applied Research

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120

Subcategory: Microbiology/Immunology/Virology

Characterizing the Role of Cytoplasmic Dynein in HTLV-1 Intracellular Trafficking

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Human T-Cell Leukemia Virus type 1 (HTLV-1) is a human retrovirus that is associated with a variety of human diseases, which include adult T-Cell leukemia/lymphoma (ATLL) and HTLV-1-associated myelopathy/tropical spastic paraparesis (HAM/TSP). A hallmark for retroviral infection requires the integration of the viral genome into the host cell genome. One problem the virus faces is trafficking through the cytoplasm in order to reach the nucleus. Some viruses have overcome this obstacle by hijacking molecular motors that move through the cytoplasm on microtubules (MT) in a retrograde fashion. The motor protein, termed

cytoplasmic dynein, mediates retrograde movement of intracellular cargo along microtubules.

In previous experiments, our laboratory has demonstrated that HTLV-1 particles co-localized with cytoplasmic dynein and dynactin within HEK293T cells. Also immunoprecipitation studies revealed that HTLV-1 directly or indirectly interacts with cytoplasmic dynein in-vitro. Thus, we have hypothesized that HTLV-1 utilizes cytoplasmic dynein to travel to the nucleus in order to insert its DNA into the host genome.

To investigate the role of cytoplasmic dynein in HTLV-1 trafficking, we have optimized conditions to perform experiments using short interfering RNAs (siRNA).We have targeted the expression of the enzyme termed glyceraldehyde 3-phosphate dehydrogenase (GAPDH). The GAPDH protein is constitutively expressed which makes it a good control for knockdown experiments. We have conducted transfection studies to knockdown GAPDH expression in HEK 293T cells. Fluorescence microscopy was performed to monitor transfection efficiency of our siRNA oligonucletodies in-vivo. Our studies demonstrated that 45-65% of the cells were successfully transfected with GAPDH siRNA oligonucleotides. Next, we evaluated the protein level of GAPDH in the transfected HEK293T cells. Western blot analyses revealed that GAPDH expression was significantly reduced in HEK 293T transfected cells compared to untreated control cells. Additionally, quantitative analyses revealed a (two – four) fold decrease in GAPDH expression in transfected cells. Collectively, our data supports the idea that siRNA can be used to knockdown the expression of cytoplasmic dynein. Currently we are using our optimized conditions to investigate if cytoplasmic dynein is required for HTLV-1 intracellular movement. By inhibiting the expression of this protein, we can better understand the role cytoplasmic dynein has in retrovirus movement. Through these studies, we expect to further elucidate the molecular details of HTLV -1: host cell interactions. Furthermore, these studies should reveal insights to potential therapeutic targets.

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121

Subcategory: Microbiology/Immunology/Virology

Protein Synthesis Inhibitors can Down-Regulate the Protein Expression of Staphylococcus Aureus Virulence Factors

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S. aureus has been implicated in serious infections within the scientific and medical communities. Methicillin-resistant S. aureus (MRSA) strains have become resistant to traditional antibiotics treatments. It is important to understand the mechanisms that S. aureus utilizes to cause damage to the host. Toxic shock syndrome toxin 1 (TSST-1), enterotoxins, proteases and exfoliative toxins are some virulence factors that can cause tissue destruction. Regulation of these virulence factors by treatment with antibiotics is poorly understood.

The objective of this study is to evaluate the regulatory effects of sub-inhibitory concentrations of antibiotics on S. aureus virulence factors.

It is our central hypothesis that protein synthesis inhibitors/ ribosomal assembly inhibitors can down-regulate S. aureus virulence factors by inhibiting the translational process.

After incubation with sub-inhibitory concentrations of antibiotics, (erythromycin, choramphenicol and kanamycin), TSST-1, exfoliative toxin, and enterotoxin expression were evaluated by enzyme-linked immunoabsorbant assay (ELISA). Kanamycin, erythromycin and chloramphenicol decreases TSST-1 protein expression by 45-48%. Kanamycin decreases enterotoxin expression by 20% and exfoliative toxin by 10%. Erythromycin is shown to decrease exfoliative toxin by 75%.

This study supports our hypothesis that protein synthesis inhibitor antibiotics can decrease the protein expression of S. aureus virulence factors. If lethal concentrations of antibiotics are not reached during treatment of an infection or if drug resistance develops, antibiotics may still exhibit inhibitory effects on the expression of the virulence factors. Identifying these mechanisms will help develop preventative treatment strategies against S. aureus infection and its related pathologies.

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122

Subcategory: Microbiology/Immunology/Virology

Traditional and Genetic Methods to Identify Specific Species of Coccidia in Turkeys

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Coccidiosis is a parasitic disease that infects the intestinal lining of turkeys. The disease is a concern for the economic production of poultry and for the management of wild populations of this

widely hunted bird. Seven species of Eimeria, the protozoan parasites that causes coccidiosis, may be found in the intestines of infected turkeys. During outbreaks it is necessary to identify the specific species responsible in order to choose an effective treatment regimen. Traditionally these species are painstakingly identified by the size and shape of the oocysts, the time of oocyst sporulation, pathogenicity, and the region of intestine that they damage. Our objective was to investigate the accuracy and efficiency of traditional approaches to identifying turkey coccidia relative to a molecular genetic approach. Twenty-six turkey poults were infected with either a lab isolate of coccidia from a production facility for domestic turkeys or a newly collected field isolate from local wild turkeys. Eight days post infection the oocyst characteristics and host intestinal damage were characterized. DNA was isolated from tissue from five diagnostic regions of the host intestine (duodenum, jejenum, ileum, cecum, colon) using the Qiagen DNeasy Tissue kit. We will optimize PCR procedures so that we can amplify the small ribosomal subunit gene from very small quantities of parasite DNA present relative to the abundant host DNA, using Eimeria-specific oligonucleotide primers previously described for chicken and grouse coccidia. The PCR-amplified DNA will be commercially sequenced and compared to Genebank accessioned sequences. Our results will reveal whether the traditional methods of determining the identity of Eimeria causing turkey coccidiosis during a particular outbreak are best replaced or supplemented by genetic identification of parasite species and perhaps the particular strain within a species of this protozoan.

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123

Subcategory: Microbiology/Immunology/Virology

System for Continuous Evolution of a Target Gene

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Mutations in nature are one of the driving forces for evolution, therefore methods which allow one to recreate natural mutagenesis patterns is an invaluable tool for the study of protein evolution. Furthermore, generation of varying forms of an enzyme is important for the study of its structure and function, and aids in the creation of improved variants for medicine and technology. However, laboratory methods are limited in that they are difficult to perform iteratively and often result in a bias for the type of single nucleotide substitutions made. Our approach aims to generate a continuous system for mutagenesis in vivo. Our hypothesis is that mutagenesis in live organisms is limited over multiple cycles by tolerance to mutations. Based on this hypothesis, continuous mutagenesis in vivo should be possible at low mutation frequencies. Our goal is to find that tolerance threshold empirically. Moreover, continuous mutagenesis would be a much more efficient driver of protein evolution than a single burst of mutations, even if that burst initially produces a higher mutation load. We present a two plasmid system that includes two components: the first one is an error-prone version of DNA polymerase I (low fidelity (LF Pol I), and the second one bearing the gene of interest—TEM 1 Beta-lactamase and GFPuv. LF Pol I contains three point mutations altering key Pol I residues for replication fidelity. This low-fidelity variant of Pol I generates random mutant libraries with high mutation loads, but mutagenesis occurs during one passage and does not continue to increase with subsequent passage; instead retransformation into naïve cells is needed. Here we describe a fourth mutation (K54E) affecting the 5'-3' exodomain of Pol I, which mediates processing of Okazaki fragments during lagging-strand replication. We demonstrate that this mutation increases the fidelity of the polymerase in vivo. We show cumulative mutagenesis in cells expressing K54E-LF Pol I upon serial passage. This continuous mutagenesis in vivo allows us to raise the mutation frequency and to control it by simple passage, without the need for iteration. As controls we plan to repeat the experiment including other Pol I variants that have high replication fidelity relative to LF-Pol I We have preliminary data suggesting we have a continuous system of mutagenesis in vivo. We suspect that a moderate mutation frequency is key for the system to work. We plan to confirm this proposition and also test our hypothesis that continuous mutagenesis in accelerates evolution because in this setting the generation of genetic diversity is coupled to a selection. As a model for genetic adaptation, we will evolve extended spectrum Beta-lactamase under cefotaxime selection. These experiments will be performed on a drug gradient, which will allow us to score the number of independent resistant mutants obtained and their level of resistance.

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124

Subcategory: Microbiology/Immunology/Virology

Isolation of Bacteria from Human and Kitchen Waste for Biogas Production in Bahir Dar, Ethiopia

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Anaerobic digestion treatments have often been used for biological stabilization of solid wastes. Recently, anaerobic digestion of solid wastes has attracted more interest because of current environmental issues in Ethiopia, most especially those concerned with global warming and waste renewal. Classification and analyses of the microbes found within waste samples will be necessary to determine if the sludge left after digestion

can be reused as fertilizer in real-world application. Analyzing three samples of human waste (HW) and kitchen waste (KW) at ratios of 100% KW pre-anaerobic digestion, 90% HW and 10% KW, and 10% HW and 90% KW post-anaerobic digestion. I hypothesized a higher bacterial count post-anaerobic digestion as opposed to pre-digestion. Culture Methods include a serial dilution, preparation of selective media, Violet Red Bile Agar (VRBA), and pour plating. Plates were incubated at 42˚C to promote coliform bacterial growth. Contrary to what was predicted, the bacteria after digestion in the reactor lacked microbial growth, while the kitchen waste before digestion contained insignificant CFUs/g. Perhaps in future investigations, I can incubate the bacteria under different inoculation parameters by using a spread plate method to yield significant results. To protect human health and natural environment from waste problems in Bahir Dar and worldwide, further research needs to be done, in order to significantly prove that the sludge left after digestion can be safely used as fertilizer for crops through proper classification and analysis of microbial growth.

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125

Subcategory: Microbiology/Immunology/Virology

Peptide Conjugated SPIONs as Antimicrobials

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Staphylococcus aureus is recognized as one of the antibiotic resistant bacteria and has an ability to form biofilms. So far use of antimicrobial peptides (APs) appears to be the most promising alternative to antibiotics. However, penetration of the biofilms using APs still remains as a challenge. Coupling the antimicrobial peptides with the superparamagnetic iron oxide nanoparticles (SPIONs) which are controlled by an exterior magnetic field may strengthen the curative effects of antimicrobial peptides. Present study attempted to conjugate SPIONS with two commercially available peptides TP575 and TPOB1016 from Therapeutic Inc. and characterized them using zeta sizer, zeta potential, Fourrier transform infrared spectroscopy (FT-IR) and UV vis spectra. The characterization analysis revealed a successful functionalization of the peptides on SPIONS. The minimum inhibitory concentrations (MIC) of TP575 and TPOB1016 against S. aureus were evaluated and determined to be in between 3.90 -1.95 µg/mL but SPIONs alone do not have any antimicrobial effect. With the successful conjugation of the SPION to the APs and knowing that it inhibits S. aureus, we are hopeful that it will be used to penetrate biofilms of microorganisms in the future.

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126

Subcategory: Microbiology/Immunology/Virology

Comparison of Primer Sets for Molecular Identification of Soil Ciliates

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Ciliates are a diverse eukaryotic protozoan group; in soils and other habitats they regulate bacterial community structure by predation. Traditionally, ciliate identification has been performed on both living and fixed cells by microscopy, which is time-consuming and requires a high level of expertise. Molecular methods for ciliate identification, while becoming more common, are still in development. In this research, two ciliate-specific primer sets targeting the 18S rRNA gene were tested and used to amplify DNA extracted from eight soil types which were collected from Sumter National Forest. Primer sets 121F-384F-1147R (semi-nested) and 315F-959R were used to amplify soil ciliate DNA via polymerase chain reaction (PCR), and the resulting PCR products were analyzed by gel electrophoresis to obtain quantity and band size. All bands were between 650-850 base pairs long. To evaluate the efficacy of the experimental method, one soil sample was chosen for cloning and ~10 ciliate 18S rRNA sequences were obtained. Sequences were aligned against the NCBI GenBank database for identification, and the taxonomic classification of best-matched sequences was determined. Further cloning experiments to obtain a more representative sample size are ongoing. Once completed, the apparent community structure revealed by each primer set will be compared for one or two soil types. This is an important research question since molecular methods for ciliates are relatively new, and the connection between those observed microscopically and those revealed by DNA analysis is still under investigation.

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127

Subcategory: Microbiology/Immunology/Virology

Cutaneous Bacteria from Pseudacris Regilla Inhibits Growth of Amphibian and Human Fungal Pathogens

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The fungal pathogen, Batrachochytrium dendrobatidis (Bd), is causing massive extinctions in the amphibian population. When infected, the cutaneous layer thickens, depriving them of oxygen and other nutrients they normally acquire through the skin, in a sense suffocating them to death. In the Southern San Joaquin valley, where Bd is present, the Pacific Chorus frog (Pseudacris regilla) is thriving while other species are in decline. Their survival may be the cause of a symbiotic relationship with cutaneous bacteria. We hypothesized that bacterial species, obtained from the Pacific Chorus frog, will inhibit the growth of known amphibian pathogens (Basidiobolus ranarum (Br) and Bd) and even human pathogens (Candida albicans (Ca), Cryptococcus neoformans (Cn), Epidermophyton floccosum (Ef), Microsporum gypseum (Mg), Trichophyton mentagrophytes (Tm)). To test our hypothesis, three different types of challenge assays were performed with 19 bacterial isolates collected from Pacific Chorus frogs against the amphibian and human pathogens. Challenge assays against Ca and Cn, were prepared by inoculating sterilized media with the fungus. The media was poured into petri plates and let to solidify. Three bacterial isolates were streaked on the plate including a negative control. Challenge assays against Br, Ef, Mg, and Tm, were prepared by cutting a fungal plug and placing it in a fresh media plate. After the growth period, two different bacterial isolated were streaked on either side of the fungal plug. Challenge assays against Bd were prepared by adding 1 mL of Bd, containing active zoospores, onto a 1% tryptone media plate. Two bacterial isolates were streaked using a positive control. All challenge assays were classified as positive if any zones of inhibition were present or negative no zones of inhibition.

Preliminary results suggest that the bacterial isolates inhibit at least one of pathogens used in this study. To date 10% have inhibited the growth of Ca, 10% have inhibited the growth of Cn, 16% have inhibited the growth of Ef, 21% have inhibited the growth of Mg, 26% have inhibited the growth of Tm, and 16% have inhibited the growth of Br. The antifungal potential of the cutaneous bacteria is important because it can help improve amphibian conversation. The antifungal compounds secreted from the bacteria may have the ability to combat human fungal diseases. Future work includes determining the specific metabolite secreted that possesses antifungal properties.

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128

Subcategory: Microbiology/Immunology/Virology

Generation of Tumor-reactive Cytotoxic T lymphocytes Using Chimeric Immune Receptors

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Adoptive cell transfer of tumor-reactive cytotoxic T lymphocytes (CTL) has been identified as a promising cancer immunotherapy; however, such immunotherapy has been hindered by the limitation of functional T cells. In this study we tested the approach using chimeric immune receptors (CIR) gene transduced CTL from the peripheral blood mononuclear cells (PBMC) for potential ACT-based leukemia therapies. We have formed a MFG-based retroviral DNA vector encoding CIR which consists of a combination of single chain antibodies specific to CD20, a tumor associated antigen of leukemia, T cell receptor (TCR) signaling elements (CD3 zeta) and T cell costimulatory signaling elements (CD28 and CD137). Using the Plat-E packaging system, we observed CIR gene expression on the packaging cells, and the supernatant of packaging cells transfected with the CIR construct contained viruses that had ability to transduce CIR on CTL from the PBMC. We are expecting that the CIR- transduced CTL will be able to specifically recognize and kill CD20+ target cells in an in vitro setting of cytotoxic assay and this CIR-transduced CTL will be a good tumor-reactive effector for ACT- based leukemia immunotherapy.

Funder Acknowledgement(s): National Science Foundation

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129

Subcategory: Microbiology/Immunology/Virology

The Influence of Porphyromonas Gingivalis Serine Protease/ Chaperone HtrA on the grpE Locus During Oxidative Stress

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Periodontal disease has been linked to systemic complications including cardiovascular disease. Porphyromonas gingivalis is a major etiologic agent in periodontal disease. Understanding the regulatory processes of virulence and survival mechanisms of this organism is important in identifying new therapeutic strategies against P. gingivalis associated disorders. Previously, we have demonstrated that inactivation of the P. gingivalis periplasmic serine protease/chaperone htrA gene resulted in altered gingipain activities, distribution, and profiling. We have also

demonstrated sensitivity of the htrA-defective mutant to oxidative stress.

In this study, we evaluated any possible influence that HtrA may have on other chaperones, such as the GrpE and DnaJ. We have previously demonstrated that the grpE and dnaJ are down-regulated in the presence of hydrogen peroxide in the htrA-defective mutant. In this study we have evaluated the expression of the downstream genes in the htrA-defective mutant. It is our central hypothesis that the grpE locus (including the downstream hypothetical genes) coordinately works with HtrA during periods of oxidative stress resistance for survival.

Using quantitative real-time PCR and bioinformatic analysis, genetic analysis of the pg1777, pg1778 and pg1779 in the htrA-defective mutant were evaluated. Data from this study demonstrated that three grpE down-stream hypothetical genes are down-regulated under oxidative stress in the htrA-defective mutant. Bioinformatic analysis suggests that these genes may play a role in protection or repair of P. gingivalis.

This evidence indicates that HtrA may play a significant role in oxidative stress resistance during periods of oxidative stress.

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130

Subcategory: Microbiology/Immunology/Virology

Expression Dynamics of Gene for Universal Stress Protein of Toxoplasma Gondii

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Genome sequencing has revealed the presence of a gene encoding universal stress protein (USP) domain in Toxoplasma gondii, an apicomplexan parasite that infects warm blooded animals including humans. Universal stress proteins help plants, bacteria, archaea and some metazoans to respond to changing environmental conditions such physiological changes in a host. The life cycle of Toxoplasma gondii alternates between lytic growth and dormant development stages. The dormant stage is known as an environmental stress response. The hypothesis of the research is that gene for the universal stress protein are expressed in response to stress related to life cycle signals between acute (lytic growth stage) and chronic (dormant stage) infection of host. Transcriptomic data on expression of 2236 Toxoplasma gondii genes during acute or chronic infection in mouse brain were obtained from the ToxoDB (http://toxodb.org/). A combination of bioinformatics and visual analytics tools was used to determine differences in expression levels of genes between acute and chronic infection. A comparative data set also investigated was Toxoplasma oocyst time course (Day 0, Day 4 and Day 10). Among the gene annotated for response to stress, the USP gene had the highest fold change of 2.2. In the oocyst time series the fold change for USP was lower than the other genes annotated for response to stress. The increased expression of Toxoplasma USP in the chronic stage could be related to the availability of calcium that is controlled by the phytohormone abscisic acid (ABA). Future research will determine if calcium is one of the chemical ligands that bind to the universal stress protein of Toxoplasma.

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131

Subcategory: Microbiology/Immunology/Virology

Rapid Identification of Coastal Ocean Antibiotic Resistance Sentinel Species Vibrio Parahemolyticus

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We hypothesized that a cornerstone antimicrobial resistant bacteria (ARB) species, Vibrio parahaemolyticus, could be detected rapidly and inexpensively using direct antibiotic selection, 16S amplification and inexpensive Sanger DNA sequencing. Ocean dwelling ARBs are more regularly isolated along the Southern California coast than a decade ago. Identifying the reservoirs of antibiotic resistance genes in ocean populations presents unique challenges and quantitatively monitoring ARBs as their populations expand dramatically in coastal waters during the dry summer months is desirable. As a control, a 4-day standard bacterial isolation and identification assay of ocean water isolate was performed using standard 0.2uM filtration, growth on media selective for enteric bacteria replica plating onto antibiotic media containing carbenicillin and DNA sequencing for identity. A 2 -day experimental assay incorporated the direct transfer of the 0.2 uM filter to carbenicillin selective media followed by PCR and sequencing of the pooled isolates.

The results of the 4-day control assay were that V. parahemolyticus were present as one of many moderately antibiotic resistant bacteria. However, the experimental 2-day assay was able to consistently, inexpensively and reliably select for V. parahemolyticus from an identical 0.2 uM filter of ocean water. The new selection-sequencing method consistently identified a single sentinel species. In both control and experimental groups, the results of the real time fluorescence, melt curve analysis and DNA sequencing confirmed singled-species DNA amplification.

We conclude that a single ARB could be used as a sentinel in surveying coastal California as an indicator of the total regional ARB population. The global increase in antibiotic resistant V. parahemolyticus in the past ten years correlates with increases in antibiotic usage in aquaculture, agriculture and humans. Further investigation of the proximity of this species to transoceanic ports of call is suggested.

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132

Subcategory: Microbiology/Immunology/Virology

Novel Biomarkers for HIV-1 Disease Progression

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Approximately forty million people worldwide live with the human immunodeficiency virus-1 (HIV-1), which can progress into HIV-1-associated neurocognitive disorder (HAND). The most severe form of HIV-1 Central Nervous System (CNS) Disease is HIV-1-associated encephalitis (HIVE) or dementia (HAD), which is a defining condition of acquired immune deficiency syndrome (AIDS). Research suggests that pro-inflammatory proteins and other biomarkers may correlate with the level of neurological impairment in seropositive patients. The purpose of the study is to identify biomarkers that may correlate with neurocognitive decline in patients of varying gender, race, age, and disease progression. A cohort of HIV-1 seropositive patients is currently being recruited from the University of North Texas Health Science Center (UNTHSC) infectious disease clinic. A study visit includes a review of HIV-1 relevant patient history, a socio-demographic survey, a neurocognitive assessment, and a donation of 30-40 milliliters (ml) of blood. Plasma samples, isolated from patient blood, were analyzed by ELISAs specific to human soluble CD40 ligand (sCD40L), Interleukin (IL)-6, CCL2 or monocyte chemoattractant protein (MCP)-1 and tissue inhibitor of metalloproteinase (TIMP)-1. Biomarker levels were correlated to neurocognitive assessments, socio-demographic responses, and relevant measures of HIV-1 infection medical history. The inflammatory biomarkers, CCL2 and TIMP-1, were elevated in the HIV-1 seropositive cohort as compared to non-infected controls. Further, as the neurocognitive abilities of the patient cohort declined, levels of CCL2, IL-6, and TIMP-1 were correspondingly elevated. While sCD40L demonstrated no significant correlations between infection status, longevity, or neurocognitive score, the inflammatory protein showed consistent, positive trends. Although patient T-cell counts did not correlate significantly with inflammatory biomarkers, trends were seen that may improve upon analyzing of the entire cohort. Our data show that inflammatory biomarkers may play an important role in predicting HIV-1 disease progression through the comparison of plasma samples within the HIV-1 seropositive population.

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133

Subcategory: Microbiology/Immunology/Virology

Screening for Serratia Marcescens Mutants for the Lack of Biofilm Formation

Brittany Thompson, Claflin University

Serratia marcescens is a species of rod-shaped gram-negative bacteria that can be found anywhere including: food, water, and soil. Bioremediation uses biological organisms to solve environmental problems, which involves finding ways to enhance the growth of pollution eating microbes that live in contaminated sites. Biofilms are suitable for the remediation of pollutants because of their high microbial biomass and ability to immobilize pollutants. However, they can also prevent bacterial movement through sediments reducing the bioremediation capacity of the bacteria. The purpose of this study was to use transposon mutagenesis to generate S.marcescens biofilm mutants. S. marcescens was mated with Escherichia coli, containing pTnModRKm', which has a mini-Tn5 transposon. The exconjugates were plated on Luria Bertani agar with kanamycin. Individual colonies were then arrayed onto fresh agar and sub-cultured into LB broth in polyvinyl chloride 96 well plates. The bacteria were removed after 24 hours and the plates were stained with crystal violet. About 3,570 mutants were made, and of those, 72 were tested for biofilm formation. Upon visual inspection, 20 mutants had less biofilm formation than the original strain. Understanding how S. marcescens forms a biofilm allows us to interfere with the process and manipulate it so the bacteria form biofilms on demand.

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134

Subcategory: Microbiology/Immunology/Virology

B Cells in the Cutaneous Immune Response Against Leprosy

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The role B cells play in the cutaneous immune response is largely unknown. Leprosy, a chronic disease caused by Mycobacterium leprae, is a useful model to examine the immune response in the skin because lesions are easily accessible for study. Leprosy causes a spectrum of diseases in which we can observe differences in the immune response. B cells have been found to be present in leprosy skin lesions but their role in these lesions in unknown. We sought to gain insight into the role B cells play in the cutaneous immune response by using leprosy as a model system. We hypothesize that B cells, their products, or both help form the immune response against M. leprae.

Specifically, we asked whether M. leprae or its products could activate B cells. We used cellular proliferation (as assessed by [3H]thymidine uptake, and Carboxy Fluorescein Succinimidyl Ester (CFSE) dilution) and expression of cell surface activation markers (as assessed by flow cytometry) as measures of activation. To this end, we isolated B cells from the peripheral blood of healthy donors and exposed these cells to products of M. leprae. We found that B cells when cultured with products of M. leprae showed no differences in proliferation or cell surface activation markers when compared with unstimulated B cells. We then tested whether activation of B cells would ensue if B cells were exposed to products of M. leprae in the presence of other peripheral blood mononuclear cells. We used CFSE to label total PBMCs and then gated specifically on the B cell population after exposure to stimulatory conditions. We did not find a difference in B cell division as measured by CFSE dilution when stimulated with products of M. leprae in the presence of other PBMCs. These results suggest that products of M. leprae do not activate B cells directly or in the presence of other peripheral blood mononuclear cells.

These experiments are limited as products of M. leprae may not contain appropriate epitopes to stimulate B cells. We may overcome this limitation in the future by examining markers of B-cell activation in the presence of live M. leprae. Future studies also include examining B cells from patients with leprosy, and examining other markers of cellular response including cytokine and Immunoglobulin production in the presence of M. leprae or its products. We hope that information gained about the role B cells play in the immune response to M. leprae may provide new possibilities for advancement of treatments for various human diseases.

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135

Subcategory: Microbiology/Immunology/Virology

Predicting the Functions of Universal Stress Proteins of Actinomyces

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Actinomyces is a genus in the actinobacteria that include members that are disease-causing and of biotechnological relevance. Genomes of Actinomyces encode proteins for stress response including those for the universal stress proteins (USP). The focus of the reported research was to characterize the neighborhood of USP genes in genomes of Actinomyces. The hypothesis of the research is that the function of adjacent genes would provide clues to the biological processes that involve the universal stress proteins.

The USP genes encoded by Actinomyces genomes was determined using the Integrated Microbial Genomes (IMG) System (http://img.jgi.doe.gov/). The gene neighborhood was determined with the BioCyc collection of databases (http://biocyc.org/). Several Actinomyces genes for universal stress proteins were observed to be part of multi-gene transcription units. One such transcription unit in an oral Actinomyces species consisted of five genes including gene for putative aminobutyraldehyde dehydrogenase involved in putrescine degradation.

A bioinformatics approach was used to uncover functional associations of universal stress proteins in Actinomyces. A future research question is to determine co-expression of genes in multi-gene transcription units encoding universal stress proteins.

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136

Subcategory: Microbiology/Immunology/Virology

Phenotypic Variations of Pathogenic Nonencapsulated Streptococcus Pneumoniae Based on Infection Site

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The introduction of the pneumococcal conjugate vaccine (PCV) has caused a decrease in the number of pneumococcal related deaths in the United States. This vaccine targets the pneumococcal polysaccharide capsule. Nonencapsulated Streptococcus pneumoniae (NESp) are not covered by the PCV. NESp are known to cause non-invasive disease and some limited invasive disease. We examined the ability of a number of NESp isolates to adhere to and invade human epithelial cells. The purpose of this project was to determine the differences of epithelial cell interaction with NESp based on the type of infection associated with NESp isolates.

An adhesion/invasion assay was performed using the human epithelial cell line A549. NESp were added to confluent wells of A549 cells. At 30 minutes, the wells were washed and cells remove to estimate the number of adhere NESp. In other experiments, antibiotics were added one hour after incubation to kill any NESp that were external to the A549 cells. One hour later, the cells were removed to estimate the number of NESp that had invaded the epithelial cells.

We found that there was increased adherence of the colonization and otitis media NESp isolates to epithelial cells when compared to invasive NESp isolates. We also saw that there was increased invasion of the nasopharyngeal epithelial cells by the otitis media isolates compared to the colonization and invasive NESp isolates. Our data demonstrate that NESp isolates exhibit a range of interaction with epithelial cells. These interactions appear to be associated with the source of isolation of these human NESp isolates. Future research will be conducted to determine why epithelial interactions differ with isolation sites.

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137

Subcategory: Nanoscience

Nanomaterial Toxicity and the Effect on Genomics

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Though there are tremendous advancements in nanotechnology, the exposure of nanoparticles to the environment has proven to be extremely hazardous to the human body as well. In recent years, there has been effort to determine the toxicity of nanomaterial to a wide range of cell species. Though AuNPs and AgNPs are both metals, their effects on cells differ. Whenever AgNPs are exposed to cells there is a potential source of oxidative stress, this introduces reactive oxygen species (ROS), which is the up-regulation of Heme oxygenase 1(HO-1) expression, causing apoptosis and autophagy. While AuNPs also causes oxidative stress, it can also damage the DNA. In this study, we investigate the toxicity of gold nanoparticles (AuNPs) and silver nanoparticles (AgNPs). Four different sized AuNPs viz., 10, 15, 20 and 25 nm were used. RNA was extracted from nanoparticle incubated cells and cDNA was synthesized. The RNeasy Plus Mini Kit was used for RNA extraction. The Nanodrop was used to count the quantities of RNA within each sample. PCR with gene specific primers were performed on cDNA. The genes analyzed were p53 (tumor suppressor), capsase-3, whereas AgNPs were 20 nm in size. Cell viability and toxicity of nanoparticles were determined using trypan blue dye and MTT Assay. Two cell lines, human epithelial tumor (HEp-2) cells and African green monkey epithelial tumor (Vero) cells were used for the study. Trypan blue dye exclusion assay showed 77.3% cell viability with 100 µg/ml AgNPs. Likewise AuNPs showed up to 67.67% cell viability. Likewise MTT assay showed very little toxicity to gold nanoparticles. We further investigated the effect of nanoparticles on the apoptosis pathway genes. The genomics of each cell were analyzed to acquire data on how the nanoparticles alternate proteins within the DNAl2 and bax (apoptosis regulator). We observed an increase in gene amplification of cells exposed to higher concentrations of AgNPs. In qPCR, we amplified cDNA samples using 84 genes.

In this study both cell lines surprisingly displayed resistance when exposed to the nanoparticles. The viability of each sample varied after being compare to each control. We observed an increase in a variety of gene regulation of cells exposed to AgNPs in qPCR. The silver and gold nanoparticles (AuNP & AgNP) showed little to no toxicity to the cells. However, qPCR analyses showed up regulation of stress-related proteins.

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138

Subcategory: Physiology and Health

The Effect of Carbohydrate or Protein on Blood Glucose, Blood Pressure and Heart Rate Before and After Exercise

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Glucose is a major source of energy for most cells of the body. A normal blood glucose level is 70-100 milligrams per deciliter. The objective of this experiment was to determine the effect of eating carbohydrates or proteins on blood glucose, blood pres-

sure and heart rate after fasting and before and after exercise. Glucose was hypothesized to increase after eating and decrease from exercising. Ten subjects were subjected to glucose heart rate and blood pressure testing at three different sampling times (first thing in morning, after eating, after exercise). The experiment was repeated two different times varying the meal (either carbohydrate or protein). Preliminary data showed blood glucose was lowest after fasting, increased after a meal, and decreased after exercise regardless of the food eaten. Eating carbohydrates increased blood glucose more than protein. Heart rate and blood pressure increase after eating protein, but decreased after eating carbohydrates. Post exercise heart rate and blood pressure increased regardless of the food eaten. Further study and additional subjects should be tested to determine the effect of diet on exercise and energy levels.

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139

Subcategory: Physiology and Health

Role of Acetylcholine Release in the Locomotion of Drosophila Larvae

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Decline in cholinergic neurotransmission is associated with normal and pathological aging. Cholinergic release remains a subject of great interest to human biology. However, the precise role of changes in acetylcholine release in mediating behaviors, such as locomotion, remain poorly understood. The vesicular acetylcholine transporter (VAChT) is present in many species, including worms, flies, and humans, and is responsible for the packaging and transport of acetylcholine for exocytotic release. A complete loss of VAChT function is lethal, while severe mutations can cause decreased locomotive performance in Drosophila. Here, we hypothesize that deficits in vacht function can be rescued by a pharmacological or genetic increase in VAChT, which can be identifiable by a shift in the rate of locomotion towards normal. The overall purpose of this study was to determine an effective method of rescuing mutations in Drosophila vacht. In order to find a rescue for the mutation, drugs in different concentrations were given to the larvae for a set period of time. Drug-fed larvae were then tested in two locomotion assays, using the automated Multi-Worm Tracker and the touch response assay. We report that treatment with brucine (an acetylcholine agonist) rescues the locomotion defect in three vacht mutant alleles. The results indicate that genetic deficits in the vesicular acetylcholine transporter can be repaired using pharmacological methods, which could pave way for future methods used to treat human disorders, such as Alzheimer's disease, that are associated with defective cholinergic release.

Funder Acknowledgement(s): SMILE Program, Delaware State University

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140

Subcategory: Physiology and Health

The Effects of Lower Protein Levels on Sow Lactation and Heat Increments

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In the swine industry, weather conditions have a large effect on the sow performance. The swine industry in the US holds heat stress responsible for over $299 million annual loss. Farms have to figure out new cost efficient ways to keep sows cool. Swine lack the ability to sweat in order to reduce their body temperature and are effected greatly by high temperatures. There has been a move to find new ways to control the sow's temperature in the housing units to prevent overheating. The reproductive sow is the most effected by heat stress. She has to dissipate more heat, as lactation and gestation contribute greatly to the sow's heat increment. (Black et al. 1992). Overheating causes a loss in appetite, and poor lactation. Under heat stress, the sow's heart rate decreases and blood flow increases. She then, must make additional metabolic alterations in an attempt to maintain thermal homeostasis. In this study we are looking at sow health and milk quality under heat stress on a lower crude protein (CP) diet, from days 3-10 of the 21 day study. The experimental diet was a low protein diet of 11.82%, while the high diet was 17. Sow health was monitored by checking respiration rate (RR), heart rate (HR), and core body temperature (CBT). There was a 2×2 factorial arrangement for the study. We had a High Protein/ Heat Stress environment (High CP/HS), Low Protein/Heat Stress environment (Low Protein/HS), High Protein/Thermal Neutral (High CP/TN) environment and a Low Protein/Thermal Neutral environment (Low CP/TN). Our goal was to decrease heat increments while maintaining lactation performance. We found that with the short span of time reported more of a significant difference was seen between each sow in the body temperature, heart rate, and respiration rate than has a whole group. Even though statistically there was no significance in the short span we looked at body temperature (BT), respiration rate (RR), and somatic cell count in the milk proved that the sows were heat stressed. A data set taken from a longer time span would show more significant p- values in the data as a whole. Overall data showed that heat stressed sows were stressed and that the diets were in fact a high and a low protein diet.

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141

Subcategory: Physiology and Health

Osmoregulatory Plasticity of Freshwater-acclimated Red Drum in Acute Saltwater Transfer

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Although many fish species can only tolerate a narrow range of water salinity, some fish species are euryhaline and can therefore tolerate broad salinity ranges. Salinity change poses unique osmoregulatory challenges. Unlike freshwater fishes, marine fishes are hyposmotic to their surroundings and most have adapted to drinking seawater to prevent dehydration. Salt in ingested seawater is processed in the intestine and ejected out the gills for a net water gain. Considering this physiological contrast it follows that euryhaline fish must undergo large-scale remodeling of their gut and gills as they move across salinity gradients. Previous studies have shown that the degree of remodeling and the rate at which it occurs varies across species and is related to the severity of the osmotic stress. This study investigated the osmoregulatory plasticity of euryhaline fish species red drum (Sciaenops ocellatus) when faced with acute osmotic stress on short time-scales. Freshwater-acclimated red drum (N = 30) were acutely transferred to 100% saltwater (33ppt) and fish were subsampled at 0, 24, 72 hours and 7 days post-transfer. Concentrations of Na+, Cl-, Mg++, and Ca++ in blood plasma, muscle fluid, and intestinal fluid were measured. Collected muscle tissue was dehydrated to determine muscle water content. Real-time PCR was performed on gill lamellae to compare expression of marine-osmoregulatory proteins NKCC and CFTR. One way ANOVAs were used to determine significant differences between each time group, where 0 hour served as the control. No significant changes over time were observed in muscle water content and ion content. Unexpectedly, there was a significant decrease in plasma osmolality in the 7 day group. Significant changes in plasma Cl- content were observed in the 24 hour and 7 day groups, and fish started drinking within 24 hours post-transfer. As observed with similar studies involving different species, CFTR was rapidly up-regulated while no significant changes were observed in NKCC expression. Overall, these data demonstrates that freshwater-acclimated red drum are highly plastic and are able to rapidly osmoregulate when challenged with acute osmotic stress. Although this study provides novel answers about the mechanism and time-scale of osmoregulatory plasticity in red drum, it raises questions about how red drum might respond to hypersaline stress and demonstrates the need for further studies regarding their plastic limits.

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142

Subcategory: Physiology and Health

The Effect of Acute Exercise on Superoxide Dismutase and GP91phox Expression in Peripheral Blood Mononuclear Cells

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Cardiovascular Disease (CVD) is the leading cause of death in the United States. Every 1 in 3 deaths can be attributed to CVD, approximately 600,000 deaths annually. Peripheral Blood Mononuclear Cells (PBMCs) are essential to immune and inflammatory response, these two processes play a key role in the development of CVD. One of the main causes of disease onset and development is the accumulation of free radicals. Free radicals or Reactive Oxygen Species (ROS) are a byproduct of aerobic respiration. When regulated ROS are beneficial to the body, serving as mediators for angiogenesis, cell proliferation, differentiation and various other cellular functions. The human body has an antioxidant defense system in place to regulate ROS and prevent hazardous concentrations from accumulating in the body. In response to increased levels of ROS, the body produces antioxidants, one of these being Superoxide Dismutase 1 (SOD1). SOD1 is responsible for catalyzing the breakdown of Superoxide (O-2) a toxic ROS. O-2 is produced by NADPH oxidase, GP91phox is a subunit of this enzyme complex. It has been shown that chronic exercise upregulates the antioxidant defense system, counteracting the detrimental effects of ROS. SOD1 may be one of the enzymes in this system regulated by exercise. We hypothesized that if exercise is upregulating the antioxidant defense system then endurance athletes should have an observable difference in SOD1 and GP91phox.

Participants (n=12) were 18-35 years old with no existing medical history of CVD, and not on any known medication. Body fat percentage was calculated using Bod-Pod while the participant was fasting. A VO2 Max Test was conducted on each participant to measure their maximal oxygen uptake. Subjects exercised until they reached exhaustion, or until VO2 Max had been reached. True VO2 Max was characterized by the following: respiratory exchange ratio >1.1, rating of perceived exhaustion (RPE) >18; > Very Hard. Participants returned at least 48 hours after their initial test to perform an acute exercise test at 70% of their VO2 Max. Blood was taken from participants before and after an acute bout of exercise and used for PBMC isolation. PCR was conducted and gel electrophoresis was run on 1.5% agarose gel. Gels were quantified using ImageJ software.

There was a nonsignificant (p=0.262) decrease in SOD1 expression post exercise. There is a nonsignificant (p=0.418) decrease

in GP91phox expression following acute exercise. These results support the hypothesis that SOD1 is affected by chronic exercise, and has an effect on ROS after an acute bout of exercise. In most cases there is an increase in ROS producing enzymes like GP91phox post exercise. In the case of these endurance athletes we found that they showed no increase in GP91phox post exercise, leading us to believe that their body is efficiently regulating ROS compared to sedentary individuals.

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143

Subcategory: Physiology and Health

Investigating Molecular Responses of Cardiac Tissue to Age- and Adrenergic Agonist-induced Hypertrophy

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Cardiac hypertrophy occurs in response to stress, thereby cardiomyocyte enlargement can be induced by a beta-adrenergic agonist such as isoproterenol. Sarcospan (SSPN), an integral-membrane protein that associates with dystrophin, acts to stabilize skeletal and cardiac muscle integrity. Mice lacking SSPN, at 12 months of age, exhibit normal cardiac tissue with no visible alterations; however, Isoproterenol treatment of SSPN-null mice exacerbates hypertrophy relative to treated, wild-type (WT) controls. At 18 months of age, untreated SSPN-null mice display cardiac hypertrophy with increased ventricular mass and increased fiber size. Isoproterenol treatment causes an earlier hypertrophic response that occurs naturally upon aging. Gene expression changes are likely to be coupled with the changes in cardiac remodeling in both aged and isoproterenol-treated mice. We will investigate whether similar patterns of gene expression of hypertrophic responsive genes occur upon aging or a hypertrophic stimulus (Isoproterenol). To investigate these findings, we will study gene expression changes in: 12 month old, untreated or isoproterenol treated (WT and SSPN-null) mice. To complete the aging study, we will compare gene expression changes in: 18 month old untreated or isoproterenol treated (WT and SSPN-null) mice. Comparisons will be made to examine how the aging phenomenon exacerbates the hypertrophic response in 18 month mice in the absence of isoproterenol treatment. Upon examining these mice, qRT-PCR will be performed to look at differences in expression of key genes known to be pathological hypertrophic markers. In addition, morphological characteristics, such as fiber size and fibrosis, which are associated with hypertrophy, will be examined using hematoxylin and eosin (H&E) staining of cardiac tissue obtained from the 12 and 18 month old mice. Preliminary results show an increase in fibrosis in the hearts of 12 month SSPN-null isoproterenol treated mice compared to WT controls. We will determine effects of isoproterenol treatment of SSPN-null mice at 18 months of age compared to untreated 18 month SSPN-null mice. Preliminarily, we found an increase in atrial naturietic peptide (ANP), a cardiac stress marker, in 18 month old mice compared to 12 month old, untreated SSPN-null mice. The results of this study will allow us to elucidate underlying changes in gene expression in SSPN-null mice associated with age and hypertrophic stimulation by beta-adrenergic agonists.

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144

Subcategory: Physiology and Health

Disruption of Circadian and Cardiovascular Function in the Q175 Mouse Model of Huntington's Disease

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Huntington's disease (HD) is an autosomal dominant neurodegenerative disorder which has hallmark symptoms of abnormal motor coordination as well as non-motor symptoms which have received less attention. For example, one of the first symptoms reported by patients before full onset of the motor disorder is irregular sleep and circadian behavior. Autonomic nervous system (ANS) and cardiovascular dysfunction is another early symptom of HD that often is a cause of early death in the population. Studies have demonstrated that disruption of the circadian system alone leads to an increased risk for serious cardiovascular events, therefore, the presence of a circadian phenotype so early in the disease progression of HD may be a factor which contributes to cardiovascular pathogenesis.

To examine this idea, we have used the Q175 mouse model of HD to test the hypothesis that this model exhibits progressive cardiovascular dysfunction and changes in daily heart rate rhythms. The Q175 model contains 175 expanded CAG repeats and has been shown to closely recapitulate many aspects of the disease seen in the HD population. A telemetry system was used to measure daily patterns of heart rate and body temperature, which are physiological processes highly regulated by the circadian system. In addition, we have examined rhythms of heart rate variability over a light/dark cycle, which will assess the quality and health of the ANS. A poorly functioning ANS may be an-

other factor leading to cardiovascular disease in HD. We expect gene-dose and age-related deterioration of daily rhythms in heart rate, body temperature, and heart rate variability, as well as an overall depression in heart rate variability which is an indication of ANS dysfunction. Studying the compromised cardiovascular function of the Q175 mice may provide a deeper understanding of the pathology of the disease and the mechanisms that create the circadian deficits, with the hope of creating clinical approaches to help HD patients.

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145

Subcategory: Physiology and Health

Increases in Major Enzymes of Fatty Acid Beta-oxidation Pathways in Female Low Birth Weight Rat Liver at P3 and 1 Yr

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A decrease in birth weight begins when the fetus is developing in an environment of reduced nutrients passing from the mother to the fetus via the placenta. An individual born at low birth weight (LBW) is typically susceptible to inflammatory disease and pathological disorders resulting in defects occurring later in life, and exhibits an increased risk of developing type II diabetes, obesity, and hypertension (HT). Females born at LBW are smaller than males born at LBW; however, studies have shown that LBW females develop HT much later than males. Fetal programming of metabolic pathways during fetal development can impact the aging female. Our current study uses a reduced uterine perfusion rat model that results in intrauterine growth restricted offspring (IUGR) to study the changes in lipid metabolism in aging females. We hypothesized an increase in free fatty acids (FFA) in the liver in the LBW young rat at 3 days postnatal due to the uterine fasting environment and that this increase in FFA also occurs at the post-menopausal stage. We used qPCR, Western Blot, and activity analyses for our methods. We focused on the PPAR-α and CPT-1 pathways that are activated to increase β-oxidation of fats and the SREBP-1c and FAS pathways that are activated in lipid synthesis. There was a 2-fold increase in PPARα mRNA expression in liver of 3 day female (P3) IUGR and a 2.5-fold increase in 1 year female IUGR in comparison to age-matched control groups. There was a significant increase in PPARα protein expression in P3 female IUGR ($P \leq 0.02$) and an increase in 1 year female IUGR. There was a 3.2 fold increase in CPT-1 mRNA expression and protein expression ($P \leq 0.01$) in P3 female IUGR liver, and a 2.8 fold increase in 1 year female IUGR. These data indicate there should be an increase in fatty acid β-oxidation in the liver. Fatty acid quantitation assays were performed on P3 female liver tissue and preliminary data showed an increase in fatty acids but not at a significant level (n=4/group). Fatty acid quantitation at 1 year was inconclusive and will be repeated. Further, our study found no significant changes in SREBP-1c mRNA or protein expression between P3 groups and 1 year female groups. There were no significant changes in FAS mRNA or protein expression. Together, significant increase in PPARα and CPT-1 would indicate an increase in β-oxidation of fatty acids in the IUGR liver. SREBP-1c regulates FAS and together these are a part of the metabolic pathway of lipid synthesis. The levels of SREBP-1c and FAS expression indicate a condition in the liver where there are no changes in lipid synthesis between groups. In conclusion, we found that there is an increased expression of major metabolic enzymes that suggest an increase in β-oxidation of fatty acids in the female LBW rat at P3 postnatal and at 1 year postnatal while there are no changes in lipid synthesis. Thus, disregulation of lipid metabolism is occurring in the IUGR female on a long-term basis.

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146

Subcategory: Physiology and Health

Functional Interactions: A Study of NIH Funding Trends

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Several universities and organizations around the world receive funding from the National Institution of Health (NIH) yearly. Functional interactions are the intentional interactions of researchers from multiple disciplines towards a common goal. Here, the common goal is to better understand health disparities. Here, we propose to determine NIH funding trends to increase funding for health disparities research through NIH.
All organizations who are the recipients of NIH funding are listed in a dataset along with additional information which includes city, state, the category of research being funded, institution type, and many more. This information is stored in a database called NIH RePORTER. NIH funding data was downloaded using the NIH RePORTER tool in XML format. The data were then parsed using the Perl programming language to create one large dataset. The data were then imported into Rstudio. Rstudio is the environment used, in conjunction with the R programming language, to examine the data from NIH. Once imported and

examined, the data was further analyzed to answer proposed questions.

Over 132,000 organizations were analyzed throughout the years 2004 to 2013. The top funded institution remained Johns Hopkins consistently. The most commonly funded school from NIH was the School of Medicine followed by the School of Arts and Sciences. Of the 50 states in the United States, California had the most funded projects at 46,962, but Boston came out to be the top city with 21,608 funded projects. Through the years 2008 to 2012, biotechnology was the spending category that received the most funding with 3,913 projects reported.
As funding decreases and funding trends change, Johns Hopkins continues to receive the largest amount of funding. Our next step is to study the funding trends within the top funded institutions and their collaborative working teams.

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147

Subcategory: Physiology and Health

The Effect of Caffeine and Electrolytes on Urine

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Urination is the body's method of releasing toxins to maintain a healthy body. This study examined the effects of caffeine and electrolytes on urine. Caffeine was expected to cause higher urine volumes, pH, and produce a darker color. Ten subjects drank 16.9 fl. oz of one of the three liquids (water, Gatorade (electrolytes), or Coke (caffeine)) after fasting for 9 hours. Urine was collected one hour later and tested for volume, color, odor, specific gravity, pH, and ketones. Gatorade produced the lowest volume of urine, while water produced the highest specific gravity. Drinking coke caused urine to have a higher pH, darker color, and potent smell. These results demonstrate that water was the most hydrating fluid, while Coke was the least hydrating fluid. Urine also proved to be an effective tool for determining potential infection in test subjects. Further studies should be conducted to correlate the impact of urinalysis for use in detection of infection.

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148

Subcategory: Physiology and Health

Repeatability and Morphological Correlates of Fish Behaviors in Hypoxia

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The habitat of the gulf killifish, Fundulus grandis, is characterized by variable oxygen levels. In this study, we evaluated the repeatability and morphological correlates of two behaviors of fish in hypoxia: aquatic surface respiration (ASR), where fish ventilate their gills with oxygen-rich surface waters, and loss of equilibrium (LOE), a non-lethal measure of tolerance to extreme hypoxia. We exposed fish to gradually lowered oxygen levels and recorded the time and oxygen levels when fish conducted ASR and LOE. We also measured total filament length, total filament number, and average filament length of gills from these fish. Results from 14 fish used in 2 to 4 trials, each spaced by approximately 2 weeks, show that the time when fish conduct ASR and the oxygen levels at ASR, are significantly dependent upon the individual ($P < 0.05$) and have a repeatability of about 50%. The time to LOE approached statistical significance ($P = 0.09$) with a repeatability of 22%. Mass-adjusted average filament length was significantly correlated with time at ASR ($r = 0.53$, $P < 0.05$) and showed weak negative relationship with the oxygen levels at ASR ($r = -0.44$, $P = 0.11$), suggesting that fish with longer gill filaments do not conduct ASR until oxygen levels reach lower values. Thus, fish behaviors during hypoxia, ASR in particular, vary in a repeatable fashion among fish, which may be explained, in part, by intraspecific variation in gill morphology. Importance of this study may rest upon the thought that hypoxia is an environmental phenomenon that affects many populations of fish, and the mechanisms they use to cope with this affection may be dictated by molecular factors which can be studied in further stage of the project.

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149

Subcategory: Physiology and Health

Progesterone Supplementation Improves Blood Pressure and Uterine Artery Resistance in RUPP Rats

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Preeclampsia (PE), new onset hypertension at 20 weeks of gestation, is characterized by increased uterine artery resistance

index (UARI), chronic immune activation and decreased of vasodilators such as nitric oxide (NO). Despite being one of the leading causes of death in pregnant women, currently there is no effective treatment for PE except for early delivery of the fetus. We have demonstrated that PE women have significantly lower circulating progesterone than normal pregnant (NP). 17-alpha-hydroxyprogesterone caproate (17-OHPC) is a synthetic metabolite of progesterone used for the prevention of recurrent preterm birth and although the mechanism is not understood, is suspected to have vasodilatory and anti-inflammatory effects. Therefore, we hypothesized that progesterone (17-OHPC) supplementation could reduce blood pressure (MAP), pro-inflammatory cytokines,CD4+ T cells, UARI, as well as increase NO bioavailability in a hypertensive rat model of PE. To address this question17-OHPC (3.32mg/kg) was intraperitoneally administered on day 18 of gestation into Reduced Uterine Perfusion Pressure (RUPP) rats and carotid catheters were inserted. MAP, blood and tissues were collected on day 19. MAP in NP rats (n=13) was 92+2; 123+2 in RUPP (n=18), and 116 +1 mmHg in RUPP+17-OHPC (n=10), $p < 0.05$. UARI was 0.78+0.03 in RUPP (n=4) and 0.63+0.038 in RUPP+17-OHPC(n=8), $p<0.05$.Circulating CD4+ T cells were 1.19+1.0% of gated cells in NP (n=7), which increased to 8.52+2.4% in RUPP rats (n=10) but was significantly reduced to 2.72+0.87% (n=14) in RUPP + 17 O-HPC, $p < 0.05$. Total circulating nitrate/nitrite was 26.34 +3.5µM in NP (n=12); 14.58+3.1 in RUPP rats (n=8) and increased to 26.69+1.62in RUPP+17-OHPC (n=7), $p < 0.05$. Aortic eNOS expression was 0.65+0.11A.Uin NP (n=4), which decreased to 0.33+0.01 in RUPP rats (n=4) but increased to 0.57+0.01 in RUPP+17-OHPC(n=5), $p < 0.05$. Levels of TNF-alpha were 65.84+17.7 pg/ml in RUPP rats (n=5) but were blunted to 17.24+3.9in RUPP+17-OHPC(n=8), $p < 0.05$.In conclusion, 17-OHPC supplementation improves inflammation, UARI, hypertension, and nitric oxide bioavailability in response to placental ischemia during pregnancy and should therefore be considered further for addition to the clinical management of PE.

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150

Subcategory: Physiology and Health

A Biophysical Model for the Role of Inhibition in Regulating a Two-phase Breathing Rhythm

Joshu Mendoza, University of Washington

From the moment we are born there are few processes as important as being able to regulate respiration. Respiration occurs in a two-phase pattern, with alternating inspiration and expiration. This arises from alternating activity among groups of neurons in the pre-Bötzinger and Bötzinger complexes, distinct areas in the brainstem. However, much about the cellular and network mechanisms that produce this activity remains unknown. Our approach is to use a biophysical computational model to test possible mechanisms. We explore how the topology of inhibitory connections impacts activity patterns in a model pre-Bötzinger/Bötzinger system. Our starting point is a model in which inhibition is from one area to the other, as in a half-center oscillator, but does not occur within a given area. We then gradually increase the extent to which inhibition also occurs within a complex. At each stage, we investigate how the phase relationship between both areas changes. We simulate our biophysical model and output binary spike trains, which represent whether or not each neuron fired at a given timestep. We then use statistical and signal processing methods to determine a phase lag and population correlation number for each simulation. We use methods such as convolutions to visualize the population's behavior as a whole and then use cross and auto correlations to generate the phase lag and population correlation numbers based on those convolutions. The phase lag and population correlation for each specific network topology is an average over 30 realizations of the networks and simulations. From this analysis we find that robust rhythmic activity can occur with multiple network architectures. We can readily see this from both visual inspection of spike rasters and using the phase analysis. Our phase lag number over the series of networks and simulations tells us that the model continues to generate a two-phase breathing rhythm with every network architecture. Our population correlation tells us that as we increase our inhibition within a complex we see a degrading coherency within the populations of 20% over. We conclude that it is not necessary to restrict inhibitory connectivity to between complexes in order to produce a two-phase breathing pattern. This result could have implications for the mechanisms that underlie breathing rhythms in health and disease. Future research will investigate the role of other topological features of the network.

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151

Subcategory: Physiology and Health

Oral-Fetal Transmission of Oral Bacteria from Mother to Fetus During Pregnancy

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Oral health is an important element of general health and well-being, and should be implemented consistently throughout a woman's lifespan, especially during pregnancy. Bacteria naturally exist in the mouths of adults, but during the onset of periodontal disease, the prevalence of oral bacteria multiplies. Cardiovascular disease, diabetes, and other disorders have been

linked with oral diseases, from which bacteria are transferred to the heart via the vast number of blood vessels that supply oxygen to the oral cavity. In a study completed in 2009, 35% of women reported that they did not visit a dentist in over a year, and over 56% of women did not visit a dentist during pregnancy. Women, especially pregnant ones, who do not maintain their oral health pose a high risk of transferring copious amounts of bad bacteria from their mouth to their fetus. Due to this connection, it is hypothesized that periodontal disease affects the maternal and fetal immune responses, leading to premature labor. To test this hypothesis, pregnant women of different backgrounds between 30-38 weeks of pregnancy were given a dental exam and cleaning. Samples of the tartar scraped away from their gums were tested for periodontal disease bacteria, while samples of amniotic fluid were screened for content of the oral bacteria that was transferred orally to the uterus. A pregnant woman who had healthy gums and maintained her oral health prior and during pregnancy was used as a control, to which the other participants were compared to. Periodontal disease causing bacteria were found in the amniotic fluids of all pregnant women, including that of the control. However, smaller amounts of the bacteria were found in the control, while women with periodontal disease and non-consistent oral habits had higher amounts of the bacteria. None of the pregnancies were pre-term, as hypothesized. Future research needs to be done to investigate the mechanisms involved in the said mechanisms to understand the host susceptibility to oral-uterine transmission. Only when this is thoroughly understood can meaningful intervention be established and appropriate groups be targeted for necessary therapy and relevant outcomes.

References: Oral Health and Adverse Pregnancy Outcomes-What's Next? J Dent Res. Mar 2011; 90(3): 289-293.
Oral health care during pregnancy and through the lifespan. Committee Opinion No. 569. American College of Obstetricians and Gynecologists. Obstet Gynecol 2013; 122:417-22.

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152

Subcategory: Physiology and Health

Competition-induced Loss of Synapses onto Mature Dentate Granule Cells

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It is known that immature and mature dentate granule cells (DGCs) of the Dentate Gyrus receive synaptic input from Entorhinal Cortex Perforant Path axons. Morphological studies suggest that the continually proliferating population of adult-born neurons acquire their synapses from a fixed number of preexisting afferent terminals. However, it is not known whether the addition of new synapses affects transmission to the mature cells in the network. We tested this by eliminating the pro-apoptotic Bax gene from adult-born DGCs using an inducible Nestin-Cre Floxed-Bax (NCFB) mouse model to enhance immature DGC survival and promote competition with mature DGCs for Perforant Path axonal boutons. We measured Excitatory Postsynaptic Currents (EPSCs) in mature DGCs of the NCFB and control Bax WT groups. We found a decrease in EPSCs in NCFB with no change in the control and concluded that increasing neurogenesis decreased excitatory transmission to individual mature cells. Furthermore, we created a computational model. That model took as parameters the initial number of mature DGCs, an initial number of synapses per mature DGCs, a rate of immature DGCs being added per day, a rate at which immature neurons appropriated synapses from mature DGCs, and time starting at 8 weeks of animal age. It output a predicted number of synapses removed from mature neurons from which we extrapolated a percentage of synapses remaining for both the NCFB and control groups. Upon normalizing the EPSCs and the percentage of synapses remaining in mature DGCs, we saw that the degree of change in the normalized percentage of synapses remaining corroborated that seen in the normalized EPSCs in both groups. The corroboratory nature of the model suggests it can also be predictive. As such we plan on using the model's predictions to aid in the design of future experiments.

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153

Subcategory: Physiology and Health

Plasma Treatment Accelerates Tail Regeneration in Tadpole, *Xenopus Laevis*

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Atmospheric pressure plasma has found large application in regenerative medicine. Presently, we investigated the effect of plasma on wound healing and tail regeneration of tadpoles, Xenopus laevis especially role of reactive oxygen species (ROS).

Tail amputation was carried out by removing 40% of the tail and the amputated region was immediately exposed to helium plasma (generated inside a quartz tube with a single electrode powered by an AC voltage (15kHz) having peak-to-peak voltages

of 18kV) for 40 seconds. Here we report faster rate of growth of the regenerating tail following plasma exposure. By comparing results on in situ staining for ROS, nitric oxide (NO) and mitochondria between experimental and control groups, there is increased ROS (hydrogen peroxide and superoxide but not NO) production at 2h, 4h, 12 h and 24 h post amputation at the wound site in plasma treated tadpoles. However, these ROS species were not derived from mitochondria evident from double immunostaining. Growth of the blastema (5 days post amputation) in experimental group was higher than control with increased ROS, NO and catalase in plasma exposed group compared to control. Microscopically, in plasma treated tadpoles, cells of wound and blastemic epithelium showed blebbing of plasma membrane, increased cellular lipid droplets, hypertrophy of the cells, increased mitochondrial density, and reduced intercellular connections.

These findings demonstrate that some of the free radicals might be acting as signalling molecules and these tadpoles possess sophisticated mechanisms to respond to stress of plasma and yet hastening the dynamics of wound healing and tail regeneration.

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154

Subcategory: Physiology and Health

Selective Deficits in Social Behavior in Adult Mice after Traumatic Brain Injury at Adolescence

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Traumatic Brain Injury (TBI) is a leading cause of death and disability in children worldwide. Despite advances in research, we have yet to understand the full spectrum of behavioral deficits that persist into adulthood after injury to the developing brain. We have previously shown that TBI at post-natal day 21 (p21, age of a toddler), results in marked long-term deficits in social interactions. Here we investigated the behavioral consequences of TBI at p35 (adolescent) in male C57Bl/6J mice. Mice were subjected to either a focal TBI (n= 9) or sham surgical controls (n=9). Mice were behaviorally tested starting at p70 (adulthood) by an investigator blinded to treatment (Sham or TBI). Assessments included performance in an open field and evaluation of behaviors associated with scent marking, resident intruder, buried food and three-chamber tasks. We found a selective deficit in preference for social novelty using the three-chamber test, indicating impairment in social recognition and memory; however, mice showed normal sociability, social investigation, and socio-sexual communication with normal olfactory function despite the injury. In conclusion, we demonstrate that TBI to the adolescent brain results in selective social deficits, a finding that contrasts the more profound social deficits seen in mice that are subjected to TBI at a younger age. Thus, the age at time of injury should be considered when developing therapies for brain-injured children.

Funder Acknowledgement(s): This study was supported by an NIH/MARC 5T34-GM008574-16 to Pingdewinde Sam at San Francisco State University, the Neurobehavioral Core for Rehabilitation Research at the University of California San Francisco (UCSF) and NIH/NINDS R01 # NS050159 to Linda Noble.

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155

Subcategory: Physiology and Health

Examining Working Memory Capacity and Neural Activity in Prefrontal and Posterior Parietal Cortices

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Working memory is the capacity-limited ability to store and process information in memory over a period of seconds. Neural activity in the prefrontal cortex (PFC) and other cortical areas, such as the posterior parietal cortex (PPC) represents information stored in working memory, as indicated by studies in non-human primate models. In the presence of distractors, PFC represents stimuli that need to be remembered whereas memory PPC identifies the object whether the distractor or actual target. When multiple stimuli are present, the PFC maintains active memory to filter out non-targets. Much less is known about the representation of multiple stimuli in memory, when subjects are required to remember all of them simultaneously. Experiments we conducted examined the capacity-limitation of working memory in the firing of neurons recorded from the prefrontal cortex of non-human primates; using a non-match/ match task system.

The results indicated that the subjects' memory decreases as number of stimuli is increased while capacity limit levels off at the maximum of three items remembered, but brain areas of post-parietal and prefrontal represent suppressed neural activities. Future research should include multiple sensory integrations.

Funder Acknowledgement(s): NSF-funded Historically Black Colleges & Universities-Undergraduate Program at Johnson C. Smith University.

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156

Subcategory: Plant Research

Pedicel Fruit Abscission in Sweet Cherry

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To successfully adapt to increasing labor costs and a declining workforce, the labor-intensive sweet cherry industry would benefit from mechanical harvest strategies. For such strategies to be possible, a better understanding of gene expression involved in the development of the stem/fruit abscission zone is required. The aim of this project is to identify and analyze the genetic components of fruit-pedicel abscission in sweet cherry and use it to interpret observed physiological data. Three genotypes were used, Chelan, Bing, and Skeena representing the range of phenotypes and expected alleles in response to ethylene. A time-course transcriptome analysis of fruit-pedicel abscission zone was performed following an ethephon (ethylene releasing) treatment and control (water). A field study was done simultaneously to assess pedicel fruit retention force, the force required to detach fruit from the stem, throughout maturation to observe physiological effects of treatments on pedicel-fruit interactions and provide a physiological complement to genetic analyses. Previously, RNA-Seq was used to generate transcriptomic data in similarly designed experiments. Physiological data, abscission zone samples, and PFRF were collected May-July, 2014 in the Roza Orchards at the WSU Prosser Irrigated Agriculture Research and Extension Center (IAREC). Ethephon (240 ppm) and water (control) was applied at 80% maturation of each genotype. Gene expression of the abscission zone and genes related to the production and response to ethylene will be measured via qRT-PCR. Our field study demonstrated a significant decrease in PFRF in Chelan and Bing varieties, however only Bing fell below the 0.4 kg threshold required for efficient mechanical harvest. Current data correlated with previous results that response to ethephon application is dependent on genotype. Gene expression data will lead to functional characterization studies of specific genes shown to be involved with the development of the stem/fruit abscission zone. These in turn will aid breeding programs in the development of new varieties that exhibit desired traits responsive to new and developing harvest technologies. Future research will focus on evaluating the effects of treatment on storage and quality of fruit.

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157

Subcategory: Plant Research

Seq-ing the Missing Link:lncRNAs and cisNATs in Tomato Ripening

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Since the sequencing of the human genome, it has been revealed that the vast majority of DNA does not code for proteins. Upon transcription, some of these noncoding transcripts are not fruitless, but produce regions of long noncoding RNAs (lncRNAs), which play important roles, such as protein regulation and small RNA processing in biological mechanisms. However, the catalog and specific functions of lncRNAs in the ripening of tomato species (Solanum lycopersicum) are largely unknown. cis-natural antisense transcripts (cisNATs) of proximal complementary RNA strings may function to inhibit transcription, but their mechanisms are also poorly understand. In addition, global issues in food shortage and malnutrition have caused the need to understand the biological mechanisms of fruit development. In this study, we will use RNA-Seq analysis to study the roles lncRNAs and cisNATs play in tomato development. We hypothesize that there will be different expression levels for certain lncRNAs and cis-NATs between the Breaker and Mature Green stages of the tomato.

Raw reads from two different stages in the tomato ripening cycle, Mature Green and Breaker, were aligned to a reference genome to test the hypothesis that there will be different expression levels for certain lncRNAs and cis-NATs between the two stages. Then, the reads were de novo assembled, assessed for coding potential, and annotated by transcript and function. Finally, the results were filtered for lncRNAs (length > 200 bp, ORF < 100 bp, noncoding, expression value > 0) and cis-NATs (sense-antisense pairs, overlap length > 50 bp, differential splice patterns, expression value = 0). A total of 102 differentially expressed lncRNAs were identified between the two stages of development, of which 64 were unregulated in Breaker and 38 in Mature Green. A total of 209 lncRNA cis-NAT pairs, of which 190 involved noncoding-coding pairs while 19 involved noncoding-noncoding pairs, were identified, as well. In addition, lncRNAs may fold into the hairpin structure, the precursor of microRNA (miRNA). 18 lncRNAs that could fold into hairpin structures for 24 different miRNAs were detected. GC Content of the lncRNA was found to be 35.31%, while that of the coding RNA was 40.56%. Since GC bonds contain 3 hydrogen bonds while AU bonds contain 2, this could potentially explain the instability of noncoding RNA compared to coding RNA. We used a combination of assembly and alignment methods to identify lncRNAs and cisNATs in the tomato genome and analyzed how they were involved in tomato development. Experimental evidence is necessary to confirm these findings and hypothesize models of cis-NAT mechanisms for further classification and identification.

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158

Subcategory: Plant Research

Medicinal Plants of Peru: Respiratory Treatments

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As part of an ongoing 20 year project studying medicinal and economically important plants in Northern Peru, this project focuses on plant use and distribution by market vendors and healers, compared to historical surveys of plant use as well as how plants are used to treat respiratory illnesses. Herbal medicine data were collected from market vendors and healers. Data were entered into excel in the form of presence absence data, using "1" to represent presence and "0" to represent absence. This data was used in R Statistical Framework to generate a dissimilarity matrix in the form of a dendrogram for both market data and respiratory treatment data. Market dendrograms were shown in five (5) different forms. 1. Historical surveys, current surveys, vendors, and healers. 2. Current surveys, vendors, and healers. 3. Historical surveys, vendors, and healers. 4. Vendors and healers. 5. Vendors and healers only. Each dendrogram were analyzed and compared and conclusions made about how plants were used historically and how they were used modernly. Results show that most historical knowledge has been lost with the exception of 3 healers (ISA40, JULS149, and GER131). However, much of the plant use, including by the three exception vendors is experimental. This is seen by the fact that most of the healers and vendors use many plants that are not included in the historical surveys but are that are present in recent surveys. The three exception healers also have plants that are not in either historical or recent surveys showing that it may be experimental and/or new knowledge of plant cures. Dendrograms of respiratory treatments also seem to confirm that conclusion. Illnesses that were considered respiratory were asthma, bronchitis, "lungs", inflammation of the lungs, and tuberculosis. Each illness had a number of treatments. There were 41 mixtures for bronchitis, 16 for of asthma, 1 lungs, 1 inflammation of the lungs, 1 pneumonia and 2 tuberculosis. Many of the mixtures treated a variety of things while very few were specific to one disease, or even just respiratory.

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159

Subcategory: Plant Research

Differentiation of Major Black Pepper Piper Nigrum Species Using Gas Chromatography - Mass Spectrometry Fingerprinting Method

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Gas Chromatography- mass spectrometry (GC-MS) method was used to identify black pepper (Piper nigrum) samples from ten regions using chemical fingerprinting. Black pepper is a very widely used spice, known for its pungent constituent piperine. In addition to its culinary uses, piperine has been shown to have fundamental effects on p-glycoprotein and many enzyme systems, leading to biotransformative effects including chemoprevention, detoxification, and enhancement of the absorption and bioavailability of herbal and conventional drugs. Forty four black pepper samples from Brazil, Indonesia, India, Lampong, Malabar, Madagascar, Sarawak, Srilanka, Malabar, Lampong and Vietnam were studied. The GC-MS fingerprints of the black pepper samples were analyzed using principal component analysis (PCA). The chemical differences were profiles.

Funder Acknowledgement(s): 1. Natural Sciences Department, Bowie State, Jericho Park Rd, Bowie MD 20715; 2-Food Composition and Method Development Laboratory, USDA, ARS, BHNRC, 10300 Baltimore Ave.Bldg 161, BARC-E, Beltsville, MD 20705.

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160

Subcategory: Plant Research

Finding Alternative Avicequinone C Derivatives for the Treatment of Androgenic Alopecia

Kellie Hunnicutt, Howard University

Avicequinone C is a compound discovered by Ruchy Jain and a team of researchers at Chulalongkorn University. The compound is extracted from Avicennia marina, a plant used in Egypt traditionally to cure skin diseases. In the case of alopecia, Avicequinone C exhibited anti-androgenic activity through the inhibition of 5α-R1, a receptor known to cause androgenic alopecia when activated by testosterone and DHT is in overproduction. This research project is a continuation of that work. By synthesizing compounds similar in composition to Avicequinone C, the goal is to find substances that will treat alopecia better than current drugs on the market. Androgenic alopecia is a form of pattern hair loss caused by the overproduction of androgens such as testosterone. Androgenic alopecia is a major type of hair loss of the scalp which affects over 60-70% of the world popula-

tion (). The 5α- receptor has been found to play a key role in this condition. This receptor, which is found in dermal papilla cells (which were used in this experiment rather than androgenic cells) and keratinocytes, converts testosterone to dihydrogentestosterone or DHT. DHT causes the terminal hairs to shrink which results in a shortening of the growth phase and finally balding. Therefore, inhibition of this receptor could possibly solve androgenic alopecia. Currently, dutasteride is a popular treatment for alopecia. Unfortunately, the drug has low success rates and many side effects which is why alternative treatments are needed. A 96 well plate was used to test these substances on the cells: Plumbagin 2-methyl 1,4, napthoquinone Jungalone 1,4- dihydroxy anthraquinone 3,4,7- trihydroxyisoflavone Beta-Napthol Lapachol 4-methoxy coomarin WNK-2 Avicennia marina Dutasteride (+) DMSO(-) Testosterone (internal) DHT (internal) A TLC was completed to analyze the effectiveness of the compounds. The results of the TLC were unsuccessful. Since testosterone is converted to DHT in the case of alopecia, there should be a band in the last lane corresponding to the lane containing just DHT. Therefore, there are some malfunctions in the cells. If the cells were functioning properly, Beta-Napthol and Lapachol seem to produce better anti-androgenic activity than the actual compound avicequinone C (AM lane). While many of these compounds exhibit anti-androgenic activity, cell viability would have to be 80% or above for those compounds to be considered successful. The results of the cell viability test cannot be used for analysis either since the test was run without blanks for comparison. Future research would include repeating the cell testing with functioning cells in order to repeat TLC several times to ensure results.

Funder Acknowledgement(s): Chulalongkorn University, GEAR-UP Howard University

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161

Subcategory: Plant Research

Analyzing Tomato Texture and Juiciness to Develop Improved Varieties

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Texture is a major contributor to the overall liking of tomato fruit. We examined texture quality of several different segregating populations of tomatoes resulting from crosses between a commercial variety tomato and different heirloom varieties of tomatoes. We used the heirloom varieties Maglia Rosa Cherry or Bear Creek as one of the parents in the crosses because of the great flavor that they have; however the texture of heirloom varieties is often not ideal. Our goal is to produce fruit that has great flavor and great texture as well as color for consumer likeness. We used a texture analyzer with integrated software to measure juiciness, skin toughness, skin elasticity and pericarp force. We also asked consumers to rate the varieties on liking of the tomato's texture. We found varieties with improved texture attributes. Consumer liking of texture was correlated with juiciness, skin toughness, and the force needed to penetrate the pericarp. Our plan is to use this data to improve tomato varieties by using molecular breeding techniques to produce tomatoes with great flavor, texture, coloration, high yield, shelf life and durability for transportation.

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162

Subcategory: Plant Research

Potential Plant Development Manipulation Through Expression of a Mutant Histone

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Proper development of plants and animals depends on precise regulation of gene expression. The evolutionarily conserved PRC2 complex has an important role in regulating developmentally important genes, by methylating histone H3 at lysine-27 (H3K27me3). In humans, mutations in histone H3 that convert K27 to methionine (H3K27>M) inhibit the catalytic subunit of PRC2, a protein called EZH2, leading to certain cancers. PRC2 is critical for plant development, although all of its roles are not yet known. In this project we will evaluate the potential for disrupting PRC2 activity in plants through targeted expression of H3K27>M. EZH2 has three orthologous proteins in Arabidopsis: CURLY LEAF (CLF), SWINGER (SWN), and MEDEA (MEA). Using domain and homology analyses, we found that all three proteins contain a tyrosine within the potential active site, at the position that is implicated in inhibition of EZH2 by H3K27>M. Using public microarray data, we found that SWN is expressed strongly throughout the plant, while CLF and MEA show tissue-specific expression patterns. We designed genetic constructions to express H3K27>M in several developmental contexts to attempt to disrupt PRC2 activity and understand its role. The results of this research can help us get a greater view of how these genes are expressed. In addition, we gain potential to engineer phenotype in a sophisticated manner.

Funder Acknowledgement(s): Michigan State University-SROP

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163

Subcategory: Plant Research

Early Cretaceous Cupressaceae in the Budden Canyon Formation of Northern California

Ashley Ortiz, Humboldt State University

The Early Cretaceous Budden Canyon Formation is a wedge of marine sediments sandwiched among island arc deposits forming terranes accreted to the margin of North America during the Mesozoic as it moved westward over the Farallon plate. Nearshore deposits of this formation contain plant fossil assemblages ca. 125 Ma old (Barremian-early Aptian) which host a rich compression flora (>40 taxa) and have yielded a few anatomically preserved fossils. Recent investigations of the Budden Canyon Formation have revealed a much more diverse anatomically preserved flora in carbonate concretions, including abundant conifers. Among this material is a seed cone for which we are testing hypotheses of taxonomic placement. The age (among the oldest of its kind) and morphology of the cone (helically arranged peltate ovuliferous scales) suggest that it may represent an extinct member of the Cupressaceae. We test this hypothesis by characterizing the morphology and anatomy of the cone in serial sections and 3D reconstructions, and by using the reconstructions in comparisons with living and previously described fossil Cupressaceae. The cone is 10 mm long and 7 mm in diameter; the 20-24 ovuliferous scales have a cuneate base and a peltate head. A central resin canal present at the base of each scale branches a few times towards the scale tip. Comparisons of the Budden Canyon cone with living Cupressaceae reveal significant differences from most genera and closest similarity, but not identity, with Sequoia. Among fossil seed cones assigned to the Cupresaceae and which share peltate scales, the Budden Canyon cone is the oldest. Although comparisons with these fossils suggest that the Budden Canyon cone represents a distinct taxon, incomplete data preclude conclusive taxonomic inferences. Nevertheless, the Budden Canyon cone is the oldest fossil assignable to the sequoioid Cupressaceae, a lineage which gave rise to modern redwoods (Sequoia) and giant sequoias (Sequoiadendron). The occurrence of this fossil in the vicinity of the present range of these plants suggests that western North America was the cradle of this plant lineage as far back as 125 million years ago. Research in progress is aimed at characterizing vascular tissue and resin canal architecture in the ovuliferous scales of the Budden Canyon cone, for in-depth comparisons with living and fossil Cupressaceae. Future field work will resample the Budden Canyon Formation for additional specimens of this fossil conifer.

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164

Subcategory: Plant Research

Salicylic Acid Elicitation on Production Of β Carotene by Carrots, Daucus Carota (L); A Focus on the Effect of the Acid on Plant Growth

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The goal of this research was to use Salicylic acid as a chemical elicitor to enhance the carotene content of carrot plants grown in the green house. β carotene is a carotenoid of increasing demand as a precursor of vitamin A and has also been ascribed a central role in cancer prevention and therapy. Elicitors can be used as enhancers of plant secondary metabolite synthesis and can play an important role in biosynthesis pathway to enhance production of commercially-important compounds. Salicylic acid (SA) is a well-known inducer of plant systemic acquired resistance (SAR) in plant –pathogen interaction. Salicylic acid was added in 0.1µM, 10µM and 100µM concentrations to the carrot seeds overnight before planting. The same concentrations were applied to plants two times a week throughout the growing season. Our findings revealed that salicylic acid-treated seeds had 100% germination rate. The plant growth characteristics measured as plant height throughout the life of the plant and as yield had no significant difference from the control. Salicylic acid therefore has no negative effect on plant growth and is therefore a good candidate for chemical elicitation. Further work on the analysis of the enhancement of SA on total carotene production by HPLC is in progress and will be reported on in a different paper.

Funder Acknowledgement(s): Anne Osano

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165

Subcategory: Plant Research

Prevalence of ACCase and ALS Target-Site Mutations in PNW Herbicide-resistant Lolium Multiflorum

Jeanette Rodriguez, Heritage University
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In the Pacific North West (PNW) Lolium moltiflorum, also known as Italian ryegrass, is a common and troublesome weed species

in wheat fields due to rapid development of herbicide resistance in the species. Italian ryegrass has developed resistance to Acetyl-CoA carboxylase (ACCase) inhibitors, an important class of herbicides used to manage grass weeds in wheat. It is import to detect herbicide resistance early to enable a rapid response by crop managers to manage Italian ryegrass effectively. To identify herbicide target-site resistance in ryegrass, DNA was extracted from known Italian ryegrass resistant samples. Using Polymerase Chain Reaction (PCR) and Sanger Sequencing from both 5' and 3' ends, ALS and ACCase DNA sequences were determined for the enzyme active sites known to have possible mutations. The resulting five 365 to 720 base pair sequences were then analyzed for mutations known to cause resistance to specific types of herbicides. Several samples had a I2041N substitution. This mutation confers resistance to the aryoxyphenoxy propionate ACCase herbicides, but the samples are still sensitive to the cyclohexanedione ACCase inhibiting herbicides. Knowledge of which mutations are prevalent in Italian ryegrass from the inland PNW will be critical for crop managers to effectively manage herbicide resistant Italian ryegrass.

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166

Subcategory: Plant Research

Chemical Composition and Antimicrobial Activity of Wild-Harvested Achillea Millefolium from the Republic of Armenia

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For thousands of years, humans have studied plants to understand their medicinal properties. As interest in plant medicines is increasing, their components are being studied to provide evidence for their use in medicine. Achillea millefolium, commonly known as yarrow, is a plant species of the Asteraceae family that is widely spread throughout the northern hemisphere. Traditionally, Achillea is used as an anti-inflammatory, hemostatic, spasmolytic, and anti-allergenic. Wildly growing yarrow (entire shoot system) was hand-picked in late June from the Aparan, Sevan and Gyumri regions of Armenia. Raw materials were left to dry in a shady room of 30°C for one week. Microscopic analysis confirmed the identity of the collected species to be Achillea millefolium. Its essential oil was distilled (%yield = 0.44) using the steam distillation method for subsequent analysis via solid-phase microextraction (SPME). Following steam distillation, Achillea's ethanol extract (%yield = 8.8) was obtained and subjected to previously mentioned SPME analysis to further secure its chemical composition. After SPME analysis, Achillea's essential oil is expected to consist of mostly the sesquiterpene lactones achillin and achillicin whereas its its ethanol extract will likely show the presence of flavonoids such as apigenin, luteolin and quercetin. Antimicrobial activity of Achillea's essential oil and ethanol extract will be determined via disc diffusion using representative yeast, Gram-negative and Gram-positive bacteria to establish its minimum inhibitory concentration (MIC). Achillea millefolium's diverse chemical composition, coupled with its antimicrobial activity, could render it useful in mainstream medicine.

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167

Subcategory: Plant Research

Evaluating the Antibiofilm and Antibacterial Potential of Vernonia Amygdalina

Ifeanyi Uche, Claflin University

Pseudomonas fluorescens is a gram negative bacillus with bioremediation potentials and can inhabit soils polluted with heavy metals. According some studies conventional methods of removing heavy metals such as chromium VI from the environment are usually expensive, and in some cases ineffective. Bioremediation is therefore a viable alternative to conventional methods of heavy removal from the environment. Vernonia amygdalina belongs to the family of Asteraceae. It got its common name: bitter leaf from its characteristic bitter taste. Escherichia coli and Salmonella typhimurium are gram negative bacterial pathogens that cause gastrointestinal infections. Synthetically produced antibiotics, have been reported to not only have adverse side effects, increases the prevalence of antibiotic resistance by pathogenic bacteria species, but also are expensive. It is therefore imperative that antibiotics derived from natural sources such plant tissues and organs be studied as potential alternatives to synthetic antibiotics. Our hypotheses are 1. Vernonia amygdalina leaf extracts will inhibit or slow down biofilm formation by Pseudomonas fluorescens pf01 and pf5 strains. 2. Vernonia amygdalina stem and leaf extracts will have inhibitory effects on Escherichia coli and Salmonella typhimurium. This research was aimed at a. evaluating the efficacy of Vernonia amygdalina to reduce biofilm formed by Pseudomonas fluorescens pf01 and pf5 strains which will enhance their movement in porous media. b. assess the antibacterial effectiveness of Vernonia amygdalina on bacterial pathogens associated with bacterial gastroenteritis. The Static biofilm assay was used to analyze the antibiofilm property of chloroform leaf extracts of Vernonia amygdalina, while Disk and Spot Diffusion Assays were used to determine the antibacterial effects of methanolic and chloroform leaf and stem extracts of Vernonia amygdalina on

Escherichia coli and Salmonella tyhimurium. Results showed that only the chloroform extract of Vernonia amygdalina stem had an inhibitory effect on Escherichia coli and Salmonella tyhimurium. Also Vernonia amygdalina chloroform leaf extract exhibited antibiofilm effect the two strains of Pseudomonas fluorescens. Further research includes: Isolating and identifying the phytochemical responsible for inhibitory effects observed in the stem and leaf of Vernonia amygdalina, to investigate the synergistic effects of combined plant extracts on other gastrointestinal pathogens.

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168

Subcategory: Plant Research

Genome-Wide Association Mapping of Avenanthramide Pathway in Oats

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Oats are known to be heart healthy due to the amount of β-glucans present in seeds. However, a group of polyphenols known as avenanthramides, is also found in oats and can contribute to human health. Approximately 20 forms of avenanthramides exist in oats: each of these different forms exhibits unique properties that are beneficial to the immune system health. Therefore, the purpose of our research project was to identify the genome regions that harbor candidate genes of the avenanthramide pathway. We used JMP Genomics to analyze the oat genetic linkage map and identify significant markers associated with avenanthramide traits. We also forged our own biosynthesis pathway for avenanthramides to better understand various isoforms and their putative health benefits. We have determined five candidate traits: 1P, 2P, 2C, 2F and 5P that associate with avenanthramide production is oats. Further research is necessary to confirm that these markers are directly related to avenanthramide biosynthesis pathway in oats.

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169

Subcategory: Plant Research

The Role of LEAFY Homologs on the Growth and Development of the Fern Ceratopteris Richardii

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The purpose of this research is to explore the role of gene regulators on molecular and cellular functions in plants in order to track and explain the evolution and development of land plants. One gene regulator of particular interest is the transcription factor LEAFY, which has been studied functionally in the model moss Physcomitrella patens (a bryophyte) and in the model flowering plant Arabidopsis thaliana (an angiosperm). Research has shown that the absence of LEAFY affected the reproduction and development of the two plants. Although there is more insight into the role of gene regulators on plant function, there is a significant gap in the lineage in the phylogeny of land plants between bryophytes and angiosperms. To explore the role of gene regulators within this gap this experiment researches the role of LEAFY in the emerging model fern Ceratopteris richardii. To test this first generation transgenic spores of Ceratopteris richardii generated by collaborators at the University of Oxford that express an RNAi vector that effectively silences the fern LEAFY genes. The transgenic spores were grown and compared with wild type spores. Observations indicate successful fertilization of transgenic Ceratopteris richardii gametophytes to develop into sporophytes; this observation differs from the observations found in Physcomitrella where the zygote was not able to grow beyond the one cell stage. The ability of the sporophyte to continue to grow to maturity supports that there is a change in the function of LEAFY in the evolution of land plants. The research on LEAFY's effect on the flower development in Arabidopsis supports the prediction that LEAFY regulates the reproductive development of the sporophyte in Ceratopteris richardii. As the ferns continue to mature it is expected transgenic ferns with loss of LEAFY function will show signs of reduced reproductive output, perhaps fewer sporangia and/or fewer spores.

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170

Subcategory: Plant Research

Comparison of Effectiveness in Gene Silencing of Phytoene Desaturase (PDS) Gene Through CRISPR and RNAi Techniques in Tomato Plants

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Targeted genome editing approach- CRISPR/Cas (Clustered Regularly Interspaced short palindromic repeats/CRISPR-associated) is relatively new, and reported to be highly specific and effective in genome modification in a variety of living organisms. These systems are a bacterial defense against invading foreign nucleic acids and use an array of small CRISPR RNAs (crRNAs) consisting of repetitive sequences flanking unique spacers to recognize their targets, and conserved Cas proteins to mediate target degradation. This project examined the differences in effectiveness between CRISPR and RNA interference (RNAi) in silencing Phytoene Desaturase (PDS) gene in tomato leaves. Constructs for both CRISPR and RNAi with PDS sequence were constructed and infiltrated into the tomato leaves via agrobacterium infiltration method. Tissues from yellow patches, which appeared yellow because of the CRISPR and RNAi effect, were collected and subjected to further analyses. DNA was extracted from yellow tissue from leaves infiltrated with CRISPR constructs and subjected to DNA sequencing. Transcript levels were examined and found reduced in case of RNAi when compared to wild type tomato. In comparison, yellow patches were more prominent in case of CRISPR than in plants infiltrated with RNAi constructs. Together, these findings indicate that CRISPR/Cas method is more promising compared to RNAi.

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171

Subcategory: Social Sciences/Psychology/Economics

Effects of Adolescent Exposure to Fluoxetine, Methylphenidate, or Methamphetamine on Discrimination Reversal Learning

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Adolescents, when diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) or Major Depression, are frequently prescribed medications in this developmental period. The prefrontal cortex (PFC) is involved in cognitive flexibility, or the ability to make beneficial, adaptive decisions, and this region has not yet fully developed in adolescence. The introduction of methylphenidate (MPH) and fluoxetine (FLX), commonly known as Ritalin and Prozac, respectively, may interact with the development of the PFC, leading to changes in cognitive flexibility. Changes in PFC and in cognition and reward learning could either be protective or leave animals more vulnerable to develop an addiction in adulthood. Because no study has systematically compared the effects of these drugs in adolescence, a systematic investigation was undertaken. Male and female rats (n=8 females, n=8 males) were given 15 consecutive days of subcutaneous injections beginning in postnatal day 33, or early adolescence. One group was given 10 days of escalating doses of methamphetamine (mAMPH) followed by 5 days of saline injections. The other groups were given 15 days of high or low doses of MPH or FLX. The control group was given 15 days of saline injections. After the injections, the animals were tested on discrimination reversal learning using operant chambers. Once the rats successfully finished reversal learning, they were given access to mAMPH in order to examine the long term effects of MPH, FLX, and mAMPH on future drug use. Ongoing evaluations of these animals include analysis of their social play and their behavioral drug responses. Though no statistical analyses have been conducted to confirm this, the drug effects appear to be more pronounced in the female rats compared to male rats. We predict that animals treated with MPH or mAMPH, not FLX, will have higher rates of mAMPH self administration as adults. Furthermore, we predict that the animals given high doses of MPH will self-administer more mAMPH than those treated with low doses. Future research will focus on examining the brain regions involved in cognitive alterations, including PFC, amygdala, and hippocampus.

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Chemistry and Chemical Sciences

172

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Fisetin and Quercetin as Duplex and Quadruplex DNA Ligands: A Spectroscopic Study

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Plant flavonoids are in prominence from biomedical context for their wide range of therapeutic activities of high potency and low systemic toxicity.1 Rusznyák and Szent-Györgyi first drew attention to the therapeutically beneficial role of dietary flavonoids.2 Flavonoids are abundant in common plant based foods and beverages such as onions, apples, berries, tea and red wine. Both in vivo and in vitro studies show that flavonoids are therapeutically effective against a wide range of diseases including cancers, allergies, AIDS and different free radical mediated disorders such as atherosclerosis, ischemia, neuronal degeneration, cardiovascular ailments etc.3 which make them promising alternatives to conventional therapeutic drugs. Fisetin (3,7,3',4'-

tetrahydroxyflavone) and quercetin (3,5, 7,3',4'-pentahydroxyflavone) are the bioactive plant flavonoids which are potentially useful therapeutic drugs for the treatment of a broad spectrum of diseases including atherosclerosis, cardiovascular disease, obesity, hypertension and cancer. 3-hydroxy flavone (3HF) and 7-hydroxy flavone (7HF) are the synthetic chromophores of fisetin and quercetin. It is known that single and double stranded nucleic acids structures can serve as receptors for flavonoids.4 We have exploited dual luminescence properties of fisetin and quercetin along with 3-HF and 7HF to examine their efficacy of binding and compare their interactions with DNA, which is one of the macromolecular targets of flavonoids in physiological systems. Following the sequence of the human telomeric DNA 5'-d (CCCTAA-)n/(-TTAGGG)n-5', two single stranded DNA oligonucleotides, 5'-d(C3TA2)3C3-3' and 5'-d (T2AG3)4-3', and their duplex were used as receptors to study binding by the ligands quercetin, fisetin, and their chromophores. Circular dichroism (CD), differential absorption, UV thermal melting, and size exclusion chromatographic studies indicated the formation of unusual DNA structures (such as C4 and G4 tetraplexes) for both the C and G rich single stranded DNAs. Upon binding to DNA, dramatic changes were observed in the intrinsic fluorescence behavior of the flavonoids. Molecular docking studies were performed to describe the likely binding sites for the ligands. The spectroscopic studies on flavonoid–DNA interactions described herein demonstrate a powerful approach for examining their DNA binding through exploiting the highly sensitive intrinsic fluorescence properties of the flavonoids as their own ''reporter'' for their interactions with macromolecular targets.

References: 1. Harborne, J.B. in "Plant Flavonoids in Biology and Medicine II: Biochemical, Cellular and Medicinal properties". Cody, V.; Middleton, E.; Harborne, J.B.; Beretz A. (Eds.). Alan R. Liss, New York, 1988.
2. Rusznyák, St.; Szent-Györgyi, A. Vitamin P: flavonols as vitamins. Nature 1936, 138, 27-27.
3. Kris-Etherton, P. M.; Keen, C. L. Evidence that the antioxidant flavonoids in tea and cocoa are beneficial for cardiovascular health. Curr Opin Lipidol. 2002 13, 41-9.
4. Marini´, M.; Piantanida, I.; Rusak, G.; Zini M. Interactions of quercetin and its lanthane complex with double stranded DNA/ RNA and single stranded RNA. Spectrophotometric sensing of poly G, J. Inorg. Biochem. 2006, 100, 288–298.

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173

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Evaluation of Alkali and Acid Biomass Preteatments for the Production of 2,3-Butanediol

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With increased awareness of environmental issues caused by greenhouse gases as well as the depletion of the oil reserve supple, a heightened interest in displacing oil refineries with renewable energy sources has become a concern. One sustainable alternative comes from lignocellulosic biomass. The hindering factor in being able to exploit these resources for biorefining is the lack of an effective and efficient pretreatment method. The complex structure of the lignocellulosic biomass prevents hydrolysis of their carbohydrates, cellulose and hemicellulose, found within a rigid lignin barrier. These carbohydrates must become more easily accessible through pretreatment methods. Two methods that show great promise are the use of a dilute alkali or acid solution.

In this study, a 1% concentration alkali and acid pretreatment using sodium hydroxide and sulfuric acid was carried out on sorghum, switchgrass, and bmr sorghum. These sources of biomass have variations in composition but can all be grown in adverse environments so as to not displace food crop growth. Enzymatic hydrolysis was performed on the treated biomass to evaluate sugar production. After treatment, the alkali pretreatments yielded significantly higher total sugar and glucose yields than acid. It also revealed higher yields for both sorghum type biomasses over the switchgrass which demonstrates the promising characteristics of sorghum for future use. To then asses the quality of sugars formed from the biomass, fermentation for the production of 2,3- Butanediol using Klebsiella oxytoca was carried out. Upon anaylzing total product yields after fermentation, the hydrolyzates performed nearly as well as the pure sugar had in a controlled culture. Thus these forms of biomass are capable of forming quality sugars for fermentation of bio-fuels.

The composition of the biomass before pretreatment was also obtained using the procedure presented by the NREL. Sorghum type biomass serves as a promising source of biofuels based on their raw composition observed, the high conversion of usable carbohydrates to sugars, and the fermentabilty of the sugars. However, more research needs to occur on the behavior and composition of the sorghum, especially the bmr type which contains a lower lignin and higher extractive content. It has potential to utilize the carbohydrates more easily with the lower lignin and the extractives could contain potential sources of sugar. By studying with an alkali pretreatment, more advances can be

made in utilizing these sources while exploring their contents more deeply.

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174

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Regulation of Lysyl Oxidase

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Lysyl oxidase (LOX) is an enzyme involved in various biological processes. It is a copper dependent amine oxidase that catalyzes the cross-linking of elastin and collagen. This cross-linking provides stability and flexibility to connective tissues within the cardiovascular, respiratory, skeletal, and other systems within the body. Deregulation of the cross-linking mechanism can affect the stability of elastin and collagen molecules leading to diseases including fibrosis. A deregulation in the cross-linking of these molecules can result in disease within connective tissues and thus can be detrimental to an organism. In order to fight the effects of deregulation, specific inhibitors are used to restore or at least increase the regulation of LOX activity. One such inhibitor is β-aminopropionitrile (BAPN); however BAPN is not sufficiently specific for LOX and would inhibit other enzymes leading to negative side effects. The work presented here is laying the groundwork for the development of BAPN derivatives that have the capacity to return LOX activity to a normal state by selectively acting on the enzyme.

In order to achieve this objective, E.coli cells were transformed using pLOX14 that confers resistance to kanamycin antibiotic and adds a Glutathione-S-Transferase (GST) solubility tag to the N-terminus of the enzyme. This tag is crucial for solubility in aqueous buffers. Purification of the crude LOX protein was carried out via cell lysis in the form of sonication upon protein overexpression. LOX was isolated through affinity chromatography using NI-NTA resin columns. Protein analysis involved techniques such as SDS-PAGE, BCA assay for quantification, and fluorometic activity assays with amplex red to determine activity. Although inconclusive data arose in regards to the activity of LOX, the addition of the GST tag provided a soluble enzyme, which is critical when working with LOX. Efforts are now underway to obtain an activity baseline on this enzyme so that the following two analyses can be performed. First, the crystal structure of the enzyme needs to be determined and second, analyze the potential effects of varying BAPN inhibitors on LOX. By studying lysyl oxidase potential drugs may be synthesized to combat the negative outcome that lysyl oxidase can have on the body upon deregulation.

Funder Acknowledgement(s): LSAMP, CSUB Department of Chemistry and Biochemistry, Research Council of the University.

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175

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Drug Delivery: Encapsulated Zeolite H-Y Under Simulated Body Conditions

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Drug delivery consists of the methods used to transfer pharmaceuticals to the body to achieve a desired effect. Common transportation of drugs include oral, subdermal, and intravenous administration. However, medical professionals have discovered that these techniques of drug transportation into the body are of restricted efficiency in encapsulation and dispersal. Recent biotechnological research has found that zeolites may be the solution. Zeolites are microporous, inorganic materials with a low silicon to aluminum ratio and high ion exchange capacity. Previous investigation has repeatedly proven that size, shape and surface characteristics are very essential in determining the efficiency of drug delivery systems. An experiment in the Journal of Biomedical Materials Research Part A regarding drug delivery through the use of zeolites has found that drug release is strictly correlated with its grade of dissociation. Further investigation conducted by S. Fukahori et al. showed that pH greatly affects adsorption efficiency. Based on the shape selective properties, high surface area, and presence of channel and cavity systems, we predict that the use of zeolite H-Y, with a pore size of 11.5 Angstroms, will present a more efficient encapsulation and controlled release of paracetamol, a common analgesic pharmaceutical.

In this experiment we investigate the efficiency of encapsulation of paracetamol in Zeolite-HY and its release under simulated body conditions at pH 4, pH 7, and pH 9 to mimic the stomach, the human body, and the small intestines, respectively. To do this, we isolated paracetamol and loaded it into Zeolite-HY by stirring in suspension. Characterization of loaded zeolites was done using various methods including FT-IR, XRD, SEM, and TEM. The amount of paracetamol loading was measured using TGA. After loading, Gas Chromatography was employed to assess paracetamol release at simulated body conditions. TEM results have shown that paracetamol was effectively loaded into

the Zeolite supercages. This was confirmed by the presence of characteristic peaks in the asprin loaded FT-IR spectra. Results concerning the release of paracetamol from the loaded zeolites are pending. Further study on zeolite H-Y can be conducted under more diverse conditions. The functional groups can be changed in order to assess their effect on release and loading. Also, other drugs can be encapsulated in order to test the efficacy of this delivery system in more detail.

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176

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Single Molecule Fluorescence Studies on the Chloroplast Signal Recognition Particle

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In plants, the chloroplast signal recognition particle (cpSRP) is responsible for post-translational targeting of the light harvesting complex (LHC) proteins to the thylakoid membrane. The cpSRP is unique in that, in addition to a conserved 54 kDa protein (cpSRP54) that is present in SRPs in all kingdoms of life, it also contains a 43 kDa protein (cpSRP43) that is only present in chloroplasts. These two proteins bind together to form a heterodimeric SRP. Understanding the interaction between cpSRP43 and cpSRP54 is the first step to understanding post-translational targeting of photosynthetic proteins and may hold the key to tackling the increasing energy crisis. If we are able to understand how plants are able to organize LHC proteins to efficiently convert solar energy into other forms of energy, then perhaps we will be able to advance our own goals in the fields of renewable energy.

Fluorescence Correlation Spectroscopy (FCS) is a single molecule fluorescence technique that is able to measure binding affinities between proteins using much smaller quantities of protein than conventional techniques. However, FCS requires one of the proteins to be exogenously labeled with a fluorescent dye, which has the potential to interfere with binding. cpSRP43 consists of seven domains. To test if adding a dye on cpSRP43 affects its binding to cpSRP54, we site-specifically labeled cpSRP43 in various domains of the protein with two different dyes using maleimide-sulfahydryl chemistry. We obtained very similar binding affinities for each of the labeled proteins, verifying that both the identity and location of fluorescent probes does not affect binding and between the two cpSRP proteins. We also showed that the binding is mainly localized to the two C-terminal domains of cpSRP43 by labeling a truncated version of cpSRP43 in the same way as the full-length protein, and found that the binding affinity is largely unaffected. Finally, we observed a slight dependence of the buffer conditions on the binding between cpSRP43 and cpSRP54. Now that adding a dye to cpSRP43 is known to not affect the formation of cpSRP, future research will use single molecule fluorescence techniques to further study the various steps in the LHCP targeting mechanism and determine whether the buffer-dependence on the binding between cpSRP proteins is related to its function.

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177

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Synthesis & Characterization of Geranial, an E-isomer of Citral, Found in Cymbopogon Citratus

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Cymbopogon citratus, west indian lemongrass, is abundant in the US Virgin Islands. Ancient medicinal remedies use this tea bush for its medicinal benefits which include antioxidant, anti-inflammatory, antibacterial, antitumor and antifungal properties. Citral, the most prominent ingredient, is a mixture of two isomers, Geranial and Neral, which are believed to contribute to the medicinal capabilities of lemongrass. Geranial (3,7-dimethylacta-2,6-dienal) was synthesized in 61.4% yield by the oxidation of geraniol using sodium dichromate dihydrate under acidic conditions at temperatures under 10 degrees Celcius. Structural elucidation using IR and Proton NMR proved that the Geranial was successfully synthesized. In the following months, the geranial will be tested for toxicity via brine shrimp assays and the LD50 will be compared to that of extracted geranial. This is a preliminary study to determine the anti-prostate and anti-breast cancer activities of natural lemongrass oil, synthesized Geranial and Neral.

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178

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Comparison of Peroxynitrite and Hypochlorite Oxidation of Methionyl Peptides

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Methionine (Met) is one of the more readily oxidized amino acids in proteins and can be attacked by any reactive oxygen species (ROS) that are generated in biological systems. Oxidation of methionine has been implicated in numerous inflammatory, cardiovascular and age related diseases. Earlier experiments from our laboratory showed both peroxynitrite (PN) and hypochlorous acid (HOCl) can oxidize methionine. Based on the position of methionine in peptides/proteins, oxidation of methionine and decomposition of protein might be varied. In order to understand the mechanistic information on the pathways of oxidation, methionyl dipeptides such as Met-Gly, Gly-Met and Met-Met (0 to 3µmol) were allowed to react with either PN or HOCl (0 to 3µmol) in 2mL of phosphate buffer (PB) solution at physiological pH (pH 7.0). The disappearance of the oxidant peak (for PN λ302nm and HOCl λ292nm) was used to monitor the oxidation process. In the presence of PN, Gly-Met, showed a product peak at λ359nm which, increased with substrate and oxidant concentration. The stoichiometric equivalent of PN resulted in 50% of Met oxidation and 74% in Met-Gly oxidation. In the presence of HOCl, there was complete decomposition of Met, Met-Gly, Gly-Met and Met-Met peptides at stoichiometric equivalents. The product peak of HOCl oxidation was between λ200 to λ220 nm and varied depending on the peptide sequence.

The findings from these experiments will highlight the importance of the methionine in physiological conditions underlining the oxidative stress pathways and the stability of proteins in degenerative diseases such as Alzheimer's and Parkinson's disease.

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179

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Synthesis of Rhenium Carbonyl Complexes as PhotoCORMs: Contrast In Denticity Depending on the Flexibility of Ligand

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Although CO (carbon monoxide) has been known as the "silent killer" our body naturally produce CO in small amounts during the degradation of heme by the enzyme called heme oxygenase (HO). This has prompted researchers to utilize CO in various therapeutic settings. However, application of CO in gaseous form suffers from controlled and safe delivery. Therefore certain metal-carbonyl complexes have been proposed as carbon monoxide releasing molecules (CORMs), which are expected to show CO release in a more controlled manner to the biological targets. The major downside of CORMs is associated with sustainable delivery. Thus, the photoCORMs (photo induced carbon monoxide releasing molecules) have emerged as credible alternatives where the CO release process can be triggered upon light illumination. In our laboratory we are interested in the synthesis of photoCORMs with suitable design principle. Herein we have synthesized and characterized a rhenium carbonyl complexes, [ReCl(CO)3(qmtpm)] incorporating qmtpm ligand (qmtpm =2-quinoline-N-(2'-methyltiophenyl)-methyleneimine). This complex is structurally characterized. The next step in this project is to reduce the qmtpm ligand with NaBH4 to obtain to corresponding amine (qmtpa). The main aim is to determine whether the flexibility of qmtpa ligand (compare to qmtpm) can lead to a tridentate binding mode in contrary to the qmtpm which shows a bidentate chelation with a –SMe appendage. All the complexes synthesized are (or will be) characterized by 1H NMR, IR, UV-Vis spectroscopy and wherever possible with single crystal X-ray crystallography.

Funder Acknowledgement(s): CAMP

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180

Subcategory: Cancer Research

The Synthesis of Gallamide Cancer Chemopreventives

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Cancer is a major public health problem in the United States. According to the American Cancer Society, a total of 1,665,540 new cancer cases and 585,720 cancer deaths are projected to

occur in the United States in 2014. Cancer chemoprevention has become one of the major weapons in the fight against cancer. Cancer chemoprevention is the use of natural or synthetic compounds to interrupt carcinogenesis. The main focus of this research is to synthesize compounds with chemopreventive activity (chemopreventives) that can be used to treat high risk persons before carcinogenesis can take place. Gallic acid is a known polyphenolic antioxidant chemopreventive that protects cells against oxidative damage, and is cytotoxic towards cancer cells. Gallic acid is also observed naturally as a building block for the active chemopreventive found in green tea.

We hypothesize that we can synthesize compounds that can possibly produce more potent chemopreventive activity than other currently used polyphenols. We have used a derivative of gallic acid known as 3,4,5-trimethoxybenzoic acid in our amide synthesis. Our protocol for the synthesis of these compounds started with the conversion of 3,4,5-trimethoxybenzoic acid to acid chloride by its reaction with an equal molar equivalent of thionyl chloride in toluene solvent. A Dean-Stark flask was used in this 18 hour reflux to remove water created by the reaction. The toluene solution was dried using rotary evaporation. The purified acid chloride was then used in the Schotten-Baumann reaction and was allowed to react with an equimolar equivalent of amine for 2 hours. Afterwhich, the mixture was distilled, recrystallized from ethanol, and characterized by NMR, IR, and GC-MS.

We conclude that we successfully produced gallamides in yields of 73% to 95%. Our next step is to have these compounds analyzed by the National Cancer Institute to evaluate our compounds for chemopreventive activity.

References: Siegel, Rebecca, Jiemin Ma, Zhaohui Zou, and Ahmedin Jemal. 'Cancer Statistics, 2014.'CA: A Cancer Journal for Clinicians 64.1 (2014): 9-29. Print.

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181

Subcategory: Cancer Research

Synthesis of Napthoquinone Analogues for Evaluation as Potential Anti-Pancreatic Cancer Agents

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Pancreatic Cancer is the fourth most lethal cancer known. Novel compounds are needed to selectively kill cancer cells while leaving healthy cells unharmed. Novel compounds were synthesized based off of a lead from a phenotypic high throughput screen. The screen's phenotype was apoptosis of various cancer cell lines, revealing the lead, napthoquinone containing compound, BS001. Napthoquinone derivatives were synthesized and in vitro testing was performed to evaluate antiproliferative activity. A serial dilution assay was performed suggesting the compounds do not display any significant antiproliferative activity. A larger set of novel compounds must be synthesized in order to purposefully design the scaffold. This will provide an optimal lead compound that we can further manipulate.

Funder Acknowledgement(s): University of Michigan College of Pharmacy

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182

Subcategory: Cancer Research

Antioxidant Activity in Commercial Spices

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Antioxidants can be used as a prevention method of harmful degenerative diseases, such as cancer, cardiovascular and neurological diseases. The purpose of this research is to quantify antioxidant activity in commercial spices and to determine which spices had the highest antioxidant activity. Based on previous published work, our main hypothesis is that the hydrophilic antioxidant activity will be greater than the lipophilic antioxidant activity for all spices. Five different spices (basil, oregano, thyme, parsley and cilantro) were purchased in St. Croix, USVI. Antioxidants from these spices were extracted in both aqueous and organic solvents. The antioxidant activity was determined using an ABTS/ H2O2/ HRP decoloration method and monitored at 730 nm using a UV-VIS spectrophotometer. The antioxidant activity was reported as Trolox equivalent per grams of fresh weight. Our results show that oregano has the highest total antioxidant activity (529.15 ± 9.87 µmol TE per g of fresh weight) and parsley has the lowest (52.66 ± 12.52 µmol TE per g fresh weight). Future research involves growing the spices in St. Croix, performing the same tests on these spices, and comparing the results from the experiments performed with commercial spices. We also plan on mixing the spices together to test how the antioxidant activity will be affected.

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183

Subcategory: Cancer Research

Characterization of Morphine-6-O-Sulfate Sodium Salt in Bovine Brain Microvessel Endothelial Cells (BBMEC)

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The delivery of therapeutic drugs to the brain continues to be a challenge for the pharmaceutical industry. The blood-brain barrier (BBB) regulates the influx and efflux of a wide variety of substances, and remains the major obstacle in the delivery of drugs to the central nervous system (CNS). Various strategies have been devised to circumvent the BBB in order to increase drug delivery to CNS. The purpose of this work was to assess the potential mechanistic pathways present at the Blood-brain barrier in bovine microvessel endothelial cells (BBMECs) and to demonstrate that active transporters exist at the BBB that may provide alternative routes for delivering therapeutics to the brain that may exhibit poor brain/CNS bioavailability, and to also assess the potential mechanistic pathway of a newly synthesized salt of Morphine across the BBB. The following work demonstrates the presence and activity of active transporters that aid in the enhanced uptake of Morphine 6-O-sulfate in comparison to normal Morphine. Previous studies characterized the effectiveness of the derivative in various pain states and side-effect profile. We have studied the bidirectional transport of Morphine vs the Morphine derivative to determine why the derivative has an increased potency and delay in GI excretion compared to Morphine. Our data suggest that Morphine derivative crosses the BBB at a similar rate to Morphine but it is not excreted from the brain at the same rate. The results demonstrate that there is an active transporter is present aiding in the increased permeability and it is functional in BBMECs.

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184

Subcategory: Cancer Research

Synthesis of Sulfonamide Derivatives for the Improvement of Chemotherapeutic Treatment

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Cancer-related fatalities are the second leading cause of death in the USA, understanding the activity of effective chemotherapeutic agents is critical to addressing prostate and other cancers. Some cancer treatment agents are not as effective or have toxicities that limit their use. Our research group focuses on designing molecules that can possibly improve chemotherapeutic outcomes for individuals with cancers associated with hormone reproductive systems. Sulfonamides have been shown to possess substantial antitumor activity in vitro and/or in vivo. Therefore, the goal of this project is to synthesize a novel sulfonamide that could be used for this purpose and ultimately improve treatment for various cancers. The synthesis of the molecule involved traditional and microwave heating techniques. The intermediate and final molecules were isolated using liquid-liquid extractions, celite filtration, and flash column chromatography. The final molecule was obtained in modest yield and was characterized using Nuclear Magnetic Resonance Spectroscopy and Infrared Spectroscopy. The effectiveness of the molecules have been proven in prostate cell lines.

Funder Acknowledgement(s): NIH

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185

Subcategory: Cancer Research

Comparison of Hydrophilic and Lipophilic Antioxidant Activity Between Commercial and Fresh Herbs

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Antioxidants are substances that can remove potentially damaging oxidizing agents in living organisms. Research suggests that antioxidant can be potentially used as precautionary methods for certain degenerative diseases, such as cancer, Alzheimer's disease and heart disease. The purpose of this research was to quantify and compare antioxidant activity in commercial and fresh herbs. We hypothesized that the fresh herbs would have higher hydrophilic and lipophilic antioxidant properties than that of commercial spices. Four different commercial herbs, namely basil, oregano, thyme and cilantro, were purchased in St. Croix, USVI. The same four herbs were also grown in the greenhouse at the University of the Virgin Islands. Antioxidants from these herbs were extracted in both aqueous and organic solvents, separately. The antioxidant activity was determined using an ABTS/H2O2/HRP decoloration method and monitored at 730 nm using a UV-VIS spectrophotometer. This method has been used in previous research and the antioxidant activity was reported as Trolox equivalent per grams of fresh weight. Our preliminary results show that the antioxidant activity for hydrophilic extracts were significantly greater than the lipophilic extracts. Future research involves comparing the antioxidant activity on local fauna, such as mangoes and lemongrass, to the results obtained in this study.

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186

Subcategory: Chemistry (NOT Biochemistry)

Semiempirical Quantum Chemical Calculations of Al3+-bound Amino Acid Complexes Modeled for Neurodegenerative Diseases

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Recent studies have shown that oxidative processes of metal-binding (Zn, Cu, Al, etc.) amino acid residues such as methionine (Met), histidine (His), tyrosine, (Tyr), glutamic acid (Glu), etc. have been known to form conformational change of pathogenic proteins (e.g, β-amyloid (AβP), α-synuclein, etc), altered subcellular localization and prefibrillar aggregates for the neurodegenerative diseases (NDD) such as Alzheimer's disease (AD), Parkinson's disease (PD), amyotrophic lateral sclerosis (ALS), etc. In this study, theoretical semiempirical calculations of 27 newly constructed 3-D models for the controlled amino acids, their individual bases- Al3+ and amino acid-Al3+ complexes were performed by AM1 (Austin Model 1) and MNDO (Modified Neglect of Diatomic Overlap) approximations in gas and water phases to elucidate optimized metal-bound amino acid structures, intrinsic thermochemical stability, and reactivity of those biological chelates for neuronal degenerative redox chemistry. It was found that AM1 was a better computational method of examining thermostabilities of the Al3+- amino acid complexes vs. MNDO, based on the obtained data comparison with NIST database for reference molecules (H2O, CO2, and CS2). No difference in ΔHfo (heat of formation) for the modeled molecules tested between gas and water phases in each calculation method was observed. ΔHfo and ΔHreactiono (reaction enthalpy) of the Al3+-coordinated targeted amino acids and their individual bases-Al3+ complexes were successfully obtained by the validated AM1 method in a gas phase. For the ΔHreactiono of the Al3+-complexes, ΔHfo value of Al3+ was obtained with a coefficient of variation (4.8104%), a very good reproducibility. The obtained thermochemical stability order was Met>Tyr>His>Glu with Al3+. However, for Tyr and His, the obtained ΔHreactiono values have revealed that the reaction of Tyr -Al3+ complex is not kinetically favorable to the His-Al3+ complex due to its lower energy barrier. More structural insight for the amino acids- Al3+ complexes with the ΔHfo of individual bases-Al3+ complex of all tested amino acids was conducted to find that C=O-Al3+ at alkyl-chain significantly contributes to the instability of Glu-Al3+. More interestingly, the newly obtained ΔHreactiono values yielded the specific coordinated chemical bond information of the tested amino acids-Al3+ complexes with their thermal stabilities. The theromostable coordination bond numbers obtained were 4, 3, 2, and 4 for Glu-Al3+, His-Al3+, Met-Al3+, and Tyr-Al3+, respectively. The resulting data will have large potential impact on the development of drugs to inhibit or slow those targeted coordinated bonds of the amino acids residues-Al3+ complexes during conformation changes of the pathogenic proteins, which can lead to the prevention or cure of the NDD. Future study involves more computational chemistry of pathogenic metals-amino acid complexes for NDD with ab initio or DFT.

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187

Subcategory: Chemistry (NOT Biochemistry)

Spectroscopic Biosensor Based on Peptide-Aluminum Complex for Bacteria Detection

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An advantage that antimicrobial peptides (AMPs) have over contemporary antibiotics is that peptides exist in various combinations, making their excessive use less harmful to the host because pathogens are less likely to develop resistance. This research focuses on the efficiency of using AMPs to capture bacterial and viral membranes. The peptide (RW)4-NH2 was selected for its properties as a molecular recognition element. Aluminum sheets were used as the substrate onto which (RW)4 and the model bacteria membrane POPG were deposited. Five samples were prepared and analyzed: an aluminum sheet, an aluminum sheet submerged in water to form OH bonds, an Al-OH bond sheet with (RW)4, an Al-OH bond sheet with POPG, and an Al-OH bond sheet with (RW)4 and POPG. Instrumentation used to analyze the sample at each stage include the AFM and Raman and FT-IR spectroscopy.

The AFM was used to analyze changes in the surface, specifically the root-mean-square surface roughness which increased from the Al-OH to Al-OH/(RW)4 samples. The peptide appeared to enclose the model membrane in rodlike nanostructures on the Al-OH/(RW)4/POPG sample. FT-IR spectroscopy was used to confirm that the compound contained in each sample was a different material. Raman spectroscopy was used with Raman mapping to track the disordering of the phosphate groups in (RW)4.

Future research will analyze the effectiveness of AMPs with saturated Dipalmitoyl phosphatidylcholine (DPPC) and unsatu-

rated Dipalmitoyloleoyl phosphatidylcholine (DOPC). The findings will be directed towards the development of an environmental monitor in the form of a biosensor but can also be applied to neurophysiology research and biomedical diagnostics.

References: E. Ericsson, Biosensor surface chemistry for oriented protein immobilization and biochip patterning. Linkping Studies in Science and Technology Licentiate Thesis No. 1573. 2013. N. V. Kulagina, M. E. Lassman, F. S. Ligler, C. R. Tawitt, Antimocrobial peptides for detection of bacteria in biosensor assays. Anal. Chem. 2005, 77, 6504-6508. N. V. Kulagina et al, Antimicrobial peptides: new recognition molecules for detecting botulinum toxins. Sensors. 2007, 7, 2808-2824. S. Pavan, F. Berti, Short peptides as biosensor transducers. Anal. Bioanal. Chem. 2012, 402:3305-3070. J. H. Yoo, D. H. Woo, M. S. Chang, M. S. Chun. Microfluidic based biosensing for Escherichia coli detection by embedding antimicrobial peptide-labeled beads. Sensors and Actuators B 191. 2014, 211-218.

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188

Subcategory: Chemistry (NOT Biochemistry)

Synthesis of Cyclopropyl Inhibitors of Invertebrate Sterol Metabolism

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Marine sterols are of great research interest due to their diverse structural properties. Although these sterols have been isolated and characterized, little is know about their biological importance. Cholesterol is an important lipid in animals. Many invertebrates such as insects cannot synthesize cholesterol, however, they can transform plant sterols from their diet into cholesterol through a series of biochemical reactions that result in dealkylation at C-24. Petrosterol is a cyclopropyl sterol found in Petrosia ficiformis, a marine sponge. Recent studies have shown that petrosterol inhibits the dealkylation of plant sterols. Inhibiting the formation of cholesterol would have a negative impact on the health, growth and reproduction of invertebrates. The cyclopropyl group is known to lead to mechanism based irreversible enzyme inhibition through the formation of cyclopropylcarbinyl cations and radical intermediates. It is hypothesized that the cyclopropyl group present in petrosterol inhibits the conversion of petrosterol to cholesterol via the dealkylation pathway. This study focused on the synthesis of simplified analogs of petrosterol and its possible products in the dealkylation pathway. Synthesis of simplified petrosterol analogs was carried out using acetoacetate condensation, Wittig methylenation, and hydroboration as key steps following literature procedures. The structures of the compounds synthesized were determined by 1H, 13C, COSY, HMBC and HSQC NMR spectroscopy.

Successful synthesis of the 24-methyl cyclopropyl sterol and the 24-methylene sterol was achieved and verified through NMR spectroscopy. Future work includes successful synthesis of the epoxide analog and synthesis of these compounds with 13C labeling at the C-22 position. The 13C labeled sterols will be fed to invertebrates and tracked to better understand their mechanisms of action.

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189

Subcategory: Chemistry (NOT Biochemistry)

Spillover Effects in Catalysis by First Principles

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Heterogeneous catalysis is important in today's industry, and catalysts are added to a chemical process to facilitate the chemical reaction. Heterogeneous catalysts consist of small metal particles which carry the chemical activity dispersed on an inert support. A good active phase will bind the reactants strongly enough so that they produce reaction intermediates but weakly enough so that products can leave the surface thus allowing more reactions to occur at that site. At the same time, a good support material should not bind the reactants, allowing the chemical reaction to happen in the active phase. However, in realistic environments, spillover effects are present and reactant molecules tend to bind to the support, hence decreasing the overall activity of the material. Despite the recent advances in rational catalysis, the mechanism of spillover in most systems remains poorly understood. In this project, our final goal is to study the spillover effect of O2 molecules on MgO-supported Pd4 clusters. We computed the energetics of the O2 molecule adsorbed to the gas-phase molecule via a combination of density functional theory calculations and atomistic ab initio thermodynamics. We reported the binding energy changes which we plan to study the spillover effect on MgO supported metal clusters. We examined how the binding energy and Gibbs free energy changed with coverage and estimated the pressure and temperature conditions for the amount O2 to adsorb into the cluster. Examining the binding energy demonstrated an increase with the coverage of O2 molecules adsorbed to the Palladium Cluster. We then explore the temperature (T) and pressure (P) conditions for the adsorption of different amounts of O2. At fixed T, decreasing the pressure values reduce the number of O2

molecules bonded to the cluster. At fixed P, increasing temperature reduces the number of O2 molecules in the cluster. The results confirmed that a single O2 molecule adsorb on the cluster with adsorption energy of -0.50 eV and binding energy values increase with the coverage of O2, while decreasing the pressure at fixed temperature and increasing the temperature at fixed pressure reduces the number of O2 molecules bonded to the cluster.

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190

Subcategory: Chemistry (NOT Biochemistry)

Fully Conjugated Metallopolymers Containing Ru(II) Polypyridyl Chromophores

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Conjugated polymers covalently linked to metal chromophores are a promising class of materials due to their interesting photophysics and robust physical properties. A variety of metallopolymers have been reported with potential applications as light harvesting antenna for organic solar cells. We were interested in combining the best attributes of two material platforms previously exploited in our laboratory: 1) polystyrene derivatives with controlled placement of pendant ruthenium polypryidyl chromophores and 2) paraphenylenes with tuneable band gap due to the judicious choice of side chain donor/acceptor groups. Thus, we have designed a novel paraphenylene backbone polymer with side chain ruthenium chromophores. A dibromo diamine compound was synthesized in yields greater than 50% using NaBH4 in ethanol. The crude dione prepared separately in yields greater than 40% and recrystallized from methanol. The diamine and dione were coupled and the resulting crude monomer was purified by chromatography using an elutant of 4:1ethyl acetate:methanol with 1% ammonia hydroxide. All intermediates were verified by nuclear magnetic resonance and mass spectroscopy. The resulting polymer will be extensively characterized using cyclic voltammetry, UV-Vis spectroscopy, and fluorescence quenching. These materials should exhibit interesting photophysical properties and are poised to be the active layer for next generation solar cell devices.

References: 1) Fang Z, Ito A, Keinan S, Chen Z, Watson Z, Rochette J, Kanai Y, Taylor D, Schanze K, Meyer T. ATRP Preparation and Photophysical Properties of Polypyridylruthenium Derivatized Polystyrenes. Inorg. Chem., 52(15):8511-20 (2013); 2) Koepnick BD, Lipscomb JS₮, Taylor DK. Effect of substitution on the optical properties and HOMO-LUMO gap of oligomeric paraphenylenes. J. Physical Chemistry A 114(50): 13228-13233 (2010).

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191

Subcategory: Chemistry (NOT Biochemistry)

Thermal Analysis of Polymer-nanoparticle Polymer Films

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Polymers are widely used and becoming increasingly beneficial in biomedicine for stent coatings and tissue engineering, so determining ways to strengthen and improve these polymers would be valuable. HydromedTM D640 polymer films are currently used in creating bone scaffolds. In order to discover ways to improve the thermal properties of HydromedTM D640, we added different concentrations of hydroxyapatite (HAP) nanoparticles to the polymer films. We hypothesized that different amounts of HAP in the polymers would affect the melting and crystallization temperatures. We used the Differential Scanning Calorimetry (DSC) technique to analyze the effects that the different percentages of HAP nanoparticles have on the thermal properties of films. The DSC technique consists of placing two small aluminum pans in the calorimeter — an empty pan functions as a reference and the second pan contains the sample. This set-up heats and cools the two pans under identical thermal conditions and allows the researcher to determine heat flow into or out of a sample. Samples with 5% and 10% HAP had higher melting and crystallization temperatures than those with 0% and 20% HAP. These results support our hypothesis that different HAP concentrations affect the temperature at which phase transitions occur. Because higher melting points are indicative of more structured molecules, we would expect to see a positive correlation between rise in melting and crystallization temperatures and increased tensile strength for these composites. Future investigations will include determining whether this expected correlation exists for the polymer films and further characterizing the effects of HAP on this polymer.

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192

Subcategory: Chemistry (NOT Biochemistry)

Total Synthesis of the Cyclic Depsipeptide Natural Product Aspergillicin A, and Investigation of its Cell Permeability, Pharmacokinetic Property, and Bioactivity

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Cyclic peptides are an important class of natural products that display a wide range of biological activities and are of interest in drug discovery. Many of these naturally derived compounds exhibit better than expected pharmacokinetic properties, and our goal is to understand why. In the Lokey Research group, we are interested specifically in understanding how cyclic peptides can achieve cell permeability, an important property of potential therapeutics. In addition to synthetic compounds, we also use naturally derived compounds as model systems. The Aspergillicins are natural product cyclic depsipeptides originally isolated from the marine fungus Aspergillus Carneus. The goal was to perform the first total synthesis of Aspergillicin A, and use further analogs as model systems to study the pharmacokinetic properties of cyclic peptides. Using Solid Phase Peptide Synthesis (SPPS), two different synthetic approaches were tried with the objective to compare the gathered data on our synthetic materials, which included HPLC and LCMS analysis as well as NMR results; to the literature. The final goal of this project is to run the compounds on a cytological profiling assay and test for bioactivity; and use them as a test case for the study of cell permeability. Testing for cell permeability will be achieved by running the compounds through parallel artificial membrane permeability assay (PAMPA). In addition, we hope to develop new synthetic methods for the synthesis of cyclic depsipeptides, which may be of use in the future synthesis of other natural products or drug-like compounds.

Funder Acknowledgement(s): Scott Lokey, Lokey Research Group. Chemistry and Biochemistry Department - University of California, Santa Cruz

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193

Subcategory: Chemistry (NOT Biochemistry)

Synthesis, Characterization, and Antimicrobial Aspects of Macrocyclic Hemin Complexes

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Organometallic compounds have a wide range of applications in different areas of industry, including agricultural and pharmaceutical, due to their advanced chemical and physical properties. Prior research has proven that the properties of these various complexes allows them to contain antimicrobial aspects. O, O dialkyl and alkylene dithiophosphate derivatives of macrocyclic complexes of O,O-dialkyl and alkylene dithiophosphate Hemin compounds of the general formula, [Fe(L){S2 P(OR)2 and Fe(L){S2 PORGO], where L= macrocyclic ligands, (R = Et, i-Pr, i-But and Ph) and (G = –CH2CMe2CH2O–, –OCMe2CMe2O– and CH2CEt2CH2-), have been synthesized from the reactions of Fe (C34H32N4O4)Cl with Na or K salts of dialkyl and alkylene dithiophosphates in benzene. A multi-step synthesis is required in order to form the macrocyclic Hemin complex. We will begin by creating the O, O dialkyl and alkylene dithiophosphoric acids and salts. Once created, these Na or K salts of dialkyl and alkylene dithiophosphates will react with Fe(C34H32N4O4)Cl in a 1:1 molar ratio in benzene to form Hemin. It is important to ensure that all glassware is clean from contaminants. Also, moisture must be removed during each step to prevent impurities. Characterization is important when using a multi-step synthesis. In order for this multi-step synthesis to be successful, we must ensure that each step forms the correct compound(s). To help us keep track of the compound(s) formed during each major step, we will use elemental analysis, molecular weight determinations, IR, and NMR spectra (1H, 13C, 31P). In order to test the antimicrobial aspects of this compound, we will screen it against bacteria like Salmonella typhi and Bacillus subtilis. Future work will involve the synthesis and characterization of different transition metal complexes of the same or different group on the periodic table against these microorganisms to test their effect as antimicrobial agents.

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194

Subcategory: Chemistry (NOT Biochemistry)

First Principles Simulations of Pure Water

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Experimentally there is an ongoing debate regarding the structure of pure liquid water at ambient conditions. One set of experimental data suggests that over 80% of hydrogen bonds are existent in liquid water giving it a crystalline tetrahedron structure similar to solid water. Other experimental data says that only 20% of hydrogen bonds exist in water making the system seem more like a disorderly liquid. In this project, Ab Initio Molecular Dynamics (AIMD) and statistical mechanics were used to study the structural and dynamical properties of pure water at

ambient conditions. Two different density functionals Perdew-Burke-Ernzenhof (PBE), Becke-Lee-Yang-Parr with an empirical correction (BLYP-D3), and one force field , Q-TIP4P , were used to describe the system.

The system conditions were constructed in a periodic boundary cube containing 32 water molecules. The VASP code was used to run simulations. The calculations were run using Lawrence Livermore National Laboratories computer clusters. A canonical ensemble was used for Q-TIP4P simulations. Some disadvantages when running computer simulations for pure water are that most functionals over structure water at ambient conditions. Also, PBE describes water as having a density of 0.85-.90 g/cm3 and an extremely high melting point of approximately 400 K. The functionals also lack quantum nuclear effects which are observed in the radial distribution functional results for oxygen-hydrogen.

Here we present the impact of these approximations on structural properties such as the radial distribution functions, tetrahedrality parameters, hydrogen bond (HB) angles, and percentage of broken HB's in liquid water. The two functionals and the force field are compared to each other and to experimental results to help determine a defined structure for water. After running the simulations, it is seen that the BLYP-D3 functional and the Q-TIP4P yield a less over- structured liquid than PBE with a smaller molecular dipole moment and a higher number of broken HB's. HB's give us an idea of how structured the liquid is. If the liquid has a high number of HB's it appears to be more like a solid. PBE gave a value of 72% HB, BLYP-D3 48% and Q-TIP4P 43%, which tells us how disordered the liquid is.

In the future, we hope to extend the methods to study ion solvation in pure water with H3O+ and OH-.We are also interested in using different functionals in our simulations with more accurate descriptions for dispersion forces and calculate structure factors for all of the functionals and compare them to experiment.

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195

Subcategory: Chemistry (NOT Biochemistry)

Synthetically Derived Trichloroacetamides in Benzylic Systems via Transformation of Trichloroacetimidates

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The conversion of alcohols to protected amines, such as acetamides, is an important process in synthetic organic chemistry. While this transformation has several solutions, research in this area continues to develop as rapid, environmentally friendly and economical methods are still highly desirable. The goal of this research was to determine if benzylic trichloroacetimidates, which are easily synthesized from benzylic alcohols and trichloroacetonitrile, could be rearranged to benzylic acetamides, which are easily transformed to their corresponding amines. This transformation is known for allylic trichloroacetimidates but usually proceeds through a [3,3] sigmatropic rearrangement, which is unavailable to most benzylic systems. Attempts to directly convert the benzylic trichloroacetimidates to their corresponding trichloroacetamides are described. In the presence of an acid catalyst the reaction proceeded in synthetically useful yields. A number of Lewis and Brønsted acids were screened, and TMSOTf emerged as the catalyst that gave the best yields. The utility and generality of this approach was tested by applying the method to a number of imidates. Progression of the rearrangement was evident in most systems and wide ranges of trichloroacetamides were formed from their corresponding imidates in good to excellent yield. As a control, attempts were made to rearrange the benzylic trichloroacetimidates under thermal conditions (toluene, reflux) without a catalyst. However, under thermal conditions product was only observed in highly reactive systems. This research may be used as a cost-effective, atom-economical, operationally simple protocol to convert benzylic alcohols to their corresponding amines using readily available commercial reagents.

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196

Subcategory: Chemistry (NOT Biochemistry)

Development of Pd-Cu Catalysts for Application in Polyethylene Industry

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The selective hydrogenation of acetylene to ethylene is one of the most important reactions in the plastic industry today. In fact, the selective hydrogenation of acetylene is the most common selective hydrogenation reaction. Acetylene is an undesired by-product of the high temperature cracking of naphtha or other short chained hydrocarbons to produce ethylene. The acetylene will poison the catalysts used in the polymerization process to form polyethylene. Acetylene must be hydrogenated to ethylene to an industry standard of 5 ppm. Catalysts are commonly utilized to hydrogenate acetylene to ethylene. A majority

of these catalysts incorporate Pd commonly combined with Au, Ag or Ga. Cu-Pd catalysts with high Cu/Pd ratios have never before been attempted with this reaction. Previous work done with other selective hydrogenation reactions show that Cu-Pd catalysts are of great promise.

The alumina supported Cu-Pd catalysts were synthesized with varied loadings of Cu and Pd. Along with the different loadings, different treatment methods were also used. The treatments included calcination, vacuum drying, and non-thermal plasma treatments. Cu loadings ranged from 1.25 wt% to 15 wt%. The Pd loadings were 250 ppm, 500ppm and 0.19 wt%. The catalysts were characterized by TGA, TPR, chemisorption and AA. The catalysts were tested for the selective hydrogenation of acetylene from 25°C up to 300°C with gas phase space velocity of 66,000 cc/h/g and H2/C2H2 ratio of 3/1. The catalyst showed high conversion and selectivity at higher temperatures. Cu noticeably increased the selectivity of the catalyst. Detailed results of catalytic activity and selectivity and the relationship between catalyst properties and the performance of the catalysts will be presented. Future work will be done to optimize the Pd-Cu loadings as well as the implementation of other supports.

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197

Subcategory: Chemistry (NOT Biochemistry)

Development of Carbohydrate-based Heterogeneous Solid Acid Catalyst for Biodiesel Production

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Demand for biodiesel production has been skyrocketing due to renewable fuel mandates established by the Environmental Protection Agency. Biodiesel has a number of environmental benefits including biodegradability and lower CO2 and sulfur emissions. The production of biodiesel utilizes a catalyst to efficiently generate product from an esterification reaction of a fatty acid. To study this esterification reaction, the reaction of oleic acid and methanol is used as a model due to being the primary fatty acid in a number of oilseed crops. This study investigates a starch-based catalyst due to its economic and environmental advantages, including being recyclable, reusable and relatively low cost.

The focus of this study is on the development of preparation procedures for high surface-area mesoporous cornstarch and the effects this material has on the oleic acid model. The preparation of mesoporous cornstarch is a four step process that is performed prior to preparing the material into a catalyst. Mesoporous materials have higher pore volumes which allow for a higher acid density on the catalyst. Hypothetically, the higher acid density will lead to a more active catalyst and more efficient biodiesel production. BET surface area analysis was used to verify that the cornstarch achieved mesoporous surface area and an acid-base titration was performed to determine the acid density of the catalysts.

The reaction system employed consisted of the catalyst, oleic acid and methanol being inserted in a vial that was placed in an ultrasonic bath for three hours. Injections of the reaction were taken at regular time intervals in order to monitor the progress of the reaction. These injections were analyzed through gas chromatography analysis.

The findings of this study determined that a faster rate of reaction was achieved for the mesoporous catalyst as compared to a traditionally prepared catalyst. These findings were reinforced by quantitative acid density results to verify the increase in observed rate of reaction. Future study is focused on improving the successful preparation procedures demonstrated in this study as well as optimizing the reaction conditions of the model with the purpose of improving the economical and environmental production of the catalyst.

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198

Subcategory: Chemistry (NOT Biochemistry)

Spectroscopic Elucidation of the Equilibria Involving Pyridine and Its Analogues with Cobaloximes in Various Solvents

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The U.S. Energy Administration states that the United States alone consumed a total of 6.89 billion barrels of fossil fuels in 2013. It should also be noted that the amount of fossil fuels in reserves are approximately 1.3 trillion barrels. An important objective related to this research is the transition away from fossil fuels as the world's primary energy source, to renewable-generated power to produce storable fuels. An ingenious option is exploring the use of solar fuels, one source can be the use of hydrogen as a solar fuel produced from photo-assisted water

splitting or artificial photosynthesis. The focus of this study is to use first-row transition metal complexes, specifically cobalt(II) complexes called cobaloximes, and study their interaction with pyridine in various solvents. UV-visible studies were carried out on the cobalt(II) complex, [Co(dmgBF2)2(H2O)2] 1 (where dmgBF2 = difluoroboryldimethylglyoximato) in the presence of pyridine (py) in acetonitrile, water, and methylene chloride. Throughout this study, the main hypothesis is as follows: The water ligand in the axial position of [Co(dmgBF2)2(H2O)2] will be substituted with pyridine or one of its analogues. The studies in the various solvents were carried out by maintaining a constant concentration of the cobaloxime, while varying the concentration of pyridine or its analogues. UV-visible spectroscopic studies showed that in acetonitrile and water, both of which are coordinating solvents, as the concentration of pyridine increased, the absorbance marginally increased at wavelengths longer than 300 nm which could be caused by the solvents' competing ability to coordinate on the cobaloxime. In methylene chloride, which is a non-coordinating solvent, various absorbance changes were observed, with a blue shift from 440 nm to 420 nm. A spectrophotometric titration in methylene chloride proved that the stoichiometric ratio of pyridine to the cobaloxime was 1.00 ± 0.05, thus proving, that a complex with the formula [Co(dmgBF2)2(H2O)(py)] 2 was formed. The equilibrium constant in acetonitrile was calculated to be 1.72 x 103. The results showed that in the presence of a non-coordinating solvent such as methylene chloride, pyridine substituted one of the water ligands in [Co(dmgBF2)2(H2O)2] 1.

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199

Subcategory: Chemistry (NOT Biochemistry)

Investigation of Urban Grime in the Environment

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Urban surfaces such as roads and buildings are often coated with "urban grime", which consists of complex mixtures of inorganics and organics. The heterogeneous chemistry that may occur on these poorly-characterized reaction media could affect the fate of atmospheric pollutants and air quality. We have studied the photochemical and photophysical features of urban grime to help us understand its behavior as a reaction medium. Raman microscopy and scanning electron microscopy were used to show that urban grime is a collection of particles rather than a homogeneous film, as is commonly believed. We have demonstrated that urban grime absorbs sunlight, and that its absorption spectrum changes after being irradiated by simulated sunlight. Different components of urban grime undergo photolysis at different rates. These results suggest that urban grime could affect the photochemical fate of atmospheric species in cities.

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200

Subcategory: Chemistry (NOT Biochemistry)

Examination of N-Benzoyl Substituted Praziquantel (PZQ) Analogue Release in a LiquoGelTM Drug Delivery System

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Schistosomiasis, also known as bilharzias is a parasitic disease caused by flatworms known as cercariae. Although this parasite does not pose a threat in the United States, the Center for Disease Control reports over 200 million individuals are infected worldwide by this disease known to be one of the Neglected Tropical Diseases. Praziquantel is the leading compound in the treatment of Schistosomiasis. It has been noted that praziquantel has several administration drawbacks which include need for high dosage, bitter taste, and a low supply which cannot fulfill its current demand around the world. Praziquantel, as used today, has a short half-life that spans only from 0.8 - 1.5 hours. There is currently a need for a drug which can last in the blood stream for a longer period of time. This research addresses that need by looking at an alternative way to deliver praziquantel with the hope of decreasing the dosage taken by the patient. We hypothesized that incorporating praziquantel into a co-polymer (LiquoGelTM) system, would allow us to manipulate its release overtime. To monitor the compound in a chosen LiquoGelTM system, we have created an analogue of praziquantel that will allow for more efficient detection by UV light. This compound will be used in a series of polymer systems and measured for release overtime. This research is the foundation for identifying the most efficient delivery system for praziquantel. The next step is to test the efficacy of this delivery in a schistosome assay.

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201

Subcategory: Chemistry (NOT Biochemistry)

Computational Studies of Cathinone and Cathinone Derivatives

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Cathinone is a monoamine alkaloid derived from the Khat plant. Recently, derivatives of cathinone were studied to determine the biological effects of the compounds because of consumption abuse. This research focused on determining the electronic structures of compounds that have not been synthesized. From these electronic structures, predictions about the biological activity of the compounds can be made. In order to complete this task, a series of programs and software including the Gaussian 09 computational chemistry package were used. The authors modeled cathinone derivatives and performed geometry optimizations using Density Functional Theory's B3LYP method and 6-31G (d) basis set. From the output geometries, molecular descriptors were calculated and compared to experimental data. Data comparisons revealed a correlation between biological activity and the atomic charge of the nitrogen in the amine group. Additional results will be presented.

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202

Subcategory: Chemistry (NOT Biochemistry)

DNA Methylation and its Role in Repair Post UV Damage

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Although still a relatively new area of research that is not clearly understood, epigenetics has become a topic of much interest in the scientific community within the last decade. One sub-area of particular interest is the putative role of epigenetic modifications in DNA repair, specifically Nucleotide Excision Repair (NER), where the addition of certain functional groups to DNA or histones may be involved in the recognition of damaged DNA. NER is an important DNA repair mechanism in humans which is responsible for repairing UV damage, and deficiencies in NER hinder its efficacy. A decrease in function can lead to diseases such as xeroderma pigmentosum or cancer, and understanding these underlying deficiencies could lead to possible future treatments to reduce health risks associated with impaired NER.

It has been shown through earlier results that the NER rate on DNA strands being transcribed is greater than the NER rate on strands not being transcribed, and it has also been suggested epigenetic modifications play a role in this disparity. In this study, we decided to measure DNA methylation levels after UV damage had taken place to test the theory that the methylation of DNA serves as a potential recognition element to enable faster NER rate during transcription. HeLa cells were cultured and a fraction exposed to UV radiation to induce DNA damage. The UV-irradiated HeLa cells, along with the remaining unirradiated cells, were then collected at times 0 hours, 4 hours, 8 hours, and 24 hours, and an extraction for methylated DNA was carried out. Afterwards, the methylated DNA levels of the irradiated and unirradiated at the four times were compared using qPCR. Although preliminary, the data suggests that at least in the coding regions of the DHFR 70 and GAPDH genes, DNA methylation increases after UV damage has been inflicted, and the methylation levels vary over a 24-hour time period. Increased DNA methylation and varying levels indicate the potential for the methylation of DNA to play a role in repair after damage from UV irradiation has occurred. Further research to verify the data is needed, as well as further research on other possible epigenetic modification that may play a role in NER.

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203

Subcategory: Chemistry (NOT Biochemistry)

Investigating Cholesterol-lipid Interactions in the Presence of Zinc Ions Using AFM and SERS

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Cholesterol in the membrane has been found to strengthen the interactions between the individual phospholipid molecules forming the membrane which increases the layer stability and lowers its permeability for water and ions. Very few studies have been devoted to the effect of metal ions on cholesterol-lipid interactions. In this project, AFM and SERS techniques are used to investigate the interaction of cholesterol with a binary mixture of phospholipids in the presence of zinc ions. AFM images have shown that cholesterol increases the roughness of the liposomes composed of Dipalmitoyl Phosphatidylcholine (DPPC) and Dipalmitoylglycerophosphoglycerol (DPPG), and form microdomains. In the presence of zinc ions, AFM images show that zinc ions affect the shape and size of cholesterol-phospholipid systems. The wavenumbers and integral intensities of Raman bands were used to identify the components of the ternary system cholesterol/liposome/zinc. SERS spectra indicate that cholesterol interact strongly with DPPG with and without zinc. Raman mapping of the ternary system revealed that ZnCl2 affects

the lipid chain packing of DPPC bilayers. Correlation between sample chemical composition and AFM images was observed.

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204

Subcategory: Chemistry (NOT Biochemistry)

Monosubstituted Benzene Adsorption on a Cu(111) Surface

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Activating and deactivating monosubstituted benzene derivatives adsorbed onto a Cu(111) surface may lead to an activation of benzene for use in organic synthesis. Four functional groups were chosen to study based on their relative effect on adsorption strength (NH2, CH3, F, NO2). We hypothesized that both electron donating and electron withdrawing groups would show greater surface affinity through larger charge transfer with the surface. Density functional theory (DFT) calculations with the Vienna Ab-inito Simulation Package (VASP) and the Grimme (D3) empirical dispersion correction were employed to study the monosubstituted benzene derivative surface adsorption. VASP naturally operates as a plane-wave periodic code, making it suitable for solid state calculations. We found that a 15x15x1 k-point mesh gave rise to energies that were converged to < 0.1 kcal/mol, with a plane wave cutoff energy of 500 eV. These parameters were used to determine the binding energies of our systems by employing the following equation: EBinding= ESystem- EAdsorbate- ESurface

As predicted, both the stronger activating and deactivating groups result in a stronger surface-adsorbate interaction (e.g. larger binding energies, relative to benzene). The next step in this research would be to compare different potential binding sites, such as the bridge, hollow and top sites. Another direction this research could take, given more computational resources, would be to increase the number of atoms in the copper surface and/or allow more of the copper surface atom to relax. The data and results discovered could be used in a comparison with a different functional or results from a molecular quantum chemical program that models the Cu surface as a finite cluster. The use of a different surface element can also serve useful to illustrate if the observed trends continue across different elements, and not simply Cu. The future direction of this project has endless potential.

References: Grimme, S.; Antony, J.; Ehrlich, S.; Krieg, H. J. Chem. Phys. 2010, 132, 154104 Hoffmann, R. Rev. Mod. Phys. 1988, 60, 601-628.
Simpson, S.; Kunkel, D.; Hooper, J.; Nitz, J.; Dowben, P.; Routaboul, L.; Braunstein, P.; Doudin, B.; Enders, A.; Zurek, E. J. Phys. Chem. C. 2013, 117, 16406-16415.
Simpson, S.; Zurek, E. J. Phys. Chem. C. 2012, 116, 12636-12643.
Rockey, T.; Yang, M.; Dai, H. J. Phys. Chem. B. 2006, 110(40), 19973-19978.

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205

Subcategory: Chemistry (NOT Biochemistry)

Interactions Between a Short Antimicrobial Peptide and Model Membranes: Effect of Zinc Ion

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An increasing problem in pharmaceuticals today is that bacterial infections are gradually becoming more resistant to conventional antibiotics. Antimicrobial peptides or AMPs are a promising solution to this problem. The small antimicrobial peptide DDDDDDD-OH (D7) in zinc saline solution was found to be bactericidal for both Gram-positive and Gram-negative bacteria. This study investigates the binding of D7 with model membranes using atomic force microscopy (AFM) and surface-enhanced Raman spectroscopy (SERS). The model membranes considered were the saturated Dipalmitoyl Phosphatidylcholine (DPPC), the unsaturated Palmitoyloleoyl phosphatidylcholine (POPC), and the anionic Dipalmitoyl Glycero Phosphoglycerol (DPPG).

Morphological modifications induced by the binding of saturated and unsaturated phospholipids to the D7 were examined by AFM. AFM images have shown that zinc decreases the size of D7 particles along with an increase in the surface roughness. In the absence of zinc, the liposomes composed of D7-DPPC and D7-POPC form small microdomains; the system D7-DPPG contained large microdomains. In the presence of zinc, AFM images show that zinc ions affect the shape and size of peptide-phospholipid systems. There is a decrease in the size and shape of microdomains of all the systems. The wavenumbers and integral intensities of Raman bands were used to identify the components of the ternary system D7/zinc/phospholipid. SERS spectra indicate that D7-zinc interacted very little with the saturared POPC, significantly with nonsaturated DPPC. However, it interacted strongly with negatively charged DPPG. Raman mapping of the ternary system revealed that ZnCl2 affects the lipid chain

packing of DPPG bilayers. Furthermore, low-frequency Raman spectra showed that metal cation binding induced a significant perturbation of the amide IV-VII band. The binding of Zn cation alters the structure of the peptide and may also enhance the ability of the peptide to bind with saturated lipids such as DPPC. Future work will look at the influence of the substrate (mica or gold) on the binding capabilities using the AFM. Furthermore, we are interested studying the toxicology and the interactive mechanism of lanthanide ions and their complexes with bilayers membranes.

References: Lucia Becucci, Daniela Valensin, Massimo Innocentia and Rolando Guidelli. Dermcidin, an anionic antimicrobial peptide: influence of lipid charge, pH and Zn2+ on its interaction with a biomimetic membrane. Soft Matter 10. 2014, 616-626.
S. Stewart, P.M. Fredericks. Surface-enhanced Raman spectroscopy of amino acids adsorbed on an electrochemically prepared silver surface. Spectrochimica Acta Part A 55. 1999, 1641-1660.
S. Stewart, P.M. Fredericks. Surface-enhanced Raman spectroscopy of peptides and proteins adsorbed on an electrochemically prepared silver surface. Spectrochimica Acta Part A 55. 1999, 1615-1640.

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206

Subcategory: Chemistry (NOT Biochemistry)

A Reaction-Based Fluorescent Probe for Hydrogen Sulfide Detection

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Hydrogen sulfide (H2S) is an important gasotransmitter in mammals with importance on par with that of nitric oxide and carbon monoxide. This toxic gaseous molecule has been found to accumulate in the environment in addition to being produced endogenously. Abnormal levels of H2S in the body have been associated with Alzheimer's, Down syndrome, diabetes, liver cirrhosis, and cardiovascular dysfunction. These effects have highlighted the need for the development of sensitive probes for the detection of H2S. Previous research has shown that the catabolism of H2S in the blood is fast and as a result there is a continuous fluctuation in its concentration. To be able to accurately detect H2S in the body, a quick and sensitive method has to be used. Also studies have shown that the endogenous concentration of H2S is between 10 µM – 100 µM. An effective technique has to be able to detect H2S even at a lower concentration.

Herein we describe the evaluation of a new reaction-based florescent probe known as DN4 for the detection of H2S in aqueous media and fetal bovine serum. The DN4 probe is a redox-based fluorescent probe that is designed for the sensitivity and selectivity of H2S. The detection is based on the reduction of a sulfonyl azide to a sulfonamide. In this technique, reaction with H2S is capable of switching the probe from a non-fluorescent state to a state of strong fluorescent. For the probe to be an effective tool for H2S detection, it has to be selective for H2S over other anions, reducing agents, and complex biological samples containing compounds such as cysteine, homocysteine, and glutathione. These biological molecules are intracellular thiols which are found in the body, and have been also associated with several diseases. As a result, it is important that the probe have a high sensitivity to H2S over these sulfur biological molecules. The probe shows a high sensitivity to low concentrations of H2S and was also found to be very selective for H2S over other anions, reducing agents, and complex biological samples in phosphate buffer as well as in fetal bovine serum. As a result the DN4 probe should be a very useful tool in H2S research in cells and in vivo.

References: K. Wang, H. Peng, N. Ni, C. Dai., B.Wang, '2, 6-Dansyl Azide as A Fluorescent Probe For Hydrogen Sulfide.' J. Fluoresc. 24.1 (2014)
R. Lippert, 'Designing Reaction-Based Fluorescent Probes For Selective Hydrogen Sulfide Detection. 'J. Inorg. Biochem. 133. (2014): 136-142.

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207

Subcategory: Chemistry (NOT Biochemistry)

Computational Study of a Potential Cocaine Antagonist Compounds

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Methylphenidate (methyl 2-phenyl-2-piperidin-2-ylacetate) and its analogs have been studied extensively because of their pharmacological usefulness. These compounds, in recent years, have shown potential in the treatment of cocaine abuse through antagonistic effects. Methylphenidate is characterized by two chiral carbons, one which of which is substituted by H, a phenyl ring, an ester, alcohol, or ether group, and piperidine nucleus (C1*). The second chiral carbon (C2*) is located on the

piperidine ring with substitution possible at the amino nitrogen. Additionally, functional groups may be placed in positions about the phenyl ring.

The current study proposes a new class of compounds where methylphenidate is modified by replacing piperidine with an amidine or a guanidine nucleus. The amidine/guanidine derivatives are further modified by adding oxadiazole, oxazole, and isoxazole in place of the ester group. The compounds were modeled using Density Functional Theory's M06-2X method with a 6-311++G(d,p) basis set and molecular descriptors were found. Results revealed significant changes in dipole moment when comparing the modeled compounds to the parent methylphenidate structure. The oxadiazole substituted derivative is the most polar compound (4.5 Debye). This is expected since the ester replacement groups give added metabolic stability. Future work will include the addition of halogens to the phenyl moiety because halogenated methylphenidate has been shown to exhibit an increase in biological activity. The results of this study will lead to the tuning and synthesis of a new set of compounds with desired medical properties.

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208

Subcategory: Chemistry (NOT Biochemistry)

Studies on Ionic Triphenyltin Complexes of 3, 5-Pyridinedicarboxylic Acid

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Organic compounds with three alkyl groups attached to a tin atom (R3SnX) are known as triorganotins. Triorganotin complexes have been considered in the literature as potential anti-tumor agents; however their partial solubility in water results in low bio-availability. We believe that structural modification of these triorganotin complexes can potentially improve the activity by introducing ionic characteristic in the complexes.

In this project, we combined Triphenyltin Hydroxide with a series of Dicarboxylic Acids, in the presence of an Amine in 1:1:1 molar ratio. We believe that the deprotonation of the Dicarboxylic Acid by an appropriate amine and the triphenyltin hydroxide will result in the formation of a 5-coordinated structure around tin atoms. The reaction mixture was refluxed in ethanol with stirring and cooled. The final products were extracted and recrystallized in ethanol. Successful formation of the complex was confirmed by elemental analysis, Infrared (IR) and Nuclear Magnetic Resonance (NMR) spectroscopies. Preliminary data has indicated the successful formation of ionic triphenyltin complexes of 3,5-Pyridinedicarboxylic acid. Suitable crystals will be sent for X-ray crystallographic analysis. Future studies will focus on the comparison of the toxicity of the synthesized products with that of its starting materials.

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209

Subcategory: Chemistry (NOT Biochemistry)

Utility of a Low-Valent Dinuclear Cobalt Analog in Chemical Comparison to Dicobalt Octacarbonyl

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In our efforts to better understand the catalytic influence of dicobalt carbonyls in hydroformylation and Pauson-khand [2+2+1] cycloaddition, the synthesis of novel isocyano model complexes were prepared and characterized. Using sterrically-encumbering m-terphenyl isocyanide ligands, we were successful in creating an isolobal analogue of the dominant C2v-symmetric isomer of dicobalt octacarbonyl (i.e. Co2(CO)8). Our model complexes encourage reactivity through vacant coordination sites, while promoting kinetic stability. By introducing reagents relevant to hydroformylation and Pauson-Khand cycloaddition, insight was gained into the catalytic cycle these reactions operate by. Complexes modeling the catalytic intermediates in these reactions are showcased and characterized with a variety of techniques including, multinuclear magnetic resonance spectroscopy, Fourier-Transform infrared spectroscopy, and X-ray crystallography. Taking the project further, we wish to identify all intermediary complexes in the decarbonylation pathway from Co2(CO)8 to our analogue, with goals to intimately understand our analogue synthesis and gain essential access to catalytic roles it possesses.

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210

Subcategory: Chemistry (NOT Biochemistry)

Towards the Formation of Polymeric Micelles Utilizing Cross-linked Fatty Acid Methyl Esters

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Over the years, there has been a significant growth in research concerning the transportation of pharmaceuticals to specific biological targets with precision due to the fact that drugs can degrade or diffuse into different parts of the body before reaching the intended target. Polymeric materials can be used to address this issue by acting as drug carrier agents due to their specific properties. Micelles have hydrophobic tails located within the structure, and hydrophilic heads lining the outer region of the molecule. Hydrophobic pharmaceutical payloads would be positioned within the core of the hydrophobic region of the micelle to increase circulation time and biological availability. Polymers are macromolecular materials utilized in the production of consumer products ranging from medicine to textile. With fossil resources diminishing and a renewed awareness to green chemistry, there has been an increase in demand for eco-friendly alternatives. Our research contributes to this purpose through the synthesis of polymers using sustainable resources such as plant and seed oils.

Our study was initiated by synthesizing single chained Fatty Acid Methyl Esters (FAMEs) as a result of the transesterification of castor oil utilizing methanol and potassium methoxide. The sterically unhindered hydroxyl group attached to the fatty acid chain of ricinoneleic acid was then acrylated in the presence of acryloyl chloride in a 59% yield. A 1H NMR spectra displayed a set of resonances from 5.761 - 6.384 ppm that agree with the complex splitting of a vinyl olefin. The acrylate functionality of the modified FAMEs may self assemble into a micelle under aqueous conditions that can be polymerized in the presence of UV light. The derivative monomers have the potential to serve as building blocks in the synthesis of biological relevant material based on renewable starting materials.

References: Han-Min, K.; Hak-Ryul, K.; Ching, T. H.; Beom, S. K. J. Am Oil Chem Soc. 2010, 87, 1451-1459.
Petrovic, Z. S.; Cvetkovic, I.; Hong, D.; Wan, X.; W.; Abraham, T.; Malsam, J. J. Appl. Polym. Sci. 2008, 108, 1184-1190.

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211

Subcategory: Chemistry (NOT Biochemistry)

Towards Designing Protein-Protein Interactions in the Influenza Virus Using Molecular Simulation

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Hemagglutinin (HA) is a glycoprotein found on the surface of the Influenza virus. It mediates viral entry into the cell and is the target of broadly neutralizing antibodies. Understanding the interactions important for the binding of HA with its native high affinity antibody, which can block viral infection, can help in the discovery of potential therapeutics against the virus. In this study, we used coarse-grained molecular dynamics simulations to study the nature of protein-protein interactions between HA and its antibody. Our model reproduced the HA-antibody binding mode revealed in the solved crystal structure as well as possible “allosteric” binding sites. We also simulated HA with a putative protein binder, which was predicted by a structural alignment algorithm to be a potential therapeutic for influenza, and found that this protein mimics HA interaction with the native antibody. Future research involves optimization of the coarse-grained force field and characterization of the different binding poses revealed through simulation. Our approach shows potential as a novel computational-based drug discovery technique that can be applied to investigate other protein-protein interactions of interest.

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212

Subcategory: Chemistry (NOT Biochemistry)

Molecular Modeling of Lignin

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Biomass is a fuel that is developed from organic materials, a renewable and sustainable source of energy used to create electricity or other forms of power. Biomass is produced from five identified sources which are garbage, wood, waste, landfill gases, and fuels based on alcohol. Biomass is important because it is useful and beneficial to human life, can be converted to thermal, chemical, and biochemical forms, utilizes waste and the environment, contributes to the reduction of greenhouse gas emission, and helps decrease the demand of oil and fuel from foreign countries, in turn reducing foreign dependency. It has many advantages such as no harmful emissions, clean energy, abundant and renewable, and can be used to produce different products. Lignocellulosic biomass is said to be one of the most promising renewable raw materials since it can be transformed into a wide variety of products and by-products such as energy, materials, and chemicals. Lignocellulosic biomass is mainly composed of cellulose, hemicelluloses, and lignin. Among the main constituents of lignocellulosic biomass, lignin is one of the most interesting components since its aromatic nature and the broad variety of functional groups present in its chemical structure make it a unique and promising source of

renewable products and commodity chemicals. Lignin is a constituent of the cell walls of almost all dry land plant cell walls. It is the second most abundant natural polymer in the world, surpassed only by cellulose. Of the polymers found in plant cell walls, lignin is the only one that is not composed of carbohydrate (sugar) monomers.

The present study seeks to find lignin model compounds for the purpose of understanding how various functional groups affect the reactivity. To do this, lignin models were visualized and optimized using the Gaussian 09 computational chemistry package. Calculations were performed using the DFT functional M06-2X with the basis sets, 6-31G(d) and 6-31G(d,p). Low energy structures of the polysubstituted lignins were identified. Results of the study will be presented.

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213

Subcategory: Chemistry (NOT Biochemistry)

Antioxidant Characteristics of Alternative Flours for Development of a Gluten-Free Hotdog Bun

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One in 133 people in the U.S are diagnosed with celiac disease. A strict gluten-free diet is required to treat this illness. Nonetheless, gluten-free options such as breads and other related products are limited. The goal of this research was to develop a blend of Gluten-free flours with similar antioxidant and physiochemical properties as wheat hotdog buns. This was achieved by substituting 25, 50, and 75% of each flour (amaranth, chick pea, potato) and a secondary flour blend (33% amaranth, 33% chickpea, 33% potato flour). Physiochemical properties that were measured consisted of color (Hunter Colorflex), pH (pH Meter), specific volume, texture (Texture Analyzer) and water activity (Rotronic Meter). Total phenolic, flavonoid, and frap content were also determined. Total phenolic content was averaged at 13.649 mg/100g for amaranth flour, 17.377 mg/100g for chick pea flour, and 23.042 mg/100g for potato flour. Moreover, total flavonoid content displayed that the amaranth flour was averaged at 5.698 mg/100g of sample, chick pea was 6.719 mg/100g, and potato flour was 5.386 mg/100g. The results highlighted that the selected flours rendered similar antioxidant and physiochemical characteristics as the wheat-based products. This may lead to the development of a gluten-free hotdog bun with alternative flours in the food industry.

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214

Subcategory: Chemistry (NOT Biochemistry)

Raman Spectroscopy of Lipsticks Containing Biological Impurities and in Situ Substrates

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Crime scene investigation involves identification of trace evidence of almost limitless variety. Chemical analysis of this evidence is a field with constantly emerging new techniques and methodologies in part due to the availability of more advanced instrumentation. A recent article published in Forensic Science International entitled “Analysis of Lipsticks using Raman Spectroscopy” showed excitation by the 780 nm allowed the characterization of 95% of 80 unique lipstick samples. The study presented herein is an extension of this original work and involves establishing the limits of detectability and identification of several brands of lipstick in the presence of biological impurities and typical in situ substrates. Being able to positively identify the exact brand and product line of cosmetics by creating a library of Raman spectra would have importance in crime scene investigations especially with the emergence of portable Raman instrumentation available for direct characterization at crime scenes.

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215

Subcategory: Chemistry (NOT Biochemistry)

Design of Tunable Green Polymeric Materials

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Most polyurethane consumer products are currently synthesized from petroleum sources; however, our research is investigating the synthesis of polyurethanes from renewable starting materials. The resources applied so far have been castor oil and sunflower seed oil that were transesterified into fatty acid methyl esters (FAMEs). These biofuels were purified using flash silica gel and analyzed using FT-IR and NMR techniques. The FAMEs were derivatized to yield polyhydroxylated monomers, which were cross-linked with 4,4-diisocyanate and cured at 50°C

to yield a polymeric material with tunable rigidities based on the monomer compositions.

The synthesized polymers were analyzed with FT-IR to confirm that multiple carbamates were formed. The spectra displayed resonances at 3336.08 cm-1,2355.14 cm-1, 1725.70 cm-1, and 1524.30 cm-1 that are characteristics of carbamate functionality in the material. The polymer solubilities in tetrahydrofuran (THF) were found to range from 0.00% to 36.70%. Additional thermal data of the composite were collected including glass transition point (Tg) and melting point (Tm). The Tg of the polymeric materials, ranged from 11.25°C to 51.23°C and the Tm ranged from 306.72°C to 322.32°C. It is important that the green polymeric materials synthesized in this project maintain physical and structural properties of current commercially available materials. If so, the proper design of the polyurethane may serve as a viable alternative to existing formulations thereby delaying the depletion of nonrenewable resources, and advancing the field of green chemistry.

References: Petrovic, Z. S.; Cvetkovic, I; Hong, D; Wan, X; Zhong, W; Abraham, T; Malsam, J. Applied Polymer Science. 2008, 108, 1184-1190.
Sharmin, E; Ashraf, S.M.; Ahmad, S. International Journal of Biological Macromolecules. 2007, 40, 407-422.

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216

Subcategory: Chemistry (NOT Biochemistry)

Synthesis of a Quinone Methide Precursor for Reversible DNA Alkylation

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Quinone methides are reactive intermediates present in natural and synthetic compounds, which can function as anticancer drugs, self-immolative dendrimers, or mechanism-based inactivators. Quinone methides have the ability to reversibly alkylate DNA. This unique property allows quinone methides to form crosslinks with DNA and essentially “walk” along a DNA strand. The regenerative property of quinone methides can increase longevity and distribution of DNA targeting in drugs. In previous experiments, an acridine linker has been used to deliver the quinone methide to the major groove of DNA. However, the bulkiness of the acridine linker could impede migration of the quinone methide along the DNA strand. Present work focuses on the synthesis of a quinone methide precursor with a positively charged polyamine linker. I anticipate that the charge on the cationic amine should help deliver the quinone methide to DNA by electrostatic attraction and not limit migration of its. The seven step synthesis of the quinone methide precursor has provided modest yields of the desired products. Upon purification of the final product, we hope to test for reversible alkylation of short DNA oligonucleotides.

References: 1. Veldhuyzen, Willem F., Praveen Pande, and Steven E. Rokita. “A transient product of DNA alkylation can be stabilized by binding localization.” Journal of the American Chemical Society-125.46 (2003): 14005-14013.
2. Veldhuyzen, W. F.; Pande, P.; Rokita, S. E. J. Am. Chem. Soc. 2003, 125, 14005.
3. Wang, Huan, Manvinder S. Wahi, and Steven E. Rokita. 'Immortalizing a Transient Electrophile for DNA Cross-Linking.' Angewandte Chemie International Edition 47.7 (2008): 1291-1293.

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217

Subcategory: Chemistry (NOT Biochemistry)

New Positively Charged Contrast Agents for Diagnosis of Osteoarthritis

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Cationic Contrast Agents will produce superior CECT attenuation than current FDA approved anionic and neutral Contrast Agents. We will take advantage of the Columbic Interactions between GAG chains in cartilage tissue and the Cationic Contrast agents. This will achieve better tissue penetration, attenuation, and thus ultimately obtain meaningful and detailed imaging of cartilage tissue. The project was designed to help Osteoarthritis (OA) patients by early imaging of articular cartilage degradation and with the proper treatment can be cartilage degradation can be modified. Synthesis of Contrast Agent 4+: 1 to 2 used Thionyl Chloride/Heat as the reagent and heat as a catalyst. 2 to 3 used malonyl Chloride as the reagent 3 to 4 used mono-boc-protected ethylene diamine as the reagent. 4 to 5 used trifluoroacetic acid and dichloromethane as the reagents to yield CA4+. Synthesis of Tantalum oxide nanoparticle: Microemulsion (ME) to Tantalum Oxide NP Cores to Silane ligands to Evaporation of Solvent to Centrifuged to dissolve in DI water to Placed in the sonicator bath. Articular cartilage uptake in these joint was visualized with CECT X-rays. Cationic Contrast Agents demonstrated superior uptake and better visualization of ex vivo murine tibia and femur articular cartilage than current FDA

approved anionic and neutral contrast agents. This electrostatic attraction is due to negatively charged GAG in cartilage.

We synthesized Cationic Contrast Agents, which demonstrated superior uptake and better visualization of ex vivo murine tibia and femur articular cartilage. This electrostatic attraction is due to negatively charged GAG in cartilage. A large scale synthesis for CA4+ and functional water soluble Ta2O5 NPs were developed. For Contrast Agent 4+, a large scale synthesis that contains fewer steps and less time than the current procedure would need to be developed. Green reagents will also be explored. For the tantalum oxide nanoparticles, additional test needs to be conducted to find the ideal size for these nanoparticles to yield to best attenuation rate in articular cartilage. Additional toxicology test need to be conducted on Tantalum Oxide Nanoparticles. From my current research I believe that Ta2O5 nanoparticles will be able to image Glomeruli in the kidney. A hallmark of Diabetic Nephropathy is the loss of glomeruli; Tantalum oxide NPs will be able to image the amount of glomerulus in the kidney.

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218

Subcategory: Chemistry (NOT Biochemistry)

Synthesis and Characterization of Shape Memory Polyurethane

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Shape memory is the ability of a material to remember its original shape, the material is deformed into a temporary shape and returns to its original shape from an external stimuli. Shape memory behaviors may be prompted by heat, light, electricity, or other stimuli. Developed in recent years, shape memory polymers (SMP) have been gaining vast attention because they are lightweight, have a high recovery ability, are easy to process, and have properties that can be tailored for a boundless number of different applications. A number of medical applications have been investigated for polyurethane-based shape memory polymers. Shape memory polyurethane were found to be biocompatible, non-toxic and non-mutagenic in human body. Also, the glass transition temperature (T_g) of these materials can be tailored for shape restoration/self-deployment of different clinical devices when inserted in the human body. Polymers with higher shape recovery can be used for more broad applications in medicine. Segmented polyurethanes with higher soft molecular weight exhibit shape memory properties due to their more complex structure. In this study, Segmented polyurethanes (PU) were synthesized from polyethylene glycol (PEG), 1,4-butanediol (BDO), and castor oil (CO) and tested for shape memory properties. Effects of soft segment molecular weight 〖(M〗_n=100,3000) on glass transition temperature (T_g), decomposition rate/temperature, and infrared spectroscopy synthesis were studied for analysis. Each polyurethane sample was characterized using DSC, TGA, and FT-IR. The results were of the following: (1) PU-100 had a higher T_g, than PU-3000. However, PU-3000 had a melting temperature not observed in PU-100 (2) Both samples began to decompose at approximately the same temperature and (3) PU-100 had more intense spectroscopy peaks, both samples still contained the byproduct isocyanate before being synthesized with alcohol. Isocyanate can cause hazardous reactions in humans making these samples not useful for medical application. These results concur that polyurethane with higher soft segment weight have higher shape fixity rates. In fact PU-100 did not show any shape memory properties. Further research, involves investigation as to what polyurethane would be most useful in what medical application based on soft segment molecular weight.

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219

Subcategory: Chemistry (NOT Biochemistry)

Surface Segregation in Mixed Oxides

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The composition of the surface differs from the actual bulk of the material. This phenomena is known as surface segregation. With the use of quantum mechanical modelling techniques, we study the surface segregation energy of several mixed oxides. We have used the real grid-based projected augmented wave (GPAW) code to run the density functional theory (DFT) calculations [JJ Mortensen, PRB Vol. 71, 035109,]. The main contribution to the surface segregation energy is given by the difference in the surface energies of the impurity and the host [A.V. Ruban, Physical Review B (1999) - APS, (59) 24]. Our results have allowed us to gain insight on the actual composition of the elements with the oxides. These results will help us to obtain an understanding of each impurities catalytic properties in chemical production.

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220

Subcategory: Climate Change

Carbon Storage Capacity of Soils: The Role of Oxygen Availability

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There is a growing concern regarding the impact of climate change on the soil carbon storage capacity. Soils are the largest and most dynamic terrestrial carbon pool. Soil microorganisms oxidize soil carbon - present mostly in the form of soil organic matter - to carbon dioxide (CO2) which is released into the atmosphere. Any increase in microbial carbon oxidation due to global warming may therefore increase CO2 emissions from soils, with unforeseen consequences for the climate system. The rate of soil organic matter oxidation is known to be controlled by climatic factors as well as sorption of organic compounds to minerals, their physical protection, and nutrient availability. However, it is unknown how oxygen availability affects microbial oxidation rates and CO2 emissions. To improve our basic understanding of oxygen dynamics in soil, this study determined which factors control oxygen availability in soils. It was hypothesized that diffusion, carbon availability, and nutrient availability control oxygen availability. To test our hypothesis, we incubated soil horizons of various depths over a two-week period with three different amendments treatments. The treatments consisted of water, carbon (glucose solution), or nutrient (soil water extract) amendments. Our results show that diffusion limitations induced by water saturation alone are not sufficient to deplete oxygen in these soils. Instead, a source of bioavailable carbon is required for significant oxygen depletion to occur. Future experiments could investigate how the number and type of microbes, as well as the type of organic input (other than glucose), affect oxygen availability in soils.

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221

Subcategory: Computer Science & Information Systems

Solvation and Ligand Effects on the Catalytic Production of Acetaldehyde from Alkynes on Organotransition Metal Catalysts

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Ruthenium catalysts with pyridyl or imidazolyl ligands have been used to accelerate the formation of aldehydes from alkynes. We carry out electronic structure calculations in an effort to reproduce the observed effects of ligand selection, solvent selection, and temperature on the reaction. While also including conditions that quench the reaction before completion and lead to observation of vinylidene or hydroxycarbene intermediates. The calculations employ B3LYP density functional theory and correlation consistent basis sets to optimize intermediate and transition state geometries with 2-3 explicit water and solvent molecules, followed by temperature-dependent COSMO-RS continuum solvent corrections to estimate the free energy at each geometry. The intermediates and corresponding transition states at three points in the 10-step reaction are investigated for four distinct ligands and several solvents and solvent-to-water ratios. The expansion of computational data of this 10-step reaction of the bifunctional ruthenium catalysts can be used to improve the current knowledge of the main mechanism, which can then be used to qualitatively predict similar reactions and can provide information on where to improve chemical structure of catalysts.

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222

Subcategory: Materials Science

La2Zr2O7: A Time Study for Low Temperature Anneals Comparing Dry and Humid Environments

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$La_2Zr_2O_7$ (LZO) thin films are of interest as barrier layers to prevent interaction between lithium-ion conducting $Li_7La_3Zr_2O_{12}$ (LLZO) films and silicon or other substrates. In developing solution phase routes to LLZO, reactions with the silicon substrates have hampered film preparation. These interactions may be prevented using a barrier layer of LZO that does not contain lithium. The goal of this research was to optimize the formation of amorphous, dense, smooth LZO films at low temperatures to decompose nitrates and remove residual water. Previous research has shown that in many cases for spin-cast films made from aqueous solutions, water and nitrates are removed more readily at low temperatures when the films are heated under humid atmosphere. The study compares the qualities of films annealed at low temperatures for varying times under humid and dry conditions. Our hypothesis is that residual water and nitrates in the films may be reduced in films annealed for extended periods of time at low temperatures under humid atmosphere relative to those annealed under dry air.

All films were spin coated onto silicon substrates using aqueous solutions that were 0.5 molar in each $La(NO_3)\circ 6H_2O$ and

$ZrOCl_2 \circ 8H_2O$ to give a total metals concentration of 1.0 M. The films were annealed in both dry and humid environments at 200° and 300°C for various times. Films were characterized using Scanning Electron Microscopy (SEM), X-Ray Reflectivity (XRR), and Fourier Transform Infrared Spectroscopy (FTIR).

The results revealed that the films annealed in humid air were thinner, smoother more condensed, and contained fewer voids than films annealed in dry air. Results also showed that film smoothness increases with longer annealing times. Our results confirm our hypothesis that annealing under humid atmosphere reduces water and nitrate levels in films compared with annealing under dry air, and that longer anneals further decrease water and nitrate levels in films. Future work includes further extending the time study for both dry and humid anneals, and to further characterize the films annealed under these conditions.

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223

Subcategory: Materials Science

The Effect of High Altitudes on Poly (N-vinylcaprolactam) [PVCL] Fibers

Roy McReynolds, Morehouse

Poly(N-vinylcaprolactam) [PVCL] is a thermo-responsive polymer that changes its molecular conformation upon temperature change. This research entails electro-spinning of PVCL nano-fibers with antioxidants such as vitamin E and turmeric and exposing them to high altitudes and low temperatures in a weather balloon. The goal of this experiment is to determine of PVCL nano-fibers were affected by the high altitude/low temperature exposure in the weather balloon. PVCL nano-fibers were characterized before [and after] the balloon using Scanning Electron Microscope (SEM). SEM both determined the fiber structure and the chemical composition of the PVCL nano-fibers. SEM images compared the size and frequency of the fibers for each images. The 35% (w/v) PVCL solution with 8% tumeric produced more fibers than the 35% (w/v) PVCL solution with 10% α-tocopherol.

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224

Subcategory: Materials Science

Self-Folding of Polymer Sheets Along Discontinuous Hinges

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We studied the use of light to convert two-dimensional sheets into three-dimensional objects in a process called “self-folding”. The sheets are composed of pre-strained polymer (i.e., shrink films) that shrink when heated. We deposit patterns of black ink on these sheets. The black ink absorbs light more efficiently than the rest of the sheet and therefore causes the polymer to shrink locally (at the location of the ink) when exposed to light. We sought to replace continuous patterns of ink with patterns of dots. We varied the spacing and size of the dots to understand how close they need to be to cause folding. The shape of the features should affect the shape of the heat distribution. Also, the more ink present within the hinge region, the more effectively the polymer should fold. Understanding the distribution of heat and its effects on the shrinking of polymers as part of the folding process can help to control self-folding polymers more efficiently in terms of timing and precision.

We used polystyrene with pre-printed patterns, such as lines of squares and circles, and alternating/zigzag patterns of circles and squares to test the hypothesis that polymers self-fold slower and are more likely to deform when features of the discontinuous hinges are printed farther away and as the area density of ink decreases. The polystyrene is made to fold by exposing it to a blue LED 1 cm above the sample, which is set on a hot plate and heated to 90 degrees C. The amount of time the sample takes to start to fold is recorded as the onset folding time. The test continues to run until the polymer stops folding and no more movement is observed. The results show that while the onset folding time is affected by the distance between the features, the ink ratio seems to be of less importance than the placement of the ink features and the shape of the features themselves. So far, our research has led us to believe that the heat distribution along the hinges is more affected by the shape of the features and the distance of the features from each other than the amount of ink within the hinge area. Further research is necessary to closely examine the folding tendencies of the polymers and how the different shapes of the features changes the heat distribution along the hinges.

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225

Subcategory: Nanoscience

Toward the FTIR Detection of Forensic Drug Cocaine in Fingerprint Samples

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Cocaine is a powerful drug that has numerous harmful effects on the brain, heart, and other organs. Being one of the most dangerous drugs, cocaine was originally developed as a painkiller. However, it is now a widely used drug that is abused for the purpose of creating a euphoria feeling. The hypothesis of the work is that the infrared spectra of fingerprint samples containing cocaine should provide the spectral features of cocaine and may be used to determine whether a suspect has handled the cocaine. Fourier transform infrared (FTIR) spectroscopy is a technique used to determine the functional groups in a molecule. Fingerprint analysis is used in conjunction with infrared spectroscopy and the primary objective of the two working together is to not only match fingerprints to people, but to also determine whether or not that person has been in contact with cocaine. Gold nanoparticles, and two types of fingerprint powders were used for preparing fingerprint samples, including black powders and orange fluorescent powders. The cocaine sample has generated 15 IR absorption peaks: 2953, 2882, 2851, 2800, 1753, 1717, 1457, 1319, 1278, 1232, 1181, 1115, 1069, 1038, and 716 cm-1. The IR peaks of 2953, 2882, 2851, 2800 and 1457 cm-1 are associated with the alkane group (-CH3) and (-CH2-) in cocaine. The ketone and ester groups in cocaine produced six IR peaks, 1753, 1717, 1319, 1278, 1232, and 1181 cm-1. The IR signals of 1115, 1069, and 1038 cm-1 is attributed to the amine group (N(CH2)2CH3) in cocaine. The strong IR peak at 716 cm-1 is produced by the mono-substituted benzene ring in cocaine. In contrast, the black powder, orange fluorescent powder, and gold nanoparticles showed dramatically different IR patterns. For example, orange fluorescent powder showed 12 IR signals, 1930, 2865, 2829, 1552, 1494, 1326, 1159, 1090, 1035, 814, 708, and 661 cm-1. When cocaine is added in the presence of finger powders or gold nanoparticles, the typical IR peaks of cocaine were observed. This result indicates that FTIR detection of forensic drug cocaine in fingerprint samples is achievable. However, the feasibility of the method validation is questionable and must be preformed.

In the future, we will examine two procedures for FTIR detection of cocaine in the simulated fingerprint samples: (1) The nanoparticles were directly applies to generate fingerprints imaging instead of use of fingerprint powders. After imaging of fingerprint is taken for identification of fingerprint via database, the nanoparticles are recovered by double wash using deionized water and used for FTIR measurements. (2) The fingerprint powders are used for fingerprint imaging analysis. After the analysis, the nanoparticles are added to the fingerprint samples. The fingerprint samples contain fingerprint powders and nanoparticles are collected for FTIR analysis.

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226

Subcategory: Nanoscience

Low Temperature Synthesis of Titanium Dioxide Using Recombinant Silicatein

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Photocatalysts are materials that can capture energy from sunlight and utilize this energy to perform chemical reactions. They have many potential uses in sustainable engineering, including potential in artificial photosynthesis and wastewater treatment. TiO2 is a commonly studied photocatalyst that can, for example, be used to purify water by degrading bacteria, organic compounds (e.g. phenol, chlorinated alkanes), and reducing toxic metal ions (e.g. Cr(VI)). However, TiO2 nanoparticle synthesis requires high temperatures, toxic templating chemicals, extreme pHs, and expensive laboratory equipment. We are investigating a novel alternative enzymatic route to TiO2 synthesis in order to reduce synthesis complexity, energy demands, and environment costs. Our goal is to synthesize TiO2 structures under mild (non-toxic, low temperature, neutral pH) conditions using recombinant silicatein. Silacatein is known to be an active enzyme for biomineraliaztion of silica.

Here we describe the development and implementation of a recombinant synthesis technique to produce large quantities of silicatein and deploy this enzyme for the fabrication of TiO2 nanoparticles. Silicatein was overexpressed in E.coli and then lysed with BugBuster® to help preserve the native form of silicatein. Following purification using immobilized metal ion affinity chromatography (IMAC), the protein was analayzed via SDS-page protein gel, which showed formation of dimers, trimers, and tetramers. Titanium dioxide particles were formed in-vitro using the enzyme from titanium bis(ammonium lactate) dihydroxide (TiBALDH) in aqueous solution at 24oC . Silicatein without the TiBALD precursor and TiBALDH without protein were run in parallel with the synthesis as controls. The TiO2 products were analyzed by transmission electron microscopy (TEM), energy dispersive x-ray spectroscopy (EDS), and electron diffraction. These studies confirmed the presence of amorphous TiO2 nanoparticles.

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227

Subcategory: Physiology and Health

Acute and Chronic Effects of Somatostatin on Fast and Slow Calcium Oscillations in the Pancreatic β-Cell

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It is known that insulin secretion oscillates in the presence of glucose. The higher the concentration of glucose the longer the insulin will be secreted. KATP channels have been found embedded in the plasma membrane of pancreatic beta cells where they control the secretion of insulin by being opened and closed. The KATP channels close when the ATP/ADP ratio is increased. When the channels are closed the cell depolarizes and opens calcium channels, the calcium ions flow into the cell triggering insulin secretion. There have been two types of calcium oscillations observed: fast and slow. It is known that somatostatin (SST) inhibits insulin secretion but we found that it had differential effects on fast vs. slow oscillations.

We hypothesized that chronic SST would increase the glucose sensitivity of islets by inhibiting insulin release overnight and thus cause the internalization of KATP channels from the plasma membrane of the beta cell. To test this, calcium imaging was used to compare the effects of SST treated vs. untreated cells while varying acute concentrations of glucose. When islets were acutely exposed to SST, it was found that slow oscillations and fast oscillations were differently effected. These results indicate that the mechanism of the fast and the slow oscillations is different and SST has effects them in different ways. The next step for this research would be to actually measure somatostatin's effect on insulin. Understanding pancreatic oscillations is critical because patients with type 2 diabetes show irregular Ca and insulin oscillations.

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228

Subcategory: Plant Research

Effects of Soil Application of Five Micro Elements and Chelating Agent on Mineral Content of Soybean Leaves and Soybean Seeds

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The objective of this research was to determine the effects of soil applications of five compounds (Mn, Cu, Zn, Mo and B) with a chelating agent, citric acid (CA), on soybean plants. Macro and micro- elements may travel in to leaves and later seeds at different rates. It is hypothesized that CA by itself or in combination with these five chemical applications (e.g. Zn + CA) can either aid in the uptake or decrease the mineral content depending upon ease of its mobility of these elements and complexes in soybean seeds. Six seeds of soybean cultivar (Bolivar with maturity group V) were planted in each pot. They were grown in a repeated greenhouse experiment in a randomized complete block design. The chemical applications were applied either separately or in a combined combination of the compounds with chelating agent CA (example, Mn + CA) to three-week-old soybean plants two times, (one week apart) at the vegetative (V3) stage, and one chemical application before R3 (beginning of seed pod initiation) stage. After application the plants were allowed to grow until harvest maturity under greenhouse conditions. The mature, dried soybean seeds were analyzed for a total of thirteen elements, seven micro and six macro elements. Five minerals and six chelating agents (CA) with minerals applications were used in this study. Cu, Zn, B, CA had influence in increasing the various elements. Cu increased Cu by +55.1% and Mn by +28.8%. Zn increased Zn and Mn by +8.2 and +21.1 %. B increased B by +28.6 %. CA increased B and Cu by +11.6 and +15.9%. Cu + CA increased Na by +23.5%. Mo + CA increased Cu by +42.9%. There were few applications that were decreasing the mineral content in soybean seeds. Mn decreased Na and Fe by -39.0 and -7.5%. Cu decreased Na by -25.5%. B decreased Na and Cu by -32.7 and -29.8%. These eleven applications have some minor effects for macro elements in soybean seeds. B treatment increased K, Mg, N and S by + 7.4%, +16.0%, +8.3% and +11.8%. Cu treatment increased Mg, P, N and S by +8.0%, +10.1%., +7.8 and 11.8 %. Mo increased Mg and S by +8.0% and +5.9%. Zn + CA and B + CA applications decreased Ca by -9.7%. Mo + CA decreased K by -6.9%. A possible compound that can alter seed composition may exist and can be used to select the desirable seed composition constituents.

In future research, one may use minerals such as Fe and Ca. These two minerals are needed in the human body and if we find a way to transmit the minerals into the soybean seed and make sure its edible for digestion, it can help people who have low Fe and Ca.

Funder Acknowledgement(s): NSF HBCU-UP II

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229
Subcategory: Water

A Survey of Chemical Parameters for the Development of a Water Quality Index for the Ping River

Sara Newell, Humboldt State University

A preliminary survey of water quality along the Ping River in the Chao Phraya Watershed of Northern Thailand using various analytical chemistry techniques was investigated for future development of a water quality index. The environmental parameters measured were selected to determine an overall water quality condition as well as for their relevance to human and aquatic health, and the ability to measure them in an analytical laboratory. Hardness, iron, turbidity, cadmium, lead, and the ions chloride, nitrate, phosphate and sulfate were measured using titrimetric and spectrophotometric methods, in addition to ion chromatography, and flow injection analysis. The upper Ping river resulted in higher concentrations of iron, sulfate and turbidity which may be attributed to seasonal and geological influences. The lower segment of the Ping river contained higher concentrations of phosphate and conductivity, which may be a result of anthropogenic sources.

Further analysis to correlate the potential reasoning between human influence and changes in parameter concentrations, as well as seasonal influence, is necessary for understanding the quality in this region. The water quality index will be established for convenient monitoring of select parameters that indicate water quality.

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Computer Sciences and Information Management

230
Subcategory: Cell and Molecular Biology

Redeveloping and Optimizing the Interactive Chromatin Modeling [ICM] Web Server

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DNA contains a wealth of information and offers many insights into the appearance and behavior of the body. Many diseases and disorders have genetic origin, suggesting that increased understanding of the structure and dynamics of certain DNA segments can lead to more effective treatment. Using an accurate, interactive modeling software to study DNA is favorable, as obtaining X-ray crystallography images of the many different DNA segments of interest would be infeasible. Such a software [ICM] has been created, but many improvements can be made. It is believed that redeveloping the software using an object oriented approach with particular attention to algorithm optimization will allow the program to efficiently process DNA sequences up to millions of base pairs long, as well as provide increased functionality and accuracy. This will also greatly decrease overall running time of the program.

The overall procedure involved using the C++ language to construct an intuitive class hierarchy and methods to read a DNA sequence file and output coordinates for each DNA base pair, which can then be fed into a visual graphics generator (VMD). The largest part of this process is an implementation of El Hassan's algorithm, which uses a series of rotation matrix multiplications and additions to convert known DNA parameters into XYZ coordinates. Performance benchmarks were recorded and running time comparison data between the new and original [control] ICM were collected at major stages of development. The new ICM processed a file of 1,000,000 base pairs in only 66% of the time it took the existing program, indicating a significant increase in efficiency. The new code also allows for integration with a genome browser, which could eliminate need for certain calculations and thus further decrease computation time. Also of note was direct integration with VMD, allowing coordinates to be sent to VMD as they are calculated, instead of being written to a file which would subsequently be read by VMD.

It is clear that the new ICM outperforms the current version by a great margin in terms of running times. The possibility of integration with other software, such as a genome browser, would not only increase efficiency, but also intuitiveness and ease of use. Further development steps involve increasing accuracy by improving detection of and relaxing energetically unfavorable conformations of DNA.

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231
Subcategory: Computer Engineering

Adaptive Human-in-the-loop Machine Learning Framework for Classification of Plankton

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Machine learning algorithms work well in classification of large data sets, such as text recognition. However, with data sets characterized by large temporal changes and variation, such as images of plankton sampled from an underwater microscope, the accuracy of standard classification techniques deteriorate over time. This is a problem that extends beyond plankton images, and is large factor in any similar data set (population, traffic, etc.). Thus, we proposed an adaptive framework to classify images of plankton that utilizes human input to continually refine the machine learning algorithms to ensure continual or increased performance over time.

We initially cast the classification problem in a Bayesian framework, where the machine takes an image from the camera and return the posterior probability for each class. These results are time-dependent, such that at any given time, the algorithm, priors, and likelihood computation can change as the training data set evolves due to manual classification. Creating a feedback system where the machine assists in user classification and in turn the user helps improve the results returned by the machine.

This system was implemented using image processing techniques and Naïve Bayes and Support Vector Machine algorithms, hosted on a webserver that interfaced with a database and a web application in real time. At regular intervals, the performance of the classifier was compared against a standard classifier for this system (non-adaptive). The results generated from this approach demonstrated the effectiveness of such a system; generation of training data was shown to be richer and faster, and prior probability values to be more representative of temporal shifts. We also noticed that the choices of feature selection and other algorithm parameters had complex and dramatic effects on performance.

Ultimately, such a system was successful, and provides an initial solution to the problem. Yet, excitingly, showed potential for even greater performance enhancement with using system memory to assist the adaptive methods. In continuing this research, we are examining methods that can effectively use such an adaptive framework, and previous performance marks, in order to make logical decisions for complex algorithm parameters that are linked to temporal shifts.

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232
Subcategory: Computer Science & Information Systems

Identifying Probable Missing Protein-Protein Interactions Related to Asthma and Allergy Using Diffusion Kernel

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Many diseases including cancer, diabetes, and asthma occur due to over-expression or suppression of certain proteins. These proteins come to physical contact with each other due to biochemical events in a process called Protein-Protein Interaction (PPI). Studies have been done on how the PPI networks directly influence the development and progression of diseases. However, little focus has been placed on neighborhood proteins in the PPI network that do not physically interact with each other but have a higher likelihood to interact than the actual PPIs in the network. Identifying these missing PPIs would complete the network biomarker for a disease. In the present study, we seek to predict probable missing PPIs related to asthma and allergy.

PPI network for asthma and allergy used for present analysis is developed by overlaying the differentially expressed proteins on genome-wide PPI network. The PPI network for asthma and allergy is composed of 1,425 PPIs with 84 proteins. Genome-wide PPI data are obtained from STRING database and differentially expressed proteins are obtained from SABiosciences of Qiagen. In our proposed approach, protein interactions for asthma and allergy are represented in a two dimensional space called a Laplacian matrix. In this study, Laplacian matrix is an 84 by 84 square matrix, where an element is 1 if two proteins interact, otherwise 0. The diagonal value for a protein is the negative of number of interactions with the protein. The Laplacian matrix is then used to evaluate a Diffusion Kernel, which assigns similarity weights to all possible PPIs for 84 unique proteins associated with asthma and allergy. The PPIs that do not belong to the set of actual PPIs, but have greater kernel values than the actual interactions are predicted to be probable PPIs.

From our experiment, we determined a set of probable missing PPIs for asthma and allergy. The resulting prediction, together with the actual PPIs, enables us to establish more comprehensive network of proteins that cause asthma and allergy disease. In future, we will investigate the relationship between our proposed protein interaction network and their biological functionality.

References: C. von Mering, L. J. Jensen, B. Snel, S. D. Hooper, M. Krupp, M. Foglierini, et al., 'STRING: known and predicted protein-protein associations, integrated and transferred across organisms,' Nucleic Acids Res, vol. 33, pp. D433-7, Jan 1 2005.

A. Mondal and J. Hu, 'Network based prediction of protein localisation using diffusion Kernel,' International Journal of Data Mining and Bioinformatics, vol. 9, pp. 386-400, 2014.
P. Timalsina, K. Charles, and A. M. Mondal, STRING PPI Score to Characterize Protein Subnetwork Biomarkers for Human Diseases and Pathways, IEEE 14th International Conference on Bioinformatics and Bioengineering. Nov 10-12, 2014.

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233

Subcategory: Computer Science & Information Systems

A Framework for Perceptual Processing in Autonomous Wheelchairs

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Powered wheelchairs, directed through a joystick control interface, offer increased mobility and greater independence to the physically disabled. Tongue control and breath control adaptations to the joystick interface have opened power wheelchair technology to tetraplegic individuals who do not have use of their arms or hands. Research is ongoing in addressing the mobility of individuals with physical, perceptual, and cognitive impairments.

Efforts in robotics research have pursued the idea of an autonomous wheelchair as a mobility solution for those with both physical, perceptual, and cognitive impairments. By this approach, a powered wheelchair is outfitted with sensors and algorithms that enable it to navigate while avoiding obstacles and localizing its position within its environment.

As robots interact with their environment, they employ sensors to measure and update their representation of the current environmental state. This allows robots to make decisions and select actions to achieve a goal without human intervention. In designing such systems, researchers often repeat key steps in the development of processes for extraction of percepts from sensors. Through experimentation with sensors, data acquisition, storage, and processing, I am designing a processing framework purposed with reusable perception algorithm development. The targeted platform for this work is an autonomous wheelchair platform prototype at Delaware State University.

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234

Subcategory: Computer Science & Information Systems

Evolved Virtual Creatures, Ft. Android and Arm Processors

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The purpose of this research project is to develop a simulation based off of Karl Sims' "Evolved Virtual Creatures" project that operates on an ARM-based computer system and determine how practical and efficient it would be to deploy and maintain the simulation and accompanying computer system. Sims' research project simulated the Darwinian model of evolution with virtual block creatures across several generations. Similar to Sims' project, this project will demonstrate evolution through the means of natural selection. However, unlike Sims' project, this project will model and simulate bacterial resistance on the Android operating system in conjunction with ARM CPU architecture (essentially the same technology available in many Smartphones today). By choosing the software and hardware platforms previously mentioned; the goals are to 1) create a more efficient system for simulations and 2) make said systems a practical affordable alternative to traditional simulation systems. The current phase of this multi-step process will involve creating a demo simulation that will run in an emulated instance of the Android operating system. This phase will additionally serve as a means to identify problems or challenges that may or will be encountered throughout the duration of the project.

Funder Acknowledgement(s): LSAMP

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235

Subcategory: Computer Science & Information Systems

Towards Self-organization for Monitoring Search and Rescue Based on Metric Distance

Daquille Campbell, North Carolina Central University

Swarm robots provide greater flexibility and robust performance in tasks such as sensing, surveillance and monitoring in unstructured and unpredictable environments where human interventions are impossible or very dangerous. They need to spread out in these environments maximizing coverage and maintaining network connectivity for efficient operation. An important problem is the coverage maximization problem to maintain connectivity arising and to keep the network of robots connected. The main idea is borne from the schooling behavior of fish where: the swarm needs to stay together to appear as large as possible to ward off predators, so they maintain connectivity. When the

appearance is as large as possible, they increase the coverage. The Self-organizing systems interact locally according to simple rules and the global behavior of the system emerges from these local interactions. Inspired by nature, we study a new coverage and connectivity maintenance algorithm. We focus on using swarm robots dispersed in an area for these applications. The algorithm is inspired by the self-organizing features seen in social and aggregating organisms such as insects, birds and fish while schooling. These social creatures perform complex tasks through local interaction between the individuals and between themselves and their environment. Each robot is subject to local rules: i) a separation rule that pushes it away and increases the size of the swarm, ii) a cohesion rule allows steering towards the average and maintains the connectivity of the swarm, and iii) an alignment rule to keep it aligned, steering towards the average heading and makes relocation faster. Every rule gives a request of how to change the position in the swarm. The rules form a combined behavior. That is, when each rule is applied, and its importance. Therefore, the distance to each neighbor determines which rule is applied.

We focus mainly on blanket coverage where the main objective is to maximize the total covered area. We look at two different area coverage problems in our work: sensing range-based area coverage and communication range-based area coverage. Empirical analysis shows that the algorithm improves coverage and maintains connectivity. Preliminary results obtained show that the swarm-based algorithm outperforms even the most state-of-the-art algorithms, yielding a better and faster coverage.

Reference: Reynolds, C.W.: Flocks, Herds and Schools: A Distributed Behavioral Model, SIGGRAPH 87.

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236

Subcategory: Computer Science & Information Systems

Algorithmic Trading Strategies for Students

Emmanuel Carter, Norfolk State University

The purpose of this project is to provide a novel solution to the growing problem of higher college costs by developing a consistently profitable trading algorithm that will excite, encourage, streamline, and validate students' investing in the stock market. In this project, we researched and analyzed algorithmic trading software packages and created an algorithm that maximizes profit for a portfolio of stocks while minimizing risk. We also investigated industry standard portfolio performance metrics for profitability and risk, and measured the success of the algorithm based on industry standards. By constructing an algorithm that can produce profits in the stock market, we hope to counteract and minimize the pressures that students face from college costs and allow them to focus more on academic achievement. This research will serve as a valuable start to confronting the problem of higher college costs and may lead to further algorithmic trading strategies in the future.

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237

Subcategory: Computer Science & Information Systems

A Study of Classification Accuracy of the Hunt Algorithm Using Entropy and Gini Measurements on Breast Cancer Wisconsin Dataset

Nichole Etienne, University of the Virgin Islands

Data mining techniques are becoming essentials tools for assisting physicians in drilling into large data sets in order to detect breast cancers as early as possible. This can be done by building a classification model that helps in predicting the prognosis of the patient with the disease. Early screening of patients with accurate predictive models allow to distinguish benign from malignant breast tumors from the patient records, reducing significantly the number of breadth cancer deaths. This work studies the Hunt greedy algorithm which uses a greedy strategy to build a decision tree by partitioning recursively the training data (patient records) sets into successive subsets. In order to select best local split for building the tree, two measures are considered: entropy and Gini. This work examines which of both measures (entropy and Gini) select the best split. In order to determine the quality of the split we compare the degree of impurity of the parent node before and after the split. This information is represented as the gain ratio. The higher gain the better the split. This approach is validated on the Breast Cancer Wisconsin dataset obtained from the University of Wisconsin Hospitals, Madison from William H. Wolberg. The dataset contains 699 training examples with 9 attributes: clump thickness, uniformity of cell size, uniformity of cell shape, marginal adhesion, single epithelial cell size, bare nuclei, bland chromatin, normal nucleoli, and mitose. The class labels to be predicted are benign and malignant. In future work, we will examine the importance of some features (attributes) in the accuracy of the model, and whether removing irrelevant attributes will increase the accuracy and the performance of the decision tree.

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238

Subcategory: Computer Science & Information Systems

Design & Development of an Interactive Mobile App for Truth Table Manipulation

Victor A. Frunza, Winston-Salem State University

A major issue in today's classroom is that students are not fully engaged in the presented material. Instead, many of them are texting or playing games on their mobile devices during lectures. A solution for this is to engage students via their mobile devices, as opposed to having the student's turn off their devices. This is possible with an engaging application in which students could take interactive quizzes right on their mobile device. Traditional class interaction systems, such as "clickers" or other mobile-based solutions do not have the same goal as this research, because they only facilitate static methods of interaction, such as multiple-choice, fill-in-the-blank, etc. We envision a solution where students completely immerse themselves in the problem and actively engage in finding the solution.

With the above stated goal, I designed and developed an interactive app to manipulate truth tables during class. A truth table is the first step in designing an electronic circuit and a good understanding of that is crucial in order to succeed later in the class. Conventionally, students use pen-and-paper to derive and solve such problems. However, they are unable to see the after effect of their choices, and they need to wait at least a few days in order to get their graded answers back. This app allows students to adjust their answer within the allotted time and see their graded work instantly through the Mobile Response System (MRS), which is developed by the faculty advisor.

Throughout my research process, I tested my app on the Eclipse emulator and an Android tablet for its validity and functionality. The developed app received positive feedback from faculty in the university. In conclusion, I produced a working Truth Table app, which I believe will help to engage students in the classroom. Future research involves adapting my Truth Table application to multiple variables and deploying the app in the classroom this fall to gather evaluation data.

References: Fuad M. M., Deb. D. & Etim J., "An Evidence Based Learning and Teaching Strategy for Computer Science Classrooms and its Extension into a Mobile Classroom Response System", 14th IEEE International Conference on Advanced Learning Technologies, Greece, 2014, pp. 149-153.
Fuad M. M. & Deb. D., "Design and Development of a Mobile Classroom Response System for Interactive Problem Solving", 26th International Conference on Software Engineering and Knowledge Engineering, Canada, 2014, pp. 49-52.

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239

Subcategory: Computer Science & Information Systems

Precision Agriculture Using Databases and Smart Phones

Patrick Gray, Prairie View A&M University

Smart phones and databases have become such a necessary part of our everyday lives. Before the modern day database system we had the File-Based system which was error prone and caused for lost or duplicate information. Smart phones grants us the world and information at our fingertips in a matter of seconds. We use database and smart phones in all aspects of our lives from entertainment, business and health. Could these two tools be used in agriculture and how we grow our food?
Is it possible to make growing crop more precise? Is it possible to know when a drought is about to occur? To answer these questions, Prairie A&M University implemented a collaborating research and educational project on precision agriculture. The goal of our project last year was to design and develop a Information Communication Technology (ICT) system, which received real time data from field instruments, displayed them in mobile devices to help farmers make smart and informed irrigation decision. The data was also stored in a data cloud for convenient access by users. We achieved our goal and objectives for our project by using a National Instrument (NI) wireless control system. NI Wireless Sensor Network (WSN) modules can take real time data from field humidity and temperature sensors and transmit them by radio transmitter to reach a gateway. The gateway transmitted the data to local workstation via Ethernet. The cloud system further enabled data retrieval and analysis, which supported users to make smart decisions. The decisions were relayed to field devices as well as user via smart phone or personal computer.

The next step in the project will be to create a database where data can be read and written and to have an user friendly interface. This interface is going to be developed for both personal computers and smartphones. There are three types of database systems that we can look at. They are Desktop, Servers and Web-enabled. The system we decide to use will be cost effective and will help us save humidity and temperature data to determine if we can predict droughts. If we can predict droughts we can save farmers all over time and money, but more importantly we can provide more food for the world.

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of a High Performance Computer Cluster for Multidisciplinary Computational Research at Prairie View A&M University," October 2012—September 2015.

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240

Subcategory: Computer Science & Information Systems

A Generalized Model for Maximizing Routing Requests in Ad Hoc Networks

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Ad hoc networks are multihop communication networks consisting of small computing devices with wireless interfaces. They are mainly used by a group of users for spontaneous communication among themselves without the support of preexisting infrastructure, for example, in battle fields or in search and rescue. Each ad hoc node has limited battery power, and wireless communication consumes most of the battery power of node. Therefore, energy efficiency has always been a consideration for routing algorithms in ad hoc networks. Routing is a process to send a message from one node (called source node) to another node (called destination node) in the network. To maintain the functionality of ad hoc network, it is critical that users inside the network can always successfully transmit messages to each other. In this work, we are interested in designing energy-efficient routing algorithms in ad hoc networks to maximize the total number of messages that can be successfully satisfied, under the battery energy constraint of each node. The existing approach has three limitations. First, it assumes that all the ad hoc nodes have the same initial energy level. Second, it assumes sending a message costs one unit of energy while receiving costs zero. In our work, we consider a more general energy model where different ad hoc nodes could have different initial energy levels, and energy consumption of sending and receiving routing messages depends on the distance between nodes. Third, the ad hoc networks simulated in current research is a simplistic grid network, which does not represent well the real ad hoc network applications. We extend it to more realistic ad hoc networks that are randomly generated, and design new energy-efficient routing algorithms in ad hoc networks. We create an ad hoc network by randomly generating the nodes inside a field, and assign different initial battery power level to different nodes. We then transform the ad hoc network into a flow network wherein the edge capacity of each edge corresponds to the battery power of each node. Then we design a greedy algorithm that executes in iterations. In each iteration it tries to find the minimum weighted path connecting a source and destination pair while satisfying the capacity of each edge. We show via simulations that this algorithm performs well compared to some existing approach. As future work, we will design distributed versions of the proposed algorithms and explore new energy-efficient routing algorithms in ad hoc networks.

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241

Subcategory: Computer Science & Information Systems

Data Analytics to Improve Physics Education

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Data Explorer and Assessment Resources for Faculty (DEAR-Faculty) is a government funded research program. The purpose is to increase the use of research-based assessment in physics classes, and to support physics faculty in using research-based teaching methods through online resources on PhysPort.org. Towards that purpose, we are developing a Data Explorer to help faculty analyze the results of their assessments for Physics Education Research (PER). PER is a research field focused on understanding how students think about physics and ways to improve students' learning.

The Data Explorer is a website that will allow faculty to upload and analyze their students' assessment scores. Methods used to study these data are data mining, information visualization, and statistical machine learning . These methods help faculty analyze raw data to improve teaching techniques for introductory physics. The focus for the summer of 2014 is to build user interface, uploader and statistical graphing/charting tools.

My participation in this project over eight weeks was to learn coding languages (HTML, JavaScript) and utilized these to develop codes that allow the user to find the Fibonacci sequence, and find the maximum and minimum. In addition, I also designed a sample webpage and the structure of a visitor statistic page for the PER's site that can be modified as the project continues. The PER is funded for four years and presently open for user testing. Our long-term goals are to eliminate errors and expand the website to improve users' experience.

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242

Subcategory: Computer Science & Information Systems

Evolution of the MYB Gene Family of Transcription Factors

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The MYB protein family is a group of transcription factors that regulates the expression of several target genes. Studies based on mouse identified one member of the MYB family, A-MYB, as one of the major transcription factors regulating the expression of PIWI interacting (piRNA) clusters. These clusters act as the source of piRNAs, a class of small RNAs involved in protecting genome integrity by repressing the activity of transposable elements. At present, there is great interest in elucidating how piRNAs are regulated, expressed, and processed. A reconstruction of the evolutionary history of the MYB family can shed light on when the association between A-MYB and piRNA clusters emerged. To do this we first queried MYB nucleotide sequences from both vertebrate and invertebrate genomes, and reconstructed the evolutionary history using phylogentic methods. With a few notable exceptions, MYBs were generally absent from invertebrate genomes. Interestingly, the expansion of the MYB family is notable in the early stages of vertebrate evolution: The presence of three MYB paralogs, A-MYB, B-MYB and C-MYB maps to the early branches of the vertebrate tree. Although the trees would suggest the duplications giving rise to these genes are shared between cyclostomes and gnathostomes, the former have lost traces of A-MYB. Our results would indicate that the involvement of A-MYB in regulating the expression of piRNA clusters might trace back to the common ancestor of teleost fish and tetrapods, approximately 400 million years ago.

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243

Subcategory: Computer Science & Information Systems

Benchmarking Local Vs Remote AES-128 Encrypted Databases

Magdalene McArthur, Howard University
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In 2001, AES (Advanced Encryption Standard) became the National Institute of Standards and Technology (NIST) standard of Encryption. AES has since been used to encrypt classified information for the US government, corporations, and health facilities. In this study, the AES – 128 bit standard of encryption was used to encrypt a Romanian health database “myhealth’. Benchmarking queries were then utilized to determine the difference in latency between a local and remote copy of the databases. The study found that in most cases, the latency results for the local database were considerably smaller than the results for the remote database. Future studies could investigate how the separate database management systems used played a role in the latency results.

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244

Subcategory: Computer Science & Information Systems

Using a MATLAB/Photoshop Interface to Enhance Image Processing in the Interpretation of Radar Imagery

Kalyx McDonald, Mississippi Valley State University

The Center for Remote Sensing of Ice Sheets (CReSIS) has developed many radars that operate over the frequency range from 140 to 230 MHz with multiple receivers developed for airborne sounding, and imaging of ice sheets. Understanding the echogram data depends on knowing the process of how radar waves interact with natural surfaces. The purpose of this project was to use the Bas Relief filter for image processing in order to improve the interpretation of radar imagery. The filter Bas Relief, currently in Photoshop, was once a sculpture technique in which figures or other design elements were just barely more prominent than the overall background. The University of Kansas CReSIS office heavily relies on the use of MATLAB along with Photoshop to perform several tasks. MATLAB is a high-level programming language and interactive environment with strong mathematical and graphics capabilities while Adobe Photoshop CC allows you to use advanced image processing algorithms that are not available in MATLAB. With Adobe Photoshop Extended we hoped to combine MATLAB commands with Photoshop’s image editing features to further interpret imagery. With the implementation of this algorithm in MATLAB, it would allow researchers to conveniently retrieve and use the newly edited image. By comparing the original image versus enhanced, researchers would be able to improve tracking of features such as internal layers and the ice bottom.

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245

Subcategory: Computer Science & Information Systems

The Reliability of Collaborative Tagging: A Content Analysis Approach

Bathsheba Petty, Philander Smith College

As the use of online social networking is becoming more popular, we notice a trend in user based tagging, termed here collaborative tagging. As users are now able to upload and tag their own photos, we want to analyze the content of theses tags and examine how they relate to pictures. Through a content analysis of over 250 user images we found that the tags should be categorized into 2 main categories (visual and non-visual) and 4 sub categories (content, location, image related, and non-image related). This research is the first phase of a multi-phase study that focuses on examining the reliability of collaborative-tagging in tagging images. This research is important because it affects issues related to search engines, information quality and semantic data.

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246

Subcategory: Computer Science & Information Systems

EV3ryone Can Fly Using Robotics to Invigorate Computing

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According to Forbes contributor Greg Staell, “The next era of computing will be different from anything we’ve seen before, computing will become less dependent on expertise and more a function of desire….the human experience will change dramatically!” Computing has changed the way we live today, from personal tablets, to video games, to Google driverless cars. LEGO robotic kits allow even young children the ability to create cool gadgets. The younger generation will soon be our next inventors. However, many children do not have access to interesting computing experiences. The stereotypes about computing, such as it is only for “geeks” and that it is “boring” discourage children from careers in computing. Seymour Papert proposed using computing construction kits like the LEGO robots to improve engagement, creativity, critical thinking, and problem solving. It has been proven that children who use computers gain intelligence, nonverbal skills, structural knowledge, manual dexterity, verbal skills, problem solving, abstraction and conceptual skills (Haughland, 1992). This project was designed to introduce elementary school, middle school, and high school students to computing and robotics in an attempt to improve attitudes toward computing. Students were selected based on observation of who had difficulties or passion for computing. The students built, programmed and interacted with LEGO Mindstorms’ newest robotics system the EV3, Paper Airplane Launcher. All of the students enjoyed the concept, provided constructive and honest criticism, and projected enthusiasm. We evaluated interest, building difficulty, and programing difficulty using a post survey of four (4) questions with a 5-point Likert scale and open-ended comment area for additional feedback. Students reported in the survey that the Paper Airplane Launcher was “interesting”, “exciting” and “super fun”. Future improvements will include mechanical tilt controlled by a Bluetooth connection to an android device so students can control the angle in which they want the launcher to project.

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247

Subcategory: Computer Science & Information Systems

Image Processing Cloud Web Portal Implementation

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The Cloud Computing research lab at PVAMU is working on providing an innovative cloud platform to accelerate scientific research and discoveries in image processing domain. The abstract describes our work to develop a user-friendly web interface for delivering the cloud services to users.

One of the research problems is how to deliver the cloud service to researchers in a user-friendly interface, and allow them to access the service anytime, anywhere and on any devices. We think that an web portal with good interactivity would meet these requirements. In order to verify whether a web interface would be suitable to deliver cloud services to image processing researchers, we designed and implemented a web interface as a portal to deliver the service to users to meet these requirements. The web interface runs on an Apache web server with PHP. Bash scripts are used to set up the user’s scripts directory, compile their scripts, and start the distributed jobs. The bash scripts are called through PHP’s exec function. The web interface backend makes use of UserCake, an open source PHP library, to handle user authentication. User profiles are split on the server, project data is stored separately from datasets to take advantage of the distributed file system. The distributed file system better handles the volume of large files that would

be found in a dataset. The forward facing portion of the web interface is what gets sent to the users web browser. It makes use of Bootstrap and jQuery. Bootstrap allows us to create a uniform interface most people are already familiar with, as it is used by many popular websites already. The jQuery library allows for cross browser compatibility and ease of implementing new features. Dataset management currently support two views; one for batch images and the other for seismic data. Batch image view is a series of thumbnails, very similar to how one would view pictures in a file explorer. The user can select images they want to add to the dataset individually or by folder. The 3D seismic data preloads every image in the browser and shows them on an HTML canvas element. The user can then use a scroll bar or the mouse wheel to change images and zoom through layers. This is similar to how desktop applications present seismic data.

The web interface is currently up and running with capabilities of storing and processing large number of user images. Moreover, it can compile and execute user research code in parallel within a web browser. Researchers in image processing domain are able to use it to develop and verify their algorithms productively without installing and setting up any software. Over all, the current interface is functional and far more user friendly than the command line.

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248

Subcategory: Computer Science & Information Systems

The Use of Parallelization Support to Speed up PlotViz3

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In biology there is a scientific field that develops methods and software tools for organizing and analyzing biological data. That field is bioinformatics and it combines computer science with other fields in order to study biological data and processes which in turn can provide meaningful information on genomic sequences. Currently, there is a software called PlotViz3, a three-dimensional data point browser, which can be helpful for scientists in the field of bioinformatics. PlotViz3 can be used to interactively discover intrinsic structures efficiently of which are high-dimensional and contain large volumes of data. This means that scientists will be able to find the correlations between the DNA sequence clusters that they have data for more effectively than their previous methods such as phylogenetic trees. This software should be accessible to every scientist working in bioinformatics but has yet to be put out there for them because the process is not easily done. Once it is basic enough for simple execution then scientist will have a new and more efficient tool for analyzing organism's genomic sequences.

The purpose of this project is to add parallelization support to the code for multithreading PlotViz3. By building the proper environments necessary to house the code for the software we were able to read and change the C++ code, the programing language that is used in PlotViz3. In the end, adding this support will speed up the virtualization process in the software and make it less time consuming when looking for results quickly and efficiently.

The research was completed and has helped in making sure that work can be continued off of it. We were able to find the necessary components that can help in applying parallelization support to PlotViz3. Future research includes continuing on speeding up PlotViz3 so that the visualizations render faster.

References: Choi, J. Y., Ruan, Y., Bae, S.-H., Qiu, J. and Fox, G. 2010. Introduction. PlotViz - A tool for visualizing large and high dimensional data. http://salsahpc.Indiana.edu/pviz3/#intro.
Ruan, Y., House, G. L., Ekanayake, S., Schutte, U., Bever, J. D., Tang, H. and Fox, G. 2014. Integration of Clustering and Multidimensional Scaling to Determine Phylogenetic Trees as Spherical Phylograms Visualized in 3 Dimensions. http://grids.ucs.indiana.edu/ptliupages/publications/PhylogeneticTreeDisplayWithClustering.pdf

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249

Subcategory: Computer Science & Information Systems

Design of Virtual Environments for Visually Impaired People

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Many visually impaired people lack visual perception skills, and as a result have difficulties in object detection and navigation. There exist many physical tools, ranging from the white cane to vision implants. However, these tools are often expensive and require extensive research and development. It is also possible to assess navigation and detection without developing physical products. The goal of this project was to analyze alternative methods, primarily through the use of virtual environments (VE) created by Unity3D. One VE tested a visually impaired individual's ability to recognize distant objects and be able to interact or to avoid them, while the other VE tested a non-impaired crowd's ability to navigate an impaired user through a dungeon. The VEs were hosted on a website. Three main pages were implemented: the home page, the new user page, and the game page. Individual users were tracked anonymously and custom virtual sensor configurations were managed. Unity3D programs

were written for data to be passed from the website to the game and vice-versa. This approach facilitated both its use as a laboratory setup for testing and as an online web game for massive online data collection. Through several informal tests, data has been collected on the VEs. On the first VE, non-sighted users were blindfolded and tested. The players did not know where the collectible object was, as many would pass it when they entered a room. Furthermore, when the player collided with an object, the “ouch” sound was not pronounced. This introduced problems as users repeatedly crashed into walls without any indication that they were crashing into walls. This was corrected by introducing better sound recognition. On the second VE, many players had difficulty with navigation and direction. Many of the players had delayed reaction time when hitting a trap, and the player would die frequently. Thus, on-screen text was implemented that explicitly gives the crowd directions for their game task. A formal testing is planned in the coming months to recruit both sighted and non-sighted subjects. In addition to human subjects testing, we plan to improve the audio system in the first VE by incorporating more detailed sound cues such that it become more attentive and appealing to blind users. For the second VE, adding a storyline will persuade the crowd to continue assisting the blind user. We also plan to interface Google Glass into the VEs to provide a more intuitive control.

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250

Subcategory: Computer Science & Information Systems

Energy-Efficient Data Preservation in Sensor Networks with Spatial Correlation

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Many sensor network applications require deployment in challenging environments. In these situations, it is not always possible to deploy base stations in or near the sensor field to collect sensory data. Therefore, the overflow data of the source nodes is first offloaded to other nodes inside the network, and is then collected when uploading opportunities become available. We call this process {\em data preservation in sensor networks}. In this paper, we take into account spatial correlation that exist in sensory data, and study how to minimize the total energy consumption during data preservation. We call this problem {\em data preservation problem with data correlation}. We show that with proper transformation, this problem is equivalent to minimum cost flow problem, which can be solved optimally and efficiently. Via simulations, we show that it outperforms an efficient greedy algorithm.

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251

Subcategory: Computer Science & Information Systems

Certified Confusion: The Public Comprehension of Security Certificates

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Although public key certificates are ubiquitous, it is increasingly apparent that the general public has little to no understanding of the role or function of a public key certificate. While the public key infrastructure is designed for mutual authentication, there has been limited research on the efficacy of this authentication infrastructure form the user's point of view. Therefore, we investigated user's perception of the meaning of public key certificates.

As part of a survey, distributed through Amazon’s Mturk and at DASHCon(blogger convention) we included a questionnaire to evaluate computing and security expertise and an open response question as to the meaning of a public key certificate. A team of 4 undergraduate students implemented Qualitative Data Coding and together, created our own codebook; each coding the data independently and then later resolving conflicts as a group.

We found that 52.64% of our respondents simply did not know about certificate or its function and that 24.39% responded with incorrect and fairly expansive views of the attestation provided by a certificate which includes operational security, privacy policies, business practices and even verification of consumer protection. Only 22.97% had an almost accurate view about certificate. Through univariate analysis, we found a significant difference in terms of computer expertise against certificate comprehension ($F=17.791$ $p<0.001$) and in terms of security expertise against certificate comprehension ($F=13.133$ $p<0.001$) where higher computer and security expertise leads to a more accurate knowledge about public key certificates.

In addition, we provide perception of public key certificate attestations as a function of age ($F=2.513$ $p=0.058$), education level ($F=5.404$ $p<0.05$), and income ($F=1.245$ $p=0.293$). We also included survey questions both from Westin’s work and the Internet Users Information Privacy Concerns instrument to

measure privacy, and will report on confidence in certificates as a function of privacy concern.

This work shows that certificates are not effective in mutual authentication and risk communication for users without security expertise. Computer expertise is necessary but not a sufficient measure for security expertise. Having investigated non-expert perceptions of certificates, we will expand the work into analysis of non-expert mental models of certificates and using this, we will endeavor to improve certificate warnings as risk communication.

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252

Subcategory: Computer Science & Information Systems

Topic Segmentation and Text Coherence Detection in Wikipedia Using Latent Semantic Analysis

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With the exponential increase of digitization and digital media, it is important to develop tools to organize and analyze large bodies of texts. We focus on two automatic text analysis tasks: topic segmentation and text coherence. Measuring the coherence of text within a document can aid in the task of topic segmentation as well as provide a measure of the quality of the document.

To develop and test our methodology we created a corpus of fifty Wikipedia documents, ten each from five different topics: digital art, bears, genetics, memory, and operating systems. The corpus was created through automatic web scraping and parsing tools in Python including the BeautifulSoup library.

We used the resulting paragraphs as input to create a semantic space using Latent Semantic Analysis (LSA). LSA is a mathematical method that is applied to a large corpus of text in order to derive contextual meaning and usage of words through statistical computations. LSA provides a measure of semantic similarity between documents or paragraphs, as well as a measure of the semantic content of a document or paragraph.

Our hypotheses were that each document in the corpus would be internally coherent and that each document would be most similar to documents in the same topic group. Preliminary results indicate that the average internal coherence level is higher within more technical documents. For example, Operating Systems articles tended to be more internally coherent than articles about Bears. Documents within a given topic were between 1.8 to 4.5 times as similar to other documents within the same topic compared to documents on other topics. We were then able to successfully predict which documents were similar to others by comparing their coherence.

By measuring coherence between paragraphs in an individual document, we can analyze the quality of the document by observing how often the topic changes. Additional documents could be added to the semantic space and then automatically categorized into topics based on relative coherence. Because we worked with a relatively small corpus, one area of future research could be to determine how well our results would scale up with larger corpora. Furthermore, we would like to research what types of corpora would lead to an optimal semantic space.

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253

Subcategory: Computer Science & Information Systems

AES Encryption of Health Information: Securing Through SQL

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This study aimed to investigate possible cyber security solutions for the software company ROPARDO SRL. We hypothesized that the implementation of AES-128 and AES-256 encryption methods would be able to protect the data of the company's mobile health application. In turn, we encrypted value tables composed of SQL data through a program called pgAdmin III. This type of software was selected because the given database, dubbed mywear, was compatible with it. Factors such as execution time based on unencrypted values and encryption types were considered to gain a more thorough understanding of how effective and efficiently the information could be secured. An evaluation of this caliber was necessary in order to determine what type of larger scale cyber security program ROPARDO would need to invest in. This experimental process composed of two main parts: encrypting the given values tables in the data integration platform within, and brainstorming possible data security solutions based on those results. Consequently, we were unable to encrypt all of the data due to the overwhelming amount of md5 hash codes in the mywear database since we lacked the sufficient encryption software to do so. Therefore, no conclusive results were generated.

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254

Subcategory: Computer Science & Information Systems

Climatology and Cluster Analysis: Self-Organizing Maps (SOMs)

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Global climate models (GCMs) are tools used to study climate processes and make future projections. However, GCMs can have errors that cause them to differ from reality. We hypothesize that self-organizing maps (SOMs), a computational tool for identifying and isolating underlying structures in large data sets, can help stimulate improved understanding of how real-world climate processes and models work. Using the "SOM toolbox", which contains the required code to execute the self-organizing map algorithm, we have investigated the effectiveness of SOMs to distill large amounts of climate data, specifically daily precipitation patterns, into representative categories. Our analysis focuses on two climate features, the Inter-Tropical Convergence Zone (ITCZ) and the South Pacific Convergence Zone (SPCZ), large bands of rainfall extending from north of the equator to the midlatitudes of the Southern Hemisphere. We first performed SOMs on observational data from NASA's Tropical Rainfall Measuring Mission (TRMM) satellite; using the resultant TRMM-based SOMs as a benchmark, we then performed SOMs on models from Phase 5 of the Coupled Model Intercomparison Project (CMIP5), a set of current-generation GCMs. While the SOMs from the models capture similar large-scale structures, there are evident differences in the orientation and shape of the ITCZ and SPCZ. In conclusion, our research strongly suggests that a SOM serves as a key analysis tool for modeling climate data. Further research is being performed to isolate precipitation pattern differences between individual SOMs and potentially attribute these to specific processes.

Reference(s): Crane, R., & Hewitson, B. Self-organizing maps: applications to synoptic climatology. Climate Research, 13-26; Synoptic Climatology. Synoptic Climatology. Retrieved July 8, 2014, from http://www.springerreference.com/docs/html/chapterdbid/29041.html

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255

Subcategory: Computer Science & Information Systems

Transcode 3D Content to Blind People

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Many sensory substitution systems have been studied to convey information of one sensory modality (e.g., visual perception) into another. There are various visual substitution approaches, such as, tactile-visual substitution, tactile-auditory substitution, and auditory-vision substitution. But these systems need extra special devices, and some of them require a lot of training. Furthermore, it is still very challenging to enable visually impaired people to precept the rich information of the surrounding environment, such as color, 3D and other object attributes, using existing sensory substitution methods.

In this project, we proposed a novel sensory substitution approach using a smartphone, to render haptic images of a known 3D environment. Assuming a scene consists of a number of planar surfaces in 3D, upon rendering the planar surfaces on the smartphone screen, a blind user can precept different planar surfaces by touching the smartphone screen. Important information such as the position, distance, size, and shape of each surface is conveyed to user by haptic feedback. When the user touches on different 3D surfaces on the smartphone, it plays different patterns or densities of vibration to represent various distances. Color is conveyed by text-to-speech (TTS). The 3D geometric information, which is the most difficult to convey in existing sensory substitution devices, is transformed by comparing surface normal directions between the smartphone screen and actual 3D surface, and then notify users when two surfaces are aligned, through a special type of vibration.

In order to test the effectiveness of the method, we generated a simulated 3D environment using the Unity3D game engine. The 3D environment is further segmented into multiple 3D planar surfaces, which are transferred from a desktop to the smartphone via Bluetooth. Some preliminary testing indicated that the design of new sensory substitution smartphone was effective. We are currently improving the designs, including transferring information to smartphones using wireless network, using Google app engine as a server. We will also work on recruiting more visually impaired subjects for testing. In future, we will try to replace the man-made 3D virtual model with 3D motion sensors, such as the Microsoft Kinect sensor, which can provide direct 3D models.

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256

Subcategory: Education

Exposing High School Students to Computer Science via Visual Analytics

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The U.S Department of Labor estimates that there will be 1.2 million job openings for computer specialists by 2022, but U.S. Universities will only produce enough graduates to fill 39% of those positions. Given this projected shortage of talent, it is important that creative approaches for attracting students to Computer Science (CS) are developed, implemented, and analyzed to ensure maximum effectiveness.

Our work is motivated by the projected gap between supply and demand of skilled CS talent. Our hypothesis is that exposing pre-college students to the expansiveness of CS and ensuring they know the field goes beyond programming might encourage them to pursue a CS major.

Our approach to this problem is to develop, implement, and analyze a learning module designed to introduce high school students to CS by leveraging exposure to visual analytics as a gateway. In particular, we conducted an exploratory pilot study in the summer of 2014 by integrating the module we developed into a session for the Health and Science Summer Academy (HSSA), a summer enrichment program for pre-college students held at Norfolk State University. We used the Web-Based Analysis and Visualization Environment (Weave), a powerful visual analytic tool, as a technological basis for an engaging, hands-on session. Our design strategy for the module was solely influenced by the goals of providing a rich overview of CS and an engaging introduction to visual analytics.

Our methodology for implementing the module began with a two-part exercise designed to show students how visual analytics improves the detection of outliers and anomalies in data sets in comparison to attempting to detect such phenomena in a text-based data table. Next, students were presented with an overview of areas in CS with a special emphasis on visual analytics. Students were then given data sets from pop culture, sports, and education and asked to explore Weave by importing the data, generating a graph, and using the graph to identify trends.

Preliminary analysis of the session yielded promising results. In general the students indicated the session was enlightening and that they learned more about CS and visual analytics. We plan to use our preliminary data to improve the module, session delivery overall, and data collection. A future direction of this work will be to develop learning modules that cover other aspects of CS. In our poster, we will further elaborate on our motivation, process, results, future steps, and expected contributions.

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257

Subcategory: Education

Sol y Agua Project: Furthering Game Development on a Culturally Relevant Level

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The Sol y Agua project focuses on development of a prototype educational game for middle school students. The game centers on data science with a theme of water sustainability and stewardship based on information analysis, negotiation, and decision-making, where data drives decisions. The goal of the project is to improve students' ability to learn to seek evidence to modify or challenge beliefs. Our main focus will be the immersion of students in regional issues concerning biodiversity, sustainability, and the human impact on the environment through interactive game-play.

Our interdisciplinary team consists of students and professionals, from scientists to educators. This allows us to integrate diverse perspectives. Our region is ~75% Hispanic, so another unique aspect of our team is that it is composed of underrepresented members in STEM (Science, Technology, Engineering, and Mathematics) fields. We aim for our project to get local students excited about pursuing a degree in STEM.

We began our analysis based on what we would focus the game design on and identifying the differences in modern game-play with an emphasis on game features driven by educational activities and data. For that purpose, a member of the larger project began data collection through interviewing relevant professionals to form our basis for storyboarding. A method we used to create our game was to storyboard our game alongside the TEKS (Texas Essential Knowledge and Skills) standards. We began by determining our main in-game characters identity and interactions. Defining the character types allowed us to move onto scenario development (e.g., what situations the player will face).

We are in the process of intertwining game and classroom activities. One of the most notable features that will be incorporated into the game was discovered during the design process, regarding how information is provided. Typically, a video game will present the player with menial tasks to access certain pieces of information. Our goal is to instead supply all the information necessary (mimicking the deluge of data that scientists now face) and have the player mine the data and determine what is essential for their role in the game. The intent is to simulate what an individual in a STEM field faces when making decisions to address a challenge that can impact water resources and sustainability. We will be seeking feedback from middle school students and teachers as we are developing the prototype.

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258

Subcategory: Genetics

DeFCoM: A Novel DNA Footprinting Method for Accurately Detecting and Analyzing Transcription Factor Binding Sites

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A significant fraction of the human genome consists of regulatory elements - regions of DNA where proteins called transcription factors bind and regulate gene expression. Methods for predicting the binding sites of specific transcription factors have been developed to better understand regulatory DNA-protein interaction, binding site biological significance, and the role of transcription factor binding site mutation in pathogenesis. In related studies, experimental sequencing methods have been used to gather information on DNA-protein binding events. In particular chromatin immunoprecipitation sequencing (ChiP-seq) identifies binding sites genome-wide for a single factor. Alternatively, DNase I hypersensitive site mapping (DNase-seq) more generally identifies regions of nucleosome-free open chromatin where nearly all types of factors bind. Due to the timely and costly nature of ChiP-seq experiments, algorithms using DNase-seq data have been developed to predict the location of individual transcription factor binding sites (TFBS's), referred to as DNaseI footprints.

We hypothesized that a more accurate method of predicting specific TFBS's could be developed by using a novel background model in our DNA foot-printing algorithm. Our research presents evidence that our novel statistical method for predicting specific TFBS, named DeFCoM, is more accurate than existing methods. We calculated the accuracy of DeFCoM in identifying TBFSs for multiple factors, as identified by ChIP-seq, using DNase-seq data. We compared these results to those of existing methods run on the same data. Results showed that our method more accurately and efficiently predicted true positive binding sites than that of existing DNA foot-printing methods (CENTIPEDE, Wellington, FOS, PIQ). Taken together, this suggests DeFCoM will enable us to better investigate mechanisms, solutions, and treatments for diseases involving transcription factors and their DNA–protein interactions.

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259

Subcategory: Plant Research

Interactive Visual Representations for Responsiveness of Plants to Changes in Climate

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Project BudBurst data is collected in a consistent manner across the country so that scientists can learn more about the responsiveness of plant species to changes in climate locally, regionally, and nationally. The availability of this multi-year data set presents new opportunities to use visual analytics software to develop interactive visual representations and dashboards of the data beyond those available to the budburst website (http://budburst.org/). The hypothesis of the research is that interactive visual representations of data from Project Budburst will uncover relationships between variables in the data set.

The use case for the research was the data set for the year 2013 which consisted of 21 variables and 6169 observations. An interactive visual representation was develop to compare the observation month for the types of plant's responsiveness. The view grouped the plants by state and city.

This visual representation allowed us to identify differences in the timing of phenophase such as leaves dropping and leaves changing color. Specifically, we could identify months in which multiple phenophases were observed. The findings from the data are possible through the human-computer interaction afforded by visual analytics tools.

Future research will include the development of additionally use cases, publishing the visual representation, and dash board for users of project BudBurst data.

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Ecology, Environmental, and Earth Sciences

260

Subcategory: Air

Analysis of the Atmosphere-Biosphere Exchange of Ammonia From a Fertilized Zea Mays Field Using the Atmospheric Chemistry and Canopy Exchange Simulation System for Ammonia (ACCESS-NH3)

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In this study, ammonia evasion from a fertilized corn (Zea Mays) field was modeled using two different modeling systems. One model, the Atmospheric Chemistry and Canopy Exchange Simulation System for Ammonia (ACCESS-NH3), is being developed at the NOAA Air Resources Laboratory, Atmospheric Turbulence and Diffusion Division. ACCESS-NH3 is written in the Fortran-90 programming language and operates in a Linux programming environment. The second model was developed at Agroparistech/INRA in France and is entitled SurfAtm-NH3. This model was written in the C++ programming language using Microsoft's Visual Studio Software, and input and output data are processed by way of Microsoft Excel in a Windows environment. Both models attempt to simulate ammonia fluxes within a soil-vegetation-atmosphere continuum but take slightly different approaches. SurfAtm-NH3 uses a two-layer scheme (one within the vegetation canopy and the second above canopy), while ACCESS-NH3 takes a multi-layer approach that explicitly simulates transport of ammonia from the soil surface, up through the vegetation canopy, and out into the atmospheric boundary layer.

In this work, an input parameter-space investigation was initially undertaken with ACCESS-NH3 to evaluate its capability to simulate ammonia evasion under realistic environmental conditions. In the second phase of the study, simulation results from the two models were compared to further evaluate each model's capabilities, using standardized environmental inputs. ACCESS-NH3 and SurfAtm-NH3 will both be important tools for the analysis of ammonia flux data that is being collected this summer in Bondville, Illinois, on an experimental farm run by the University of Illinois. This work was funded by the NOAA Ernest F. Hollings Undergraduate Scholarship Program and partially supported by the NOAA U.S. Weather Research Program.

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261

Subcategory: Air

Combining Spatial Kriging with Satellite Estimates to Obtain a Regional Estimation of PM2.5

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This work focuses on developing estimates of ground-level fine particulate matter (PM2.5) in the northeastern U.S. based on measurements derived from the Air Quality System (AQS) repository. Real time monitoring of PM2.5 is important due to its effect on climate change and human health, however, designated samplers used by state agencies do not provide optimal spatial coverage given their high cost and extensive human labor dependence. Through the application of remote sensing instruments, information about PM2.5 concentrations can be generated at certain locations. On the other hand, coverage limitation also occurs when using satellite remote sensing methods due to atmospheric conditions. Therefore, our approach begins by utilizing surface PM2.5 measurements collected from the Remote Sensing Information Gateway (RSIG) portal in order to build fine particulate matter estimations by applying a Spatial Kriging technique. Then, we combine our Kriging estimations to the satellite derived PM2.5 obtained through an Artificial Neural Network (ANN) scheme to generate a daily regional PM2.5 product. Finally, evaluation of our fused algorithm's technique is assessed by performing comparisons against Kriging and neural network individual performances, showing the promising value added by the combination of these two techniques in producing more accurate estimations of surface level PM2.5 over our region of interest.

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262

Subcategory: Cell and Molecular Biology

Changes of the Microbial Communities in Response to Incubation of Soils

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Protozoa are unicellular eukaryotic microbes with high morphological and molecular diversity. The ecological functions of protozoa are very diverse also; they serve as consumers, decomposers, prey, transmitters of pathogens, and as pathogens themselves. Identification of environmental (water and soil) ciliates is generally accomplished in two ways, either microscopic quantitation or through molecular identification. Studies show that incubation of soil with sterile rain water will allow dormant ciliates to excyst and multiply in order the better identify them. Finlay et. al. recorded the change in abundance of ciliates after incubating different soil samples between zero to eighteen days. We used a similar method by collecting 8 samples from Sumter National Forest and incubating them for 9 days. Samples that were unincubated showed about 34uL of DNA found after extraction and nested PCR, as well as, multiple bands visible during electrophoresis tests. 4 day incubated samples showed about 14uL of DNA and 9 day incubated samples showed some that were not visible at all and the average quantity was about 9uL. The results were not as successful as Finlay's. We believe the results were different because our soil was frozen at -80 degrees and stored for over 6 months, and we used molecular identification and Finlay used microscopic quantitation. We will later collect fresh soil samples and incubate them for a longer period of time to obtain more accurate results.

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263

Subcategory: Climate Change

Detection of Land Cover Change and Drought Trend Using Brightness Temperature and Microwave Emission

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Drought and the change in land cover are currently among the largest issues affecting the world, threatening to bring huge amounts of economic loss every year. The purpose of this paper is to determine the potential in using microwave brightness temperature and emissivity data to monitor previous droughts and land cover changes. It is known that precipitation and soil moisture provide drought information based on different data sets. Using microwave radiation at various frequencies, satellites sensors such as Advanced Microwave Scanning Radiometer-Earth Observing System (AMSR-E) and Special Sensor Microwave Imager (SSMI) have been collected to formulate the emissivity around the globe for the last few decades. Each satellite has gathered data at multiple frequencies. In this study, we focus on the lower frequencies because the signal is more sensitive to surface properties. The Emissivity Microwave Polarization Difference Index (EMPDI) from emissivity data is computed by vertical and horizontal emissivity value. The global EMPDI values for an entire month are then placed in contrast with an independent indicator such as precipitation. Moreover, a drought severity test is performed using techniques that previously were deployed on precipitation data to investigate the potential of using microwave observations in drought monitoring, directly. Finally, the limitation of using such information is investigated.

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264

Subcategory: Climate Change

Spatial Variability of Ambient Ozone Concentrations During 3 Heat Waves in the Northeast Megaregion of the United States

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Climate change, both local and global, have become the focal point of research over the past decade; in particular, the incidence of extreme temperature conditions resulting in excessive heat and/or humidity. Heatwaves are characterized by temperatures that exceed the normal daily average and can result in severe consequences such as power outages and droughts. The most problematic effect of a heatwave is its impact on human health, causing hyperthermia and heat stroke, and contributing to the death of hundreds each year. Heatwaves have no standard definition and vary depending on the geographical region in which they occur. Extreme temperatures also contribute to the accumulation of ambient ozone precursors (NOx and VOCs) which can have deleterious effects on the human respiratory system. Our hypotheses are three-fold. First, although ambient ozone levels will experience an overall rise during a heatwave event, these concentrations will vary based on geographical location, as a result of variance in factors such as latitude, to-

pology, urbanization patterns and proximity to emissions. Second, there will also be a degree of variation between each heatwave event, with the location of highest ozone concentrations varying for each event. Third, we predict that the burden of ozone pollution will be unequally distributed among different populations due to both location and socioeconomic - based variance in factors determining ozone concentrations.

Focusing on the 13-state Northeast Megaregion (Deware et al. 2007), we used the definition of heatwave described by Robinson et al. (2001) and meteorological data from the Daymet dataset to delineate our 3 study events. Site-based ozone concentration and meteorological data were obtained from the EPA AirData database. to assess spatial-based variation in ozone concentrations during recent heat waves. Using block-level census data, we investigated the relationship between ozone concentrations, meteorological parameters during heatwave events and population exposure within a 1-km range focusing specifically on socioeconomic status, age, and ethnicity. The National Emissions Inventory (http://www.epa.gov/ttn/chief/eiinformation.html) was used to investigate the relationship between ozone and proximate emission sources. The National Land Cover Dataset (NLCD) was used to consider variance in exposure in urban and rural areas. We also consider bias in sampling site locations between urban and rural areas.

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265

Subcategory: Climate Change

Validation of the Basal Stress Boundary Utilizing Satellite Imagery Along the George VI Ice Shelf, Antarctica

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The majority of ice shelves are fed by inland glaciers. Together, an ice shelf and the glaciers feeding it can form a stable system, with the forces of outflow and backpressure balanced. Warmer temperatures can destabilize this system by increasing glacier flow speed and more dramatically by disintegrating the ice shelf. Without a shelf to slow its speed, the glacier accelerates. After the 2002 Larsen B Ice Shelf disintegration, nearby glaciers in the Antarctic Peninsula accelerated up to eight times their original speed over the next 18 months. Similar losses of ice tongues in Greenland have caused speed-ups of two to three times the flow rate in just one year.

Rapid changes occurring in regions surrounding Antarctica are causing concern in the polar science community to research changes occurring in coastal zones over time. During the research, the team completed a study on George VI Ice Shelf located on the western coast of the Antarctic Peninsula. The study included a validation of the Antarctic Snow and Ice Accumulation Discharge Basal Stress Boundary (ABSB) vs. the natural basal stress boundary (NBSB) along the George VI Ice Shelf. The ASAID BSB was created by a team of researchers headed by National Aeronautics and Space Administration Goddard Space Flight Center (NASA GSFC), with an aim of studying coastal deviations as it pertains to the mass balance of the entire continent. The point data file was aimed at creating a replica of the natural BSB. Select cloud free Landsat satellite imagery from satellites 1 through 7 was used to detect changes occurring over the span of 19 years. The last major interest in the study included documenting the deviations or incorrect placements of the ABSB vs NBSB. Changes that occurred were documented in the form of a table with the change that occurred along with the geographic coordinates.The changes that were documented was that the BSB has been stable over the 19 year study period. The team future work would focus on validating more major ice shelves around Antarctica. Validating more areas would confirm past research that has been placed.

Funder Acknowledgement(s): Linda Hayden, CReSIS, Michael Jefferson

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266

Subcategory: Climate Change

Summertime Wind Speed Trends in Southern California

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Studies done previously by Lebassi et al, 2009 showed that daily maximum temperature (Tmax) in urban coastal areas of California is decreasing during summertime from 1970-2010 due to an increase in sea-breeze activity. An analysis was made to study the wind speed trends during summertime [(June, July, August, and September (JJAS)] at daytime from 1973-2010, in order to validate this hypothesis. Long term hourly daytime average and maximum wind speed trends were analyzed for six ground stations in Southern California. Results show statistically significant increases in wind speeds for inland areas where the sea-breeze didn't reach in past decades and non-significant changes in coastal areas exposed to sea-breeze during the entire period. These results give support to the hypothesis posted by the previous authors.

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267

Subcategory: Climate Change

El Nino and La Nina: Impacts on Ocean Processes and Global Weather and Climate

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El Niño and La Niña are opposite phases of what is known as the El Niño-Southern Oscillation (ENSO) cycle. The ENSO cycle is a scientific term that describes the fluctuations in temperature between the ocean and atmosphere in the east-central Equatorial Pacific (approximately between the International Date Line and 120 degrees West). La Niña is sometimes referred to as the cold phase of ENSO and El Niño as the warm phase of ENSO. The hypothesis of this study is that El Nino and La Nina can cause fluctuations in ocean processes and global warming. This hypothesis was tested by the following objectives: review of NOAA data on El Nino and La Nina impact on changes in sea-surface temperature, global weather, and climate change. The data on weather changes due to El Niño and La Niña episodes across the globe was reviewed by access to the Weather Center (s), comparing the events which took place between June and August, December and April, and May and July of the following year, since 1950. El Niño and La Niña events occur about every three to five years. The data was examined to study why El Niño occurs more frequently than La Niña. The connections between El Niño effects over North America (Canada and the western and northern United States) were examined to see assess weather conditions: Precipitation, Wetter-than-average conditions in the U.S. Gulf Coast and Florida and drier-than-average conditions in the Ohio Valley and the Pacific Northwest. Similarly the data was reviewed on the effects of La Niña causing a drop in sea surface temperatures over Southeast Asia and heavy rains over Malaysia, the Philippines, and Indonesia. The review showed the increase in El Nino events during the last decades and decrease in the number of La Nina events. The connections between these fluctuations resulted in global climate change toward global warming. The studies of historical data showed the recent El Niño variation is most likely linked to global warming. The changes in the stronger El Nino events cause global warming and may impact Earth's climate. A brief summary of events was prepared of El Nino effects on climate: winter versus summer, tropical storms, winter circulations, winter precipitation, winter temperature, snowpack, and stream flow. Similarly, the consequences of La Nina on the opposite effects of El Nino were reviewed. The literature review suggests that the overall atmospheric flow patterns differ substantially between La Nina and El Nino winters.

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268

Subcategory: Computer Science & Information Systems

Improving the Accuracy of Clear Sky Water Classification Using VIIRS Visible and Thermal Bands at Night

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This project is the continuation of the "Water Classification using VIIRS Day and Night and Thermal Bands" project. The Beaufort Sea, which is located in the Arctic Circle north of Alaska, is the region of interest for this project. The Beaufort Sea is known for having severe climate conditions, as it is frozen for most of the year. The previous objective of this project was to classify water in the Beaufort Sea region at night. Since there is a scarcity of visible data collected at night, most classification approaches have been forced to rely on thermal data obtained from emissive bands. This approach attempts to incorporate data obtained from the DNB (Day and Night) visible band onboard the Suomi's Visible Infrared Imaging Radiometer Suite (VIIRS) satellite. Our hypothesis was that using the additional information provided by this band will improve the classification of "clear sky water" pixels. The classification process was based on examining a collection of satellite granules under different lighting and thermal conditions and determining water/non-water thresholds for the respective Day and Night (SVDNB) and thermal (SVM15 and SVM16) bands. Results showed that given favorable night-time lighting conditions, such as during a Full Moon nights, the classification produced by the conjunction of these bands produces fairly accurate water classification over clear sky regions. The output of our classifier was validated using daily water/ice masks over the Beaufort Sea region produced by the National Ice Center. In this paper we extend and improve the accuracy of our previous effort by using a more sophisticated approach, the Otsu method, to find the water/non-water threshold in the visible and thermal bands. As in our previous attempt we will evaluate the performance of this approach against water maps provided by the NIC.

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269

Subcategory: Ecology

Light Visualization in the Dominican Rainforest

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The objective of this research is to use visualization tools to identify trends in understory light levels in the Dominican rainforest, and to evaluate the effectiveness of hemispherical photographs as an indirect measure of light.

Three quantum light sensors measuring photosynthetically active radiation (PAR) were placed in each of nine forest plots. Each sensor measured the light level every 10 seconds. These readings were averaged and recorded over five-minute intervals using a data logger. A hemispherical photo was taken at each sensor location using a fisheye lens, which captured a complete view of the canopy cover above each PAR sensor. The photographs were processed using Gap Light Analyzer (GLA), which returned various indirect measurements of light.

R was used to subset sensor data and to perform basic analysis, such as finding the average light level for each sensor and identifying statistical outliers. This type of analysis provides little information as to the cause of outliers, which could result from sensor failure or actual spikes and falls in understory light levels. To gain more insight, Tableau was used to visualize patterns in light levels across a time period. The readings from each PAR sensor were plotted for the month of June 2008 and filtered by forest site.

The data consist of PAR levels recorded every 5 minutes from April 2008 to February 2009, as well as GLA-processed hemispherical photos. There were 9 forest sites, each containing 3 PAR sensors. None of the sensors remained in working condition for the entire period, so most analysis was done on measurements from June 2008, during which all sensors returned regular readings. For the purpose of the first visualization, the data were treated as a time-series. The reading for each interval was plotted as a function of time. Separate graphs were created for each forest site showing light levels for every day in June 2008. This visualization allowed the data to be considered as cross-sectional since the 9 sites could then be compared to one another during one time period.

Some forest stands consistently registered higher light levels than others, but overall light patterns were similar across all sites. Total light reaching the understory exceeded the predicted level of 1-2 mol/day for a tropical rainforest environment, which may be a result of the open structure of the forest canopy. Additional research will be needed to determine the degree of the effect of canopy openness.

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270

Subcategory: Ecology

When FISH Isn't Enough: CARD-FISH Detection of Toxic Microcystis aeruginosa in Environmental Samples

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The NYSDOH Environmental Biology lab studies the ecology of microorganisms that are significant to public health and inhabit New York State waters. One microorganism of concern is the bloom-forming cyanobacterium, Microcystis aeruginosa. This organism features toxic and non-toxic morphologically identical strains based on the presence or absence of the genes governing production of the hepatotoxin, microcystin. Due to its natural autofluorescence, standard detection methods like fluorescent in situ hybridization (FISH) do not work with M. aeruginosa. As such, alternative detection methods must be used to distinguish toxic and non-toxic strains in environmental samples. Because the lab tests water samples from across the state, even one inaccurate answer could have serious public health implications.

The method utilized in this experiment was catalyzed reporter deposition fluorescent in situ hybridization (CARD-FISH). This works based on the principle that in the presence of H2O2, Horse Radish Peroxidase (HRP) bound to an oligonucleotide probe catalyzes a reaction that causes tyramide to become its radical intermediate. Once this occurs, the radical intermediate is free to react with molecules such as tyrosine and tryptophan in the cell, causing them to fluoresce. This results in signal amplification derived from the numerous molecules that glow around each hybridized, HRP-labeled probe. Many variations of the published protocol were systematically evaluated, each targeting the mcyE gene of microcystin using a non-toxic strain of M. aeruginosa as a negative control and a toxic strain as the positive control. Unfortunately, the project could not be carried out to completion as the cyanobacteria were never repeatedly viewed with the level of fluorescence CARD-FISH reportedly exhibits. However, the lab is not likely to give up anytime soon. Once successfully applied, CARD-FISH can be carried over to

similar microorganisms for which secure detection methods do not yet exist.

References: 1. Kubota K. CARD-FISH for Environmental Microorganisms: Technical Advancement and Future Applications. Microbes Environ. 2013; 28(1):3-12.
2. Metcalf, J. S., Reilly, M., Young, F. M. and Codd, G. A. LOCALIZATION OF MICROCYSTIN SYNTHETASE GENES IN COLONIES OF THE CYANOBACTERIUM MICROCYSTIS USING FLUORESCENCE IN SITU HYBRIDIZATION. Journal of Phycology. 2009; 45: 1400-1404. doi: 10.1111/j.1529-8817.2009.00750.x

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271

Subcategory: Ecology

Evaluation of Ctenus hibernalis (Aranea: Ctenidae) Fitness in Ecosystem Undergoing Restoration

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Fire suppression has greatly impacted the forest ecosystems of the southeastern United States. Fire-suppressed forests in Oak Mountain State Park (OMSP; Pelham, AL) have undergone experimental prescribed burning as a means to restore the understory of the forests. We studied the populations of a species of ground hunting spider Ctenus hibernalis in the forests of OMSP. Study site included regions burned one year prior, five years prior, as well as a region that underwent fire suppression to gain insight into the restoration progress of these forests. As a result of the restoration of the spiders' microhabitat, we expected denser populations in the region burned five years prior and for the populations to have a higher average weight than the populations in the fire-suppressed region as well as the populations in the region burned one year prior. T-test and ANOVA were performed on total individuals caught within each region, as well as their weight. No individuals of C. hibernalis were found in the region burned one year prior. We found that overall there was no significant difference in the total number of spiders in the fire-suppressed region and the region burned five years prior, but the weight of the population in the region burned five years prior was significantly greater than the populations in the fire suppressed region ($t = 3.4715$, $df = 197.047$, $p < 0.001$). Our results suggest that the prescribed burning is beneficial to C. hibernalis populations and positively affects their overall fitness levels. Future research includes expanding our sampling to multiple sites and regions that have experienced similar prescribed burning and fire suppression in order to sufficiently understand how burning is affecting the spider populations.

References: Ryndock, J. A., Stratton, G. E., Brewer, J., & Holland, M. M. 2012. Differences in Spider Community Composition among Adjacent Sites during Initial Stages of Oak Woodland Restoration. Restoration Ecology 20(1):24-32.
Vickers, M. E., & Culin, J. D. 2014. Spider (O: Araneae) Responses to Fire and Fire Surrogate Fuel Reduction in a Piedmont Forest in Upstate South Carolina. Southeastern Naturalist, 13(2):396-406.

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272

Subcategory: Ecology

Effects of Litter Biodiversity and Home-Field Advantage on Decomposition in a Tropical Montane Forest

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A central challenge in ecology and conservation biology is to understand how changes in species composition affect ecosystem processes. The biodiversity-ecosystem functioning theory (BEF) suggests that ecosystem processes increase with species richness. The home-field advantage theory (HFA) suggests that the performance of a species (e.g. growth rate, decomposition rate) should decrease as that species moves from its home range into new territory. This study questions the role of both theories in determining the rate of leaf litter decomposition in old-growth and secondary forests. Understanding the role of litter diversity in determining decomposition rates will allow us to better understand the changes in nutrient cycling through the changes in biodiversity. In the context of HFA, I hypothesized that a leaf litter species will decompose faster in its home environment than a different environment. In the context of BEF, I hypothesized that a more diverse mixture of leaf litter will decompose faster that the decomposition rates of a single leaf litter species. To test these hypotheses, I created all possible combinations of single and mixed leaf litter species from a pool of three litter species. Litter species included one common to a tropical montane old-growth forest (Chrysochlamys glauca), a second one common to a tropical montane secondary forest (Miconia trinervia), and a third species common to both (Palicourea padifolia). I put all treatments in mesh bags in plots in both the old-growth and secondary forest. After 3 weeks, we

measured total decomposition rate of all litter species within each bag. Overall, there were substantial differences in the decomposition rate of individual species (23% to 62% total mass loss). We found no evidence for an HFA effect, but did find that diverse mixtures decomposed slower than expected. We further demonstrate that antagonistic interactions with C. glauca may underlie this effect. Our results suggest that antagonistic interactions among litter species may underlie the process of litter breakdown in an environment with rapid decomposition rates. Further research is needed to examine the chemical composition of plant species and the interactions between those chemicals and decomposers. Understanding these different interactions will help explain the effects of changes in biodiversity as many ecosystems are going under constant change.

Funder Acknowledgement(s): National Science Foundation

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273

Subcategory: Ecology

Phylogenetic and Phylogeographic Structure of Brazilian Placosoma Lizards

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Placosoma is a genus of South American lizards comprised of three species, Placosoma cipoense, Placosoma cordylinum, and Placosoma glabellum. While P. cordylinum and P. glabellum occupy the southern Atlantic coast of Brazil, P. cipoense is found in the montane grasslands north of their ranges. This project seeks to elucidate the ecological and evolutionary processes that underlie the distribution patterns and genetic diversity of these three morphologically similar lizards. By comparing gene sequences in both the mitochondrial and nuclear genomes of Placosoma specimens, a genus-level phylogeny will be generated and reconciled with topographical and climate data.

I attempted to amplify BACH1, DNAH3, and 16S gene segments in 30 Placosoma samples using standard protocols for DNA extraction, polymerase chain reaction (PCR), and gel electrophoresis. While DNAH3 and 16S amplified successfully in all samples, BACH1 amplified in only eighteen of them. Among these eighteen, only PCR products were suitable for sequencing, possibly necessitating a change to the PCR protocol being used. DNAH3 and 16S sequences were then used to generate a phylogeny for Placosoma using Bayesian inference. The phylogenetic tree generated using concatenated 16S and DNAH3 sequences reinforces a finding, that P. cordylinum may be a paraphyletic group given that P. cipoense is nested within it, from a previous study carried out by the Carnaval lab. However, that is not the only interpretation possible. It is possible that the two P. cordylinum samples whose presence renders P. cordylinum paraphyletic may be members of an as yet undescribed species of Placosoma lizard. Alternatively, the species P. cordylinum could be further divided into the subspecies Placosoma cordylinum cordylinum, Placosoma cordylinum cipoense, and the third group represented by the two samples in question. Additional sampling from the sites where these samples were obtained may clarify their status within this genus.

Future investigation of Placosoma will attempt to clarify the relationships between clade range and geography in this genus. Expansion of the dataset in terms of both sampling and genes used will clarify the genealogical relationships established by this study; geographical, ecological, and topographical data will be used to further understand the origins of these phylogenetic patterns.

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274

Subcategory: Ecology

Long Term Community Changes Following Deer Management in a Remnant Montane Pinus Palustris Forest

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Montane longleaf pine (Pinus palustris) forests are currently dwindling due to fire suppression. Longleaf pine forests require reoccurring natural forest fires for longleaf regeneration and maintenance of the understory community composition. In many areas of the southeastern United States, decades of fire suppression have led to invasion of longleaf-dominated forests by deciduous hardwoods and other pine species. This study shows the impacts that high densities of white-tailed deer have on a fire-suppressed remnant longleaf pine ecosystem within Alabama's Oak Mountain State Park. The park is divided into two geologic and ecological zones: the lower elevation foothills region and the higher, rocky, southeastern-facing slopes of the ridge of Double Oak Mountain. In order to compare the impacts of deer among these two habitats, we surveyed understory woody plant diversity and rates of deer browsing in 20 plots that had initially been surveyed in 2003. Species richness and diversity of plants on the southeastern slopes of the ridge were 35 and 1.573 respectively. While in the foothills region of the park, Species richness and diversity were 27 and 1.134. Deer browsing pressure was higher in the foothills. The probability of a plant experiencing deer browsing was positively correlated with the proportion of palatable plant species within a plot, indicating

that plants may benefit from associational resistance. Comparisons of similarity indices of canopy trees and understory seedlings showed that reproduction of canopy trees may be slightly more successful in the foothills than on the ridge. Further research studies should monitor deer browsing on woody and herbaceous plant species in both areas of the park over the coming years. Deer exclosures should be set up within the park to act as control plots for plant community composition. Hypotheses: 1. The rate of deer browsing on woody understory plants on the ridge side of the park will be lower and more concentrated on a few species of plants than in the foothills because plant species that can tolerate the stressful conditions on the ridge may be less palatable. Evolution of chemical defenses to deter herbivores may be common in stressful environments where resources to replace important plant parts are scarce (Barton & Hanley, 2013; Stamp, 2003). Stressors include high heat, limited water availability, and shallow soil. 2. We predict that comparison between current rates of deer herbivory and corresponding data from the 2000 survey in Oak Mountain will show that since the deer population control measures began, deer herbivory has decreased. 3. We also predict that since 2004 (Duncan Unpublished Data, 2004), woody understory plant diversity has increased due to decreased browsing pressure and a corresponding increase in the density of palatable plant species.

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275

Subcategory: Ecology

Forest Attributes of Reproductive Habitat for Harpy Eagles in Darién Province, Panamá

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Harpy Eagle (Harpia harpyja), largest raptor of the Americas, is globally near threatened and regionally critically endangered. Their reproductive cycle is distinctive amongst all raptors and can take up to three years to successfully rear juveniles. Therefore, obtaining detailed knowledge of their reproductive habitat would assist in creating new management policies and conservation guidelines. We measured variables describing forest characteristics within five 0.5-ha plots around each of ten nesting and control trees in the Pacific region of Darién Province, Panamá. Variables measured were: tree family richness; tree density, height, and diameter; shrub density; and coverage of understory and canopy foliage. We used Akaike's Information Criterion to compare a series of models specified a priori to assess the importance of forest characteristics. Results indicated that Harpy Eagles nested in forests having high heterogeneity represented by high tree richness, variability in tree height and forest openings. Findings improve our understanding of suitable reproductive habitat and provide greater ability to conserve their environment to ensure the population growth.

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276

Subcategory: Ecology

Effects of pH and Temperature Variability on Pathogen Development & Population Survival in Daphnia

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Tad Dallas and John Drake, Odum School of Ecology, University of Georgia, Athens, GA

Extreme environmental conditions can have an influence on host-parasite relationships. Factors, such as temperature and pH, place stress on Daphnia Dentifera, an aquatic zoo plankton also known as water fleas, and its fungal pathogen (Metschnikowia bicuspidata). The objective of this study is to examine the consequences of temperature variability on population dynamics, infection prevalence and infection intensity. For this experiment, we examined host and pathogen population dynamics and the corresponding infection dynamics under various temperature treatments. We hypothesized that populations exposed to increased time variations will have a decrease in population size. We also hypothesized that an increased temperature variability will increase infection prevalence. Lastly, we hypothesized that there will be a decrease in spore survival with increasing temperature variability. Our findings let us know that temperature variability does increase infection prevalence and intensity, but decreased spore survival. Meanwhile, we know pH is likely to negatively influence host populations, but the effects of pH on pathogen development within infected hosts are unknown. So, we propose to examine the effects that a reduced pH will have on spore development within hosts over time. Daphnia can not withstand a pH lower than 4, so we hypothesized that altering the pH will stress hosts, which will result in faster rates of spore growth and higher infection intensities. The pH experiment was looking unsuccessfully at a rate of spore development as a function of pH. From this experiment, our key findings let us know that abiotic factors have an influence on the host-parasite relationships.

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277

Subcategory: Ecology

Water Quality Monitoring and Mapping of the Study Sites of Rivers flowing into the Chesapeake Bay

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The Appomattox River is an important source of drinking water for several counties, as well as a habitat for wildlife. The Appomattox River monitoring station at Matoaca, Va., receives streamflow from approximately 84 percent of the 1,600-mi2 Appomattox River Basin. The James River Basin has the second largest yield of total phosphorus in the nontidal part of the Chesapeake Bay Basin. Water quality is determined by a complex of factors which must be measured simultaneously as well as at various locations. To do this, as part of my 2014 Summer Undergraduate Internship Program, I measured various parameters concerning water quality monitoring and developed a GIS map that displays current and historical data for 4 sites around Appomattox and James Rivers in Virginia, during my 6-weeks Summer Internship Program (2014). These sites included Lake Chesdin, Sutherland (just below the dam), Colonial Heights, and City Point in Hopewell at the point where the Appomattox meets the James River. Three water samples were collected from each site in 500ml plastic bottles. Turbidity was measured on-site from the sample, while the rest was transported back to a lab at Virginia State University for further tests. The water quality monitoring parameters (hardness, pH, salinity, phosphate, ammonia, and nitrite) were measured in the water samples collected at the study sites. The data analysis was done of the 3 replicate measurements for each site on a given day and averaged. The standard error was calculated. By using ArcGIS software, a map of the river and surrounding topography was created and the data from the water testing was linked. The results show that the water temperature increased steadily through the summer. There was no significant variation between sites. Dissolved oxygen levels were consistent between sites. Turbidity levels were consistently higher at City Point than the rest of the sites for most of the study period. pH measurements showed no appreciable differences between sites or over time. Water hardness at City Point increased consistently over the course of the summer. Salinity was also low, except for one anomaly in early June for the Sutherland site. There was no significant difference in ammonia levels between the sites or over time. The continuation of the ongoing water quality monitoring strategies will lead to substantial reductions in nutrients reaching Chesapeake Bay from its tributaries.

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278

Subcategory: Ecology

Litterfall Accumulation and Composition: From the Ecotone into Primary Forest at Las Cruces, Costa Rica

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Edge effects can alter forested ecosystems due to changes in light, wind, and soil moisture that occur when forests become fragmented. Litterfall dynamics are affected by edge effects due to phenological responses of plants and animals to the altered abiotic factors. We predict that there will be a difference in litterfall biomass from the edge to the interior of a primary forest. In this study we placed 10 50x50 cm baskets on a 100 meter transect at the ecotone of a secondary and primary forest. We placed litterfall baskets at 0 meters, 30 meters, and 100 meters into primary forest. Litterfall was collected once a week over a 3 week sampling period, sorted into 5 categories to get individual biomass of leaves, reproductive parts, woody, mosses, and miscellaneous. There was no difference in litterfall biomass from the ecotone into the primary forest. However, litterfall complexity was greater 100m into primary forest compared to either 0 or 30m into primary forest. Greater litterfall complexity could provide more niches to support greater arthropod diversity and this may affect decomposition and nutrient cycling.

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279

Subcategory: Ecology

Host Breadth of Parasites in Ungulates and Carnivores

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Most parasites infect multiple hosts, but few studies have focused on characteristics of hosts and parasites that may cause differences in the host breadth. We investigated two facets of host breadth: variation in the number of host species different

parasite species infect and the similarity of parasite communities among host species (i.e., overlap in the parasite species that infect different pairs of host species). We first tested for the effects of parasite transmission mode and taxonomic identity on host breadth among parasites of ungulates and carnivores using a number of definitions of host breadth, and using several methods to try and correct for differences in sampling effort among parasite species. We found that viruses and sexually transmitted parasites infect significantly more hosts than other types of parasites in ungulates, regardless of the estimate of host breadth considered. We also found that viruses and vertically transmitted parasites infect significantly more hosts than other types of parasites, among ungulate parasites that infect at least two hosts. Finally, among carnivore parasites with two or more hosts, we found that parasites transmitted via feces infect significantly more hosts than other types of parasites. We next investigated the effect of phylogenetic distance, differences in mass, and the geographic overlap among ungulate host species on parasite community similarity. All three variables showed statistically significant correlations with parasite overlap regardless of whether Jaccard's or the corrected Jaccard's index was used to measure parasite overlap among hosts. However, geographic range area overlap and phylogenetic relatedness explained much more variation than differences in body mass among hosts. Our results were almost identical when we restricted consideration to viruses, save that mass was an even weaker predictor of overlap. Finally, we tested to see whether carnivore species that prey on ungulates are infected by more ungulate parasites than those that do not. We found that carnivore species that prey upon ungulates were infected by on average twice as many ungulate parasites than carnivores that specialize on different prey items.

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280

Subcategory: Ecology

North American Porcupine (Erethizon dorsatum) Habitat Suitability at Multiple Scales

Tina Nguyen, Humboldt State University

Habitat suitability models combine observations of species occurrence or abundance with maps of environmental variables to produce estimates of relative use. However, the relationship between species occurrence and its environment is known to vary at multiple scales. The North American porcupine is considered a generalist at a large spatial scale. However, at local levels the North American porcupine exhibits fine scale habitat and diet requirements. Here, we create two habitat suitability models comparing continental and local distribution for the North American Porcupine. At the continental level, our distribution model reveals the physiological and climatic limitations of the North American Porcupine. At the local level, our model is driven by the behavior of the North American Porcupine. We use "participant science" observations and museum records to construct a model of coastal California that includes Humboldt, Trinity, and Del Norte counties. We document their presence by bait and trapping methods based on the previous two models. The differing scales of the models reveals additional insight about porcupine biology and habitat selection at the local level in a unique environment. This work reaffirms the importance of considering scale when mapping habitat suitability for a species of concern. Understanding habitat suitability at the local versus continental level will better help wildlife biologists manage and conserve appropriate habitats needed for the diminishing population of North American Porcupine in California.

Funder Acknowledgement(s): National Science Foundation

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281

Subcategory: Ecology

Preliminary Investigation of Edge Effects on Prairie Plant Species

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Small prairies provide refuge for many native species of prairie-dependent plants and animals. However, the smaller the prairie, the greater the proportion of prairie that shares an edge with neighboring habitats. This study is a preliminary investigation of how proximity to woodlands and other edges would affect microclimates and plant species diversity within a prairie. Data was collected from Litzsinger Road Ecology Center (LREC), in Ladue, Missouri about 10 miles from downtown St. Louis. About 120 permanent 0.5 m x 0.5 m plots in two prairies where used to measure (1) distance from the plot to the nearest edge and (2) number of plant species within the plot. All plants within each plot were identified to species and assigned a value for percent coverage. At a subset of plots, temperature was captured by Thermocron® iButtons ® every 20 minutes. A significant correlation was found between minimum temperature and distance to edge and between number of species and distance to edge. The closer to the edge, the warmer the temperature and the greater the number of plant species. There were also significant correlations between different species within the prairies; some species were more abundant on the edges and others with more abundant in the middle. For further research, it would be worthwhile to investigate how big the prairies have to be before the edge effect disappears.

Funder Acknowledgement(s): NSF

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282

Subcategory: Ecology

Inter-annual Variations in the Recruitment of Spot (Leiostomus xanthurus) in the Maryland Coastal Bays

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The main objective of this study was to determine the factors influencing variability in the recruitment of spot (Leiostomus xanthurus) in the Maryland Coastal Bays (MCBs) using 23 years of juvenile fish survey data collected monthly from 20 sites by the Maryland Department of Natural Resources. The index of spot recruitment varied between years with the highest recruitment occurring in 1994, although there was no apparent increasing or decreasing trend. Spot recruitment was lower in Sinepuxent Bay than in the other Bays within the MCBs system. There was a significant positive relationship between spot recruitment index and North Atlantic Oscillation Index (NAO index), perhaps due to warmer winters associated with positive NAO indices that have been documented to result in higher survival of fishes, including Sciaenids. No other environmental factor examined, including spring temperature and salinity, significantly explained variations in the recruitment of spot.

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283

Subcategory: Ecology

Estimating Sediment Carbon Accumulation Rates in the Plum Island Estuary (MA) Salt Marsh

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Globally, sea level is now rising at approximately 3.2 mm per year and expected to accelerate (IPCC). Whether or not marshes are keeping up with this rate of sea-level rise is an important question. Salt marshes sequester a significant amount of carbon per unit area when compared to other ecosystems and provide other important ecosystem services, such as providing nursery grounds for fish and removing nutrients. This study examined the resiliency salt marshes in the Plum Island estuary to sea level rise. Sediment cores were extracted from Spartina alterniflora tall, Spartina alterniflora short, Spartina patens, and a salt marsh and sectioned into 2 cm sections. Sedimentation rates were estimated by finding the 137Cs peak and assuming that this represented 1963. The amount of carbon in each section was measured using an elemental analyzer. Selected sections were analyzed for del 13C to determine past vegetation composition. Carbon accumulation rates averaged over the last 50 years were compared to annual net C exchange between the marsh and the atmosphere measured using eddy covariance techniques.

The results showed that Plum Island estuary salt marsh is currently keeping up with rising sea levels having an average sediment accumulation rate of 3.3 mm/yr in all of the vegetated areas with slightly lower rates in ponds. C carbon accumulation rates were highest in short Spartina alterniflora and, Spartina patens, where they averaged over 75 g C m-2 y-1, and somewhat lower in tall Spartina alterniflora sediments. Lowest accumulation rates were in the pond which averaged about55 g C m-2 y-1. Carbon accumulation rates from this study were compared to net carbon exchange calculated from annual eddy flux data. While both the sediment C accumulation data and the eddy covariance data suggest that the marsh has been and is currently a sink to the atmosphere, carbon storage rates from eddy covariance were nearly double those of sediment C accumulation rates. This may be because the eddy covariance does not take into account losses of C from the system in water. At all locations 13C isotopes suggested that much of carbon being buried in the sediments likely came from C¬4 plants that are native to the marsh with a much smaller percentage attributed to algal or terrestrial material.

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284

Subcategory: Ecology

Riparian Links and Nitrogen Sinks: How Riparian Connectivity and Invasive Sspecies Affect Nitrogen Cycling in Urban Riparian Zones

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Riparian ecosystems are important nutrient sinks that are useful in preventing excessive nitrogen loading into aquatic ecosystems. The primary mechanism of N removal in riparian ecosystems is denitrification, an anaerobic microbial process that con-

verts inorganic nitrate into N gas. The process is carried out primarily by heterotrophic bacteria, and is optimized in the oxygen poor and carbon rich environments that are characteristic of wetland and riparian ecosystems. Unfortunately, increasing urbanization has lead to a suite of degrading effects in riparian ecosystems including hydraulic disconnection, erosion, drier soils and increased vulnerability to exotic plant invasions. Two prominent invasive plants found in urban riparian zones are Aliliaria petiolata and Microstigium vimineum, herbaceous C3 and C4 plants, respectively, that are known to alter soil chemistry and composition through various secondary effects. The objective of this study was to determine how hydrologic disconnection and the presence of A. petiolata and M. vimineum affect the ability of urban riparian ecosystems to function as N sinks. Soil samples collected from urban riparian zones in Baltimore were analyzed for denitrification potential, potential net N mineralization and nitrification, soil moisture, and ion concentrations. Denitrification was found to be significantly higher in the hydraulically connected DR2 site compared to the more disconnected HHB1 site and the strongly eroded and incised DR5 site. Differences in denitrification potential were strongly correlated to differences in soil nitrate pools across sites. Differences in soil nitrate pools were not the result of differences in internal N-cycling across sites, and were likely the result of varying exposure to nitrate rich stream water. Thus, it appears that more connected riparian sites have a greater potential to function as N-sinks. Among plant species, denitrification potential was found to be significantly lower in soils beneath M. vimineum than in soils beneath A. petiolata and S. foetidus. The lower denitrification potential in M. viminum colonized soils may be the result of M. vimineum altering N cycling process within the soil through the release of allelopathic chemicals or high levels of labile carbon. However, it is also possible that M. vimineum simply colonizes soils which have inherently lower nitrogen cycling and denitrification potential.

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285

Subcategory: Ecology

The Impact of Solenopsis Invicta on Ant Communities Along a Rainfall Gradient in Central Texas

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The red imported fire ant (S. invicta) is responsible for over $6 billion in annual economic loss across the US. In addition they can affect biological diversity and disrupt ecosystem functions. Several studies have shown relationships between S. invicta habitat associations and biological interactions at a local scale. Here we look at patterns across a regional scale delineated by rainfall gradients, to test the hypothesis that abiotic controls can have a direct effect on S. invicta populations, and these population dynamics can have an observable influence on native ant community structures. We surveyed the distribution and densities of S. invicta and native ants across a 350 km East-West rainfall gradient (27 -39 in.) in Central Texas, measuring patterns of interactions between invasive and native species under increasing abiotic environmental stress across 20 sites. Abiotic factors considered were: annual rainfall, maximum summer temperature, minimum winter temperature, and percent clay in soil. Local habitat, riparian (wet) and arid (dry) differences, and their correlation between S. invicta and non-fire ant community structure were examined.

We observed differences in ant community structure along the East-West gradient in central Texas. The correlations between ant diversity indices and abiotic factors were primarily driven by Annual Rainfall. Correlations differed for transects in wet zones and dry habitats. In Wet transects, species richness declines at intermediate rainfall (28-34 in) that corresponds to the rainfall domain where S. invicta is most prevalent. In contrast, in high rainfall areas, S. invicta tends to be more prevalent in Dry transects, accompanied by a decline in species richness. These findings seem to be driven by abiotic stresses of low rainfall and high temperature in the West, and wetter, dense vegetation cover in the East. Species richness also declines somewhat with increasing clay content, this is likely due to S. invicta being constrained in clayey soils. Future work should include other aspects of the climatic relationships such as timing of rainfall patterns, correlations of ant activity with drought indices and analyses of species co-occurrence.

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286

Subcategory: Ecology

Identification of Microbial Communities on Sea Stars with Wasting Disease

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Recent declines in Pisaster ochraceus populations along the west coast of North America have been attributed to a wasting syndrome event. To better understand the relationship between microbial communities and wasting syndrome, we conducted a study to identify the bacterial species found exclusively on sea

stars with wasting disease. Microbial communities were sampled from the aboral surface of healthy and infected sea stars. Microbes were then grown on different selective media at 15˚C for 48 hours. Polymerase Chain Reaction (PCR) was performed on the resulting bacterial colonies to amplify the 16S rRNA gene. PCR amplicons, 1.5-2 Kbp in length, were digested with six restriction endonucleases (HaeIII, DdeI, HhaI, RsaI, HinfI, and Sau3AI) for Restriction fragment length polymorphism (RFLP) analysis. In conjunction with PCR-RFLP analysis, a subset of the samples was sequenced to identify bacterial colonies. Characterizing and comparing the microbial communities found on healthy versus sick sea stars will contribute to the current understanding of the relationship between a host microbiome and marine infectious diseases.

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287

Subcategory: Ecology

Studies on Health Hazardous Waterborne Microbial Organisms in Water Bodies from Savannah, GA

Jamilha Washington, Savannah State University
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Environmental Protection Agency (EPA) and Center for Disease Control (CDC) are concerned with public health risks in recreational water bodies such as swimming pools and beaches. EPA has established Beaches Environmental Assessment Closure and Health (BEACH) Program and developed method to enumerate the prevalence of fecal coliforms. In 1986, EPA issued a revision to its ambient bacteriological water quality criteria recommendation to include new indicator bacteria E. Coli and Enterococci. Recreational swimming is a normal practice during summer and water bodies such as beaches and public swimming pools are commonly used. Therefore, it is important to monitor these water bodies for the prevalence and distribution of these indicator bacteria. This will not only help in protecting the general public and to predict the potential of swimming-associated health hazards but also will have close check on the environmental quality of the water bodies.

We undertook this preliminary study to enumerate the distribution of “Escherichia coli and Enterococci” in selected fresh waters (swimming pools) and salt waters (Savannah River & beach), along with control by repeated weekly sample collection for a period of 8 weeks, following the EPA method 1603 and 1600 respectively during summer 2014, to test the hypotheses that the freshwater in public swimming pools will have less number of microbial population than the water from water bodies such as river and beach. In addition, the selected water quality characteristics were also measured to see the presence of favorable conditions for the growth of the same. Results of this study indicated that the colony forming unit (CFU) counts did not exceed the guidelines posted for E.Coli by EPA in any sampling location / sampling time. Further, the results also indicated that the CFU counts of Enterrococci exceeded the guidelines posted by EPA and need to be considered as unsafe during certain sampling times in selected salt water locations of Tybee beach area, while all fresh water pools were observed to be safe for swimming. Results of measured water quality characteristics indicated that they are optimal for the growth and proliferation of concerned microbial contents in both salt and freshwaters. Results also suggested that an extended period of study is needed to see the clear trend and, if there is a trend, then there is a need for genomic studies with the help of PCR or any other techniques to identify the bacterial strains.

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288

Subcategory: Ecology

Tree Inventory for Sustainable Urban Tree Program by Using I-Tree and Geographic Information System

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The hypothesis of this research is that a trees database system is necessary for developing a sustainable urban tree program. This database should include information on the planning, design, planting, and maintenance, and removal of campus trees. To respond to this need, a simple method to develop an inventory of urban community forest trees is necessary. The result of this research can be used for the purpose of creating a tree database system. An inventory can provide useful information that can help justify starting a tree program or maintain the existing tree program’s budget. It also can be used to identify the high risk trees that may fail and cause economic losses for university by damaging buildings or injuring people. The research was managed by using remote sensing application software (Eardas Imagine 2013) to classify geospatial images of the area on the

campus of Virginia State University. The remote sensing and GIS techniques were used to classify and identify the woody species locations. The identified area on classified image was visited using GPS and GIS technology to collect data on the trees. The collected data was transferred to I-Tree tree inventory system for evaluation. The urban area forestry structure including the species composition, tree size classes, composition with family, as well as environmental values such as air pollution removal and carbon storage was evaluated and will be presented.
The results of this study will help in the formation of the tree inventory and management database for an urban community such a university campus. This in turn, will help in decision making by the personnel in the Campus Maintenance for the tree care, long-term planning for new building as well as green area, and annual budgeting. The research may expand to include flood and storm water elimination.

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289

Subcategory: Ecology

The Effects of Environmental Variables on Montane Longleaf Pine Ecosystems

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Once the dominant tree in fire maintained ecosystems throughout Southeast, the longleaf pine (LLP, Pinus palustris) ecosystem's range has dwindled from 37 million hectares to less than 1 million hectares. An important and unique fraction of this ecosystem is found in mountainous environments, but little is known about the ecology of these montane systems. Longleaf pines are found in two distinct topographic regions (foothills and ridge) within the montane ecosystem at Oak Mountain State Park in Alabama. Due to over 60 years of fire suppression, the forests are undergoing succession from LLP woodlands to broadleaf forests. This study investigated the effect of environmental variables (soil depth, slope steepness and canopy openness) and measures of competition (tree species richness and non-LLP basal area) on establishment of juveniles and maintenance of adult LLP (adult LLP basal area). We hypothesized that variables that increased stress (decreased soil depth, increased slope, decreased canopy openness) and competition (increased tree species richness and increased non-LLP basal area) would have negative relationships with the presence of juvenile and adult longleaf. We predicted this because it should be easier for broadleaf trees to invade environments that are less stressful. Parameters were quantified in ridge and foothill sites by using twenty 20x50 m plots, each subdivided into ten 10x10 m subplots within which the variables were measured. The regions significantly differed in each variable except for canopy openness. Slope, soil depth and species richness had a negative relationship with juvenile LLP frequency in the foothills, while in the ridge, species richness had a positive relationship to the juvenile frequency via multiple linear regression tests. None of the tested variables (canopy openness, slope, soil depth, species richness and non-LLP basal area) were significant in a multiple linear regression against adult basal area in the foothills, but slope and non-LLP basal area were negatively related to adult basal area in the ridge. These results suggest that variables affecting LLP establishment and growth were different between ridge and foothills sites. We found that environmental stress may be slowing the demise of LLP communities in this era of fire suppression. Further research should examine how temperature, slope aspect, and the average distance from the parent tree affect growth in LLP.

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290

Subcategory: Ecology

Stressed Out Streams: The Effects of Agriculture on Stream Nutrient Cycling

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The conversion of forest into agricultural land is known to dramatically affect stream characteristics, including increased water temperature and reductions in organic matter inputs (e.g., woody debris). This study sought to assess the effects of reduced organic matter input on nutrient cycling in streams as mediated by microbial activity. We hypothesized that reductions in woody debris inputs associated with agricultural activity would decrease the cycling of nutrients, such as oxygen and nitrogen. Specifically, we predicted that decreases in organic matter inputs would decrease microbial activity. To test this prediction, we conducted a controlled experiment using streamside flow-through mesocosms within the secondary forest of the Las Cruces Biological Station in Coto Brus, Costa Rica. Treatments consisted of rock substrate or rock substrate with organic material including leaf litter and woody debris, which simulated agricultural and forested stream substrates, respectively. We estimated microbial activity by measuring the amounts of dissolved oxygen (DO) in each stream channel. Our results show that decreases in organic matter decreased microbial activity, but only when microbial activity on both rock and organic sub-

strate is considered. Our findings may also indicate that microbial communities may acclimate to disturbances in a short amount of time and this may be of interest to further work in agriculture and even urbanized streams.

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291

Subcategory: Environmental Engineering

LAG-Correlation Analysis between Precipitation and Soil Wetness Variation Index (SWVI) in the Flood Event of Uttarakhand India during June 2013

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Soil moisture controls the division of rainfall into runoff and infiltration. The recent advancement of remote sensing has allowed researchers to analyze and observe abnormalities and variations in soil wetness (Brocca et al.,). Scientists at NOAA-CREST (National Oceanic Atmospheric Administration-Cooperative Remote sensing Science and Technology) are monitoring global flooding using passive microwave data from ATMS (Advanced Technology Microwave Sounder) on board Suomi-NPP. The flooding observation approach uses the method of Soil Wetness Variation Index to assist in monitoring the amount of excess water on soil surface (Lacava et al., 2005). The goal of this study was to analyze the LAG-Correlation between precipitation and flooding at a recent flooding event in Uttarakhand India that took place in June 2013. The flood resulted in property damage of over 65.9 billion rupees (108 billion USD) followed by over 6,000 fatalities. The ATMS based SWVI is compared with precipitation data from Tropical Rainfall Measuring Mission (TRMM) 3B42V7. Results indicated that the monsoon rain from the 11th to the 17th resulted in high values of SWVI from the 17th to the 20th of June 2013. Results also indicated that a LAG of two to three days maximized the correlation between precipitation and flooding. Results obtained from this study allow us to take into account that derived SWVI data obtained from given satellites can be highly favorable and conveniently used for wetness condition assessment. Future research will include the usage of mass media reports, flood observation from Dartmouth flooding archives will also be used to verify our SWVI data at the particular flooding location.

References: L. Brocca, G.Calice, T.Lacava, F.Melone, T.Moramarco, N.Pergola, V.Tramutoli. “Soil moisture estimation through the AMSU-based Soil Wetness Variation Index (SWVI) For Hydrological Application.” Procedings of the 33rd Inernational symposia on Remote Sensing of Environment, Sustaining the Millennium Development Goals, 1-2, 981-984, 2009.
P.Paudel, S.Regmee, S.N. Upadhyay. “Overview of June 2013 Flood and Landslides with Focus on Darchula Disaster.”:n.page
T.Lacava, V.Cuomo, E.V. Di Leo, N. Pergola, F. Romano, V. Tramutoli, “Improving soil wetness variations monitoring from passive microwave satellite data: the case of April 2000 Hungary flood,” Remote Sens. Environ., vol 96(2), p.p135-148, 2005a.

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292

Subcategory: Environmental Engineering

Sophorolipid Production Using Candida Bombicola

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A sophorolipid is a surface-active glycolipid compound that can be synthesized by a selected number of non-pathogenic yeast species. In this study the species of yeast used was the Candida bombicola. C. bombicola is a species of yeast added to the substrate from which the sophorolipids will be extracted. There are a variety of ways of producing sophorolipids and the method used in this production was the Batch method. The purpose of this experiment was to produce sophorolipids and also to determine the better form of extraction. The batch method was used to produce the sophorolipids and additional analysis including GCE and HPLC were used in this experiment. It could not be concluded which extraction procedure worked best, since the method used for the EH2 sample did not work. A calculated average sophorolipid yield was 51.62777778 g/L.

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293

Subcategory: Environmental Engineering

Adsorption Studies on a Clinoptilolite Packed Column for Treatment of Septic Tank Effluent

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The main goal of this project was to investigate the effectiveness of clinoptilolite for the removal of nitrogen from onsite

waste-water treatment systems. Adsorption experiments using medias such as lava rock, sand, experiment clay, glass, plastic, and vermiculite were tested in adsorption experiments to determine which one is best at absorbing nitrogen. Onsite waste-water treatment systems have some issues such as variable loading rates and limited to no nitrogen removal. Excessive nitrogen loadings in water can cause many effects such as eutrophication in water which can lead to many health effects and be harmful to aquatic species and even humans. The goal was centered on enhancing nitrogen removal by combining two removal processes. These processes included biological, by nitrification and denitrification and physical processes by adding an adsorptive or ion exchange media. Column experiments were conducted to study the adsorption of ammonia from onsite waste-water treatment systems. An acrylic column of 40.64 cm height and volume of 0.75L was used. The column was packed with 24.13 cm in height of clinoptilolite and 5.08 cm in height of sand. A synthetic feed of about 67 mg/L NH4+ pumped at a constant flow rate of 4 ml per min. Three sampling ports where spaced evenly on the height of the clinoptilolite and samples were collected once a day from every port. Based on previous adsorption studies performed on the clinoptilolite, its maximum adsorption capacity is 44.5 mg of ammonium per gram of media. It is expected that the first layer of the column will reach saturation within 10 days and the whole column within 20 days. Results show that after 11 days only 75% of ammonium has breakthrough. The sodium in the system also decreased due to the exchange with the ammonium.

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294

Subcategory: Environmental Engineering

Treatment of BPA Contaminated Stormwater with Manganese Oxide-Coated Sand

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As municipalities consider stormwater as a potential source for clean water, stormwater contamination by organic compounds is a concern. Such organic compounds pose threats to human and ecosystem health, but many of these compounds could be removed by infiltration through reactive geomedia. In these experiments, sand was coated with manganese oxide to remove organic contaminants from stormwater. Water with 1µM bisphenol A (BPA) was passed through upflow columns packed with Mn-oxide-coated sand in simulated stormwater matrixes. Effluent concentrations of BPA from the column were measured using liquid chromatography/mass spectrometry. Mn (II) wash-out from the column was measured using UV-Visible Spectrophotometry to quantify reactivity and Mn(II) sorption by the geomedia. Both commercially available media and media synthesized in the lab demonstrated good removal of BPA over a long period of time. These results suggest such technologies could be employed in municipal infiltration systems for treatment of organic stormwater contaminants.

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295

Subcategory: Environmental Engineering

A Seasonal Investigation of Heat Fluxes in the New York City Region

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Spatiotemporal variations in amount of available energy affect agricultural, hydrological and biological processes. Spatially distributed air temperature is one of the most important variables in various scientific fields. Although meteorological stations provide accurate data observations, their spatial coverage is limited and thus often insufficient for environmental modeling. Remote sensing provides the spatial data and it fills the spatial and temporal gaps left by the meteorological stations. In this study, the surface energy balance and Moderate Resolution Imaging Spectroradiometer (MODIS) products through the years 2003-2013 are used in order to estimate air temperature for New York City region. Land surface temperature and evapotranspiration data were obtained from MODIS instrument onboard NASA's satellites Aqua and Terra, and by using the surface energy balance equation the air temperature is computed and analyzed. Trend analysis of the data was performed in order to determine the evapotranspiration and land surface temperature deviation over the course of 11 years. In addition, the amount of land surface temperature and evapotranspiration fluxes were analyzed as some the most important and governing components of the energy balance.

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296

Subcategory: Environmental Engineering

A Comparative Analysis of Glazing Systems Using Physical Studies and Simulations

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Buildings alone use 40-48% of the overall energy used in the United States (Yudelson and Meyer, 2013), providing both a challenge and opportunity to use new technology to revamp infrastructure. The primary focus of this project was to understand if high performing glazing systems improved the visual comfort, thermal comfort, and energy efficiency within a building.

The research focused on collecting data on four glazing systems: a single pane baseline model, a double glazed window, a double glazed window with venetian blinds, and an electrochromic window. Real-time data was gathered on the single pane baseline model at Rainier Tower, an office building in downtown Seattle. For visual comfort, High Dynamic Range (HDR) photographs were collected for different weather conditions. The HDR photographs were then turned into false color images. For thermal comfort, a HOBO data logger was placed in the controlled room to gather the temperature and humidity levels. The data was then compared to COMFEN, a comparative facade analysis tool. The outputs from COMFEN indicated which glazing system would produce the most visually stimulating, thermally comfortable, and energy efficient building.

The false color images showed that most of the light was concentrated on the window, leaving the rest of the office with less light. The model simulated on COMFEN also produced false color renderings, which produced similar outcomes to the false color images. The HOBO's data was input into ASHRAE Standard 55's Thermal Comfort Tool to convert the data into the Percentage of People Satisfied (PPS). ASHRAE Standard 55 recommends a PPS of 85% or greater. Since the controlled room was vacant, the data output from COMFEN for thermal comfort was more concrete. The baseline glazing system modeled in COMFEN had a PPS below 80% in the morning while the high performing glazing systems managed to maintain above an 85% satisfaction rate throughout the entire day. This indicated that there would not be enough natural lighting to sustain comfort within the building. In addition, the energy efficiency of the glazing systems was analyzed in COMFEN, which produced the Energy Use Intensity of the building. The building used the most amount of energy (43 kBtu/ft2) when the baseline glazing system was implemented. The project concluded that implementing the electrochromic window into buildings was a beneficial investment.

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297

Subcategory: Environmental Engineering

Biosorption of Cadmium from Aqueous Solutions Utilizing Soybean Hulls

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Cadmium (Cd) is a toxic element which is present in many aquatic environments. Current Cd remediation technologies have high costs, may lack efficiency, or produce a concentrated sludge. There is a need for a cost-effective, environmentally friendly Cd remediation strategy. An emerging technique known as biosorption has been proposed to be both inexpensive and effective at heavy metal remediation. The purpose of this research was to investigate the Cd biosorption potential of soybean hulls (SH) from aqueous solutions. SH were mixed with Cd solutions. The liquid portions of the samples were centrifuged; vacuum filtered; and analyzed for Cd concentration using an ICP instrument. Additional parameters tested include the sample dose (0.5, 1.0, 1.5, & 2.0g), contact time between samples and Cd solutions (2, 24, & 48hrs), particle size (unaltered, 10-20mesh, >20mesh), concentrations of the Cd solutions (1, 5, 10, 20, & 30ppm), mixing temperature (24, 30, 35, & 40°C), and pH of the Cd solutions (2-10). Desorption studies were performed to determine if the removed Cd could be recovered and recycled. In addition, tests were done to determine if the SH could be reused for additional Cd biosorption cycles. Lastly, the SH were tested for their Cd removal potential after going through HCL treatment.

The results of this study indicate that SH worked fairly well at biosorbing Cd from an aqueous solution. The results also dem-

onstrate that as sample dose increased the percent of Cd removed increased as well (90-94%). As contact time increased the percent of Cd removed increased slightly (93-94%). As particle size decreased, the percent of Cd removed increased slightly (94-95%). As the Cd solution concentration was increased the percent of Cd removed increased from 1ppm to 5ppm (91-94%), and then decreased from 5ppm to 30ppm (94-89%). As the mixing temperature was increased the percent of Cd removed decreased slightly (94-92%). As the pH of the Cd solution was increased from 2 to 3 the percent of Cd removed increased (89-94%). As the pH of the Cd solution was increased from 3 to 10 the percent of Cd removed fluctuated slightly, but overall did not change (94-94%). Desorption results showed a 56% Cd recovery rate. Reused SH were also effective at removing Cd (77%). HCL-treated SH were less effective at removing Cd than were the untreated SH (14% less effective). Overall, SH demonstrated a great potential for biosorption of Cd from aqueous solutions.

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298

Subcategory: Genetics

Freshwater Environmental DNA Sampling of Threatened Pacific Lamprey of the Order Petromyzontiformes

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Threatened Pacific Lamprey are among the oldest extant vertebrates (~530 MYA). Abundance in the US west coast has declined, 400,000 crossing Bonneville Dam in 1969, 62,000 by 2004, and 18,000 by 2011. Anadromous lamprey serve an important role in freshwater ecosystems as a buffer species for ESA protected salmon. Marine mammals consume large numbers of lamprey for their significant lipid content. When lamprey numbers decline, salmon predation increases. Adult lamprey spawn and decease in freshwater. Nitrogen, carbon, and other substances from carcasses are absorbed by the riparian borders of streams. Increased plant growth results, which increases herbivorous food supply, macroinvertebrates and terrestrial insect habitat. Lamprey are also a traditional staple food for coastal Native American tribes. Lamprey study is problematic due to a distinct two-stage life cycle of ammocoete (larval) and adult. Ammocoetes are blind, have no oral disc and filter feeding; adults have well-developed eyes, distinct oral disc, and parasitic feeding. Current data collection techniques are visual detection and counting, which are non-standardized and dependent on declining taxonomic expertise. Environmental DNA (eDNA) from water samples is emerging as a more effective approach to monitor biodiversity with sequencing technology costs dropping. In another study, success rate of eDNA species detection by qPCR was 100% for fish, tadpole shrimp, and amphibians. It is our hypothesis that eDNA can be applied to detect lamprey. An eDNA detection assay will be optimized in an aquatic mesocosm and applied in field surveys in California Rivers. PCR amplification will be performed with primers specifically designed to amplify a short segment (<100 bp) of lamprey (Entosphenus) mitochondrial DNA. Negative controls for all PCR reactions and 20% of positive tests will be validated by sequencing. The eDNA detection probabilities of the lab, field, lotic and lentic water will be compared to visual detection counting techniques to determine if eDNA monitoring is in real-time. Applications will aid lamprey ecology and conservation. Assay results have shown positive eDNA confirmations in the Trinity and Elk Rivers of No. California. A unique locus on the lamprey gene was found which has not amplified the eDNA of sympatric species. In summer 2014, a robust field survey was conducted in 23 California Rivers to test the accuracy of the current assay. The samples are currently being processed.

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299

Subcategory: Genetics

Identification of Mitogen-Activated Protein Kinases in Prairie Cordgrass (Spartina pectinata)

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Benjamin V. Benson, Madhav P. Nepal, and Jose L. Gonzalez-Hernandez, South Dakota State University, Brookings, SD

Mitogen-activated protein kinases (MAPKs) are highly conserved serine/threonine specific kinases that play a crucial role in eukaryotic stress-signaling pathways. The MAPK genes belong to three functionally linked gene families: MAPK, MAPKK, and MAPKKK. The MAPKKK gene family contains three distinct subgroups: RAF-like, ZIK-like, and MEKK-like. MAPKs have been identified in Arabidopsis thaliana, the model species for these genes, and in other species such as corn (Zea mays) and rice (Oryza sativa) but they are yet to be identified in prairie cordgrass (Spartina pectinata). In this project, we sought to identify SpMAPKK and SpMAPKKK genes through in silico analysis using the partial Spartina pectinata assembled transcriptome. We identified four MAPKKs and 94 MAPKKKs in prairie cordgrass. Of the MAPKKKs, 64 were RAF-like, 26 were MEKK-like, and four were ZIK-like. Due to the polyploidy of Spartina pectinata, paralogs were found among the SpMAPKKs and SpMAPKKKs that were not identified in Arabidopsis. Thus, we

expect that once the prairie cordgrass genome has been fully sequenced, there will be approximately four times as many SpMAPKKs and SpMAPKKKs found as AtMAPKKs and At-MAPKKKs. After the SpMAPKKs and SpMAPKKKs were identified, names consistent with those of Arabidopsis were proposed based on evolutionary relationships depicted in two phylogenetic trees, one of MAPKK genes and of MAPKKK genes. Identifying MAPK genes in prairie cordgrass is critical for the plant's further development as a biofuel crop, and to better understand prairie cordgrass' high ability to tolerate both biotic and abiotic stresses, such as soil salinity.

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300

Subcategory: Geosciences and Earth Sciences

A Study of the Chloride Concentrations in Furnace Brook (Onondaga County, New York)

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The purpose of this study was to examine the fluctuation in chloride concentrations over the last year in Furnace Brook (Onondaga County, New York State). This study was performed through the collection of Furnace Brook waters at certain times during the last twelve months, and analyzing the samples using a Beckman Coulter DU-520 General Purpose UV/Vis Spectrophotometer. The results of this analysis were then compared to chloride concentrations that might be expected over a normal twelve month cycle. In addition to evaluating the chloride concentrations in the waters of Furnace Brook, morphological data was also collected along the stretch of Furnace Brook that passes through the Onondaga Community College (OCC) campus, between State Route 175 (West Seneca Turnpike) and State Route 173 (Onondaga Road).

Based on the data collected between August 2013 and March 2014, and in July and August 2014, the chloride concentrations seen in the waters of Furnace Brook indicate that chloride is leaching from the underlying geologic units (Marcellus shale). The chloride concentrations in the waters of Furnace Brook were measured using a Beckman Coulter DU-520 General Purpose UV/Vis Spectrophotometer. The chloride concentrations vary throughout the course of the stream, increasing during winter months and decreasing during summer months, indicating that road salt runoff from State Route 175 (West Seneca Turnpike) and adjacent road surfaces impact Furnace Brook during the winter months. Our current working hypothesis is that chloride is leaching from the bed material of Furnace Brook by hydraulic communication between Furnace Brook and the underlying unconfined shallow bedrock aquifer (units of the Marcellus shale) which has been observed during times of low flow.

Since it is known that the Marcellus shale is a hydrocarbon baring geologic formation, several chemical compounds are being investigated as possible tracers for the hydrocarbons that may be detectable in the groundwater flowing through the upper Marcellus shale, underlying the OCC campus. Bromine and iodine are two of the compounds that are now being studied. Like chlorine, bromine and iodine would also be present in the ocean waters that deposited the Marcellus, but, unlike chlorine, bromine and iodine are concentrated in aquatic organisms. The hydrocarbons present in the Marcellus shale today are the result of these organisms and the only way they could be mobilized under current conditions is through groundwater flow. Any groundwater in contact with hydrocarbon baring geologic units should show elevated levels of bromide and iodide since there are no known surface sources of these compounds in the area. If elevated concentrations of bromide and iodide are detected in the waters of Furnace Brook, we will be able to conclude that surface waters of the Brook are in hydraulic communications with the subsurface waters flowing through the Marcellus shale.

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301

Subcategory: Geosciences and Earth Sciences

Effects of Residue Removal on Wind Erosion in Western Kansas

Abby Evans, South Dakota State University

With recent growth in world population, the demand for natural resources is ever increasing. At the same time, the buildup of greenhouse gasses in our atmosphere has jumpstarted a search for renewable energy sources. Because of this, biofuels have become a large part of agricultural production over the past 20 years. This study was done to test the sustainability of using corn stover as a feedstock for biofuels. First, we tested if residue removal has a negative impact on soil properties. We found that it does. Therefore, our major objective was to establish a preliminary threshold of residue removal that could help reduce wind erosion in western Kansas. Between the years of 1930 and 1940, a majority of Kansas territory was plagued by The Dust Bowl. Strong winds paired with drought and poor management practices caused an average of 480 tons of topsoil per acre to

blow away. It is evident that wind erosion has been a problem in the past, and will continue to be a problem if standards are not put in place for residue removal. In this study we tested various soil properties including but not limited to, bulk density, water content, dry aggregate stability, random roughness, and dry aggregate size distribution. Three treatments of 0, 25, 50, 75, and 100% removal were tested to predict soil loss through wind erosion over different residue removal rates. Once collected, data was entered into a wind erosion prediction model called SWEEP. Using the results from all soil tests and SWEEP analysis, we were able to form conclusions on the sustainability of residue removal. The 0% removal treatment had a significantly lower erodible fraction than the other removal rates, indicating a lesser erosion potential. Saltation threshold velocity decreased as residue removal increased, i.e., as more residue is removed lower wind speeds are required to initiate wind erosion. Modeling the data with SWEEP, no wind erosion was predicted for all treatments except for 100% removal. These results show that removing all residue from the surface does increase the soils susceptibility to wind erosion. However, matching removal levels with climate and inherent soil properties minimizes wind erosion potential.

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302

Subcategory: Geosciences and Earth Sciences

Identifying Vent Location and Eruptive Behavior at the Sproul Crater, San Francisco Volcanic Field REU

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The San Francisco Volcanic field (SFVF) is home to over 600 cinder cones and stratovolcanoes ranging in age from 6 Ma to 900 ybp. The Sproul Crater is the only recognized spatter cone in the SFVF. The shape of the Sproul Crater reflect a complex eruptive history involving changing vent location and eruptive behavior. The eruptive behavior can be described by fluxes in gas to magma content where more magma produces more cinder and more gas produces more lava fountaining and agglutination. Research on the Sproul Crater and its dynamic vent can be used to better understand other spatter cone.

Stratigraphic columns and mapping reveal three distinct facies, which allude to three eruptive events. The facies from the first event is distinguished by agglutinated spatter, the second event is characterized by "pancake" spatter, and the third by welded cinder, spatter, and lenses of agglutinate. The shape of each mapped facies is elongate and indicates that the vent was a fissure throughout the eruptive history. The correlation between stratigraphic columns suggests younger facies are present on the southeast end of the cone, which also suggests that successive eruptive pulses migrated towards the southeast. Lateral grading from larger to smaller clast size supports that the vent existed closer to the southwest rim of the crater. The eruptive behavior of the Sproul Crater involved fluctuations in gas-to-magma ratios. The first event consisted of more gas than magma, which is represented by the spatter-dominated facies. Nearly equal proportions of gas and magma were present for the second event because it is largely composed of partially agglutinated spatter. Gas and magma content fluctuated for the third event, which is shown by the alternating layers of welded cinder with spatter and rootless flow.

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303

Subcategory: Geosciences and Earth Sciences

Chlorophyll A Concentration in Bioluminescent Mangrove Lagoon, St. Croix, US Virgin Islands

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Mangrove Lagoon is a semi-enclosed shallow man-made embayment created in 1960's as part of a hotel marina / project. The lagoon has been a very popular tourist attraction for St. Croix, US Virgin Islands. This bioluminescent phenomenon is caused by a marine dinoflagellate, called the Pyrodinium bahamense. The amount of dinoflagellate is known to have a correlation to the chlorophyll A concentration. We used a data sonde to measure the chlorophyll A concentration for a period of 8 months as part of a yearlong water quality study at the bay. Day and night chlorophyll A measurements were collected from the surface and near the bottom of the bay. A comparison of day and night profiles suggests higher chlorophyll A in the bottom waters during the daytime and a more homogeneous distribution at night. Our data also showed diel phytoplankton vertical migration for the study period.

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304

Subcategory: Geosciences and Earth Sciences

Aqueous Alteration of Presque Isle Peridotite in Marquette, Michigan

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The specific nature of the aqueous alteration phenomena that have affected an ultramafic body, the Presque Isle serpentinized peridotite, on Marquette, Michigan, has yet not been solved. Previous work debated whether the observed alteration phenomenom is a product of weathering during the Precambrian, creating soils which were preserved by deposition of mid-late Precambrian sandstone overlaying the altered peridotite, or the alteration was caused by hydrothermal fluids coming from a nearby dolomite-quartz dike, altering the peridotite. This Presque Isle altered peridotite can be used to investigate some factors that might have caused the global glaciation era in the Proterozoic, or also called 'The Snowball Earth.' The published mineralogy and chemical analyses of the Presque Isle peridotite were compared to a Ni-Laterite weathering profile on similar parent rock in the Kalgoorlie area of Western Australia. Major element ratios, the type of product created due to the alteration, and the mineralogy, from unaltered rock and altered rock in different states of alteration on Presque Isle were compared to those of the Kalgoorlie area. Major element ratios were determined and the depth profiles of the element ratios were plotted for both locations. The comparison of depth profiles from both locations showed many differences in the trends and few similarities. The trends in depth profiles for most indices from Presque Isle's data differ from a Ni-Laterite weathering profile. The dissimilarity between element-ratio profiles at Presque Isle and those at Kalgoorlie suggest that the elemental distribution with depth are not consistent with a Ni-laterite weathering origin of peridotite alteration at Presque Isle. Since the factors compared are not consistent with each other, the alteration of the Presque Isle peridotite is not altered by weathering, it is affected by hydrothermal alteration. Further work will include comparison on the Presque Isle peridotite alteration to hydrothermal alterations of peridotite and other types of alteration.

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305

Subcategory: Geosciences and Earth Sciences

Analysis of Rates of Entrainment in a Debris Flow using High Speed Video Technology

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Debris flows are a naturally occurring phenomenon that have gained attention in the past few decades. The combination of flowing sediment and water down an elevated channel1,2 is dangerous for the people and infrastructures that reside where the flow deposits.3 Entrainment during debris flows is a problem for which there is no good computational model.1,2,3 Our goal was to find a quantitative model of the rate of entrainment of debris flows with different initial conditions. Identifying how the dynamics of the flow change with varying initial conditions will be helpful to models of full scale debris flows that are used for hazard assessment analysis. This research simulated debris flows in a laboratory using 2mm zirconium silicate beads in a small elevated channel. The structure of the channel allowed for various amounts of water and beads to be added to the supply flow. The total volume of the supply flow was kept constant at 2 liters. We had four different initial conditions: 55% water, 70% water, 85% water, and 100% water; the remaining supply volume was composed of beads. High speed video (1000 frames per second) was taken and analyzed to find velocity profiles during the debris flow and to calculate instantaneous rates of entrainment. Preliminary results show that as the water content of the supply flow increased, erosional effects became more defined and entrainment penetrated deeper into the bed. Pore pressure and force sensor results have yet to be analyzed, but are expected to play a significant role in the total net erosion/deposition of the flow. Next steps include refining the analysis and incorporating the data from the sensors into a comprehensive computational model.

References: (1) Berger, C., McArdell, B. W., and Schlunegger F. 2011. Direct measurement of channel erosion by debris flows, Illgraben, Switzerland. Journal of Geophysical Research 116: F 01002.
(2) Iverson, R., Reid, M., Logan, M., LaHusen, R., Godt, J., and Griswold, J. 2011. Positive feedback and momentum growth during debris-flow entrainment of wet bed sediment. Nature Geoscience 4: 116-121.
(3) Hussin, H. Y., Quan Luna, B., et al. 2012. Parameterization of a numerical 2-D debris flow model with entrainment : a case study of the Faucon catchment, Southern French Alps. Natural Hazards and Earth System Sciences 12: 3075-3090.

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306

Subcategory: Geosciences and Earth Sciences

Characterizing Arctic Land Surfaces Using a Forward Looking Infrared (FLIR) Camera

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The exchange of carbon dioxide and other greenhouse gases with the atmosphere over the Alaskan Arctic have important implications for future climate change. The seasonal freezing and thawing (F/T) cycle in the Arctic is important to the carbon and methane exchanges with the atmosphere. The length of the thawed season, to a large degree, regulates the seasonal surface biologic carbon uptake of carbon-dioxide as well as the generation of methane gases during methanogenesis. There are still large uncertainties in estimates of gas fluxes in Arctic ecosystems during these cycles. Direct measurements of greenhouse gases from aircraft and stationary observations, as part of the Carbon in the Arctic Vulnerability Experiment (CARVE), aim to determine the rate at which greenhouse gases are released into the atmosphere and are drawn-down during seasonal ecosystem processes. CARVE is a NASA Earth Venture mission that flies a C-23 Sherpa aircraft collecting airborne measurements of carbon gases as well as thermal remote-sensing observations of the surface data during the Spring, Summer, and Fall seasons. We will use thermal images from a forward looking infrared (FLIR) camera used in CARVE to characterize the surface skin temperature of land surfaces underlain by permafrost during specific phases of the freeze-thaw cycle. In future studies, measurements of the temperature and the freeze-thaw state of various landscape components, including the soil and vegetation, will be combined with measurements of atmospheric gas concentrations to better understand the role of surface processes in the exchange of greenhouse gases with the atmosphere in the Alaskan arctic. This research is supported by the National Science Foundation's Research Experiences for Undergraduates (NSF REU) Grant No. AGS-1062934 in collaboration with the National Oceanic and Atmospheric Administration Cooperative Remote Sensing Science and Technology Center (NOAA CREST) under the leadership of Reginald Blake, Janet Liou-Mark, Shakila Merchant, and Laura Yuen-Lau.

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307

Subcategory: Geosciences and Earth Sciences

Creating Water Body Maps for the Pacaya Samiria, the Everglades, and the US Gulf Coast using NASA UAVSAR Imaging Radar Data

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Wetland areas are important ecosystems that are biologically diverse, have profound impacts on the global carbon cycle, and provide ecosystem services such as floodwater management. These important ecosystems are at risk due to changes in climate. Advanced remote sensing imaging techniques provide sources for greater mapping capability of these wetlands. The objective of this research is to develop a technique for mapping wetland-dominated regions, including areas of open water and inundated vegetation. This study focuses on the detection of surface water by using datasets from NASA's Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) and software tools such as ASF's Map Ready, PolSAR Pro, and ENVI. Within wetlands regions, the delineation of open water and inundated vegetation is accomplished using the Freeman and VanZyl polarization decomposition models, through application of PolSAR Pro. The Freeman and VanZyl decomposition models decompose the polarimetric radar scattering measured by UAVSAR into three different scattering components (double-bounce, single, and volume) which are related to different land cover classes and their inundation state. Test areas and regions of interest were selected in the Everglades, the Pacaya Samiria, and the Gulf Coast (Mississippi Delta) using the decomposition models as a basis. Different polarization bands (HH, HV, and VV) and band ratios (HH-HV, HH-VV) were also used to determine different areas of land cover using ENVI. Water body maps were developed based on the threshold values selected using backscatter histograms of the areas and then compared to unsupervised and supervised methods of land classification.

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308

Subcategory: Geosciences and Earth Sciences

Journey to the Center of the Earth

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The inner Earth, which is composed of a silicate mantle and an iron nickel core, encounters extreme conditions that may cause deformation and some amount of irregularity of the crystal lattice structures. Therefore, it is essential to illuminate the elasticity and strength of inner core compounds as well as the behavior of silicates and iron at high pressures and temperatures, because these findings can be compared to existing geophysical data to better constrain our understanding of the inner Earth. The extreme conditions experienced in the core and the mantle are simulated in the laboratory using the diamond anvil cell (DAC), which can reproduce inner core pressures. Hexagonal close packed (hcp) iron and post-perovskite samples are loaded into DACs and heated to extreme temperatures to model the inner Earth conditions. The iron samples are observed with nuclear resonant inelastic scattering (NRIXS) which determines the density of states and radial x-ray diffraction (rXRD) which indicates the potential mechanism of deformation. Data given from each are combined to acquire the strength of the samples. Furthermore, x-ray tomography measurements, that reconstruct 3D images of samples under high pressures and temperatures, are performed on post-perovskite samples to investigate the formation of the core.

Based on prior experimentation, we expect the bulk shear strength of iron to be 1GPa at the Earth's center conditions, 364 GPa and 5500K. Subjecting iron to the same conditions of deep Earth exposes the rheological weakness of the inner core which supports the dislocation creep, the primary influence in deformation. Future research interests involve identifying and determining all the compounds that contribute to the deformation of the inner core.

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309

Subcategory: Geosciences and Earth Sciences

Iron Settling Through a Magma Ocean

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The Earth accreted and differentiated an iron core from a silicate mantle rapidly in 30-40 million years. During this time, there were chondrite meteorite impacts. These violent, energetic impacts caused wide spread melting, leading to magma oceans or reservoirs. The melting of the chondrite meteorites caused rapid separation of liquid iron from the silicates. Iron droplets, settled through a magma reservoir forming a metal pond. Due to high density of iron, the metal pond will eventually sink as a diapir. Previous studies have shown that this diapir entrains magma behind it in the form of a conduit. This study is to determine how metal droplets settle through a magma reservoir and iron-silicate plume conduits react. The bottom of the model is composed of glucose solution, which represents the mantle, and we introduce liquid metal droplets which fall and settle through the fluid. I will vary ambient fluid viscosity, droplet radius and consider settling in the presence of thermal convection. The degree at which the metal emulsions sink within conduits and entrain the magma to the core may have implications for core compositions.

Funder Acknowledgement(s): Dayanthie Weeraratne

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310

Subcategory: Geosciences and Earth Sciences

Landsat Retrieved Surface Properties Effects on the Day Time Temperature Pattern in New York City

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This study aims to assess the variability in the near surface temperatures in New York City and its correlation to surface characteristics such as the Normalized Difference Vegetation Index (NDVI), the Normalized Difference Moisture Index (NDMI) and Albedo. The dataset used is the product of a fine scale data collection with mobile instruments during the summer of 2012 and 2013. Landsat TM data is processed using Envi and Matlab in order to extract the land surface characteristics at the data collection points. The methodology involved correlating Landsat derived surface properties to a high resolution temperature and

humidity spatial dataset to produce a statistical surface temperature anomaly model. Existing Modis retrieved surface properties were compared with the new Landsat dataset to investigate the better correlation with temperature. The results show an improvement on the correlation coefficients for the Landsat products compared to the previously used Modis dataset. The output will be incorporated to previous studies for a better estimation of the anomaly of temperature within Manhattan. This work will contribute to the development of a thermal map of the City of New York which will eventually be replicated for others cities.

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311

Subcategory: Plant Research

Field Evidence For a Janzen-Connell Effect

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There is an increasing interest in the mechanisms that strive high plant and tree diversity in tropical rain forest. The Janzen-Connell hypothesis suggests that high species diversity is due to lower seedling survival rate near conspecific neighbors as a result of species-specific herbivores and pathogens. We test if seedling survival rate is affected by a phylogenetic Janzen-Connell effect. In addition we test if seedling survival is affected by physical damage, fallen palm fronds and light availability. We tested these factors using the TREES project and field observation on four tree species of the Fabaceae family at La Selva Biological Station, Costa Rica. We only found seedling survival rate to increase when surrounding trees are more phylogenetically distant from our focal seedling. Our results clearly suggest a phylogenetic Janzen-Connell effect on seedling survival rate.

Funder Acknowledgement(s): National Science Foundation, LSAMP, Organization for Tropical Studies.

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312

Subcategory: Plant Research

Genetic Diversity of Chicory

Johnnieshia Frazier, University of Arkansas at Pine Bluff

The purpose of this research was to use SSR in chicory molecular breeding. The overview of the project was to conduct genetic diversity of chicory (C. inybus) and determine and distinguish chicory varieties. The objective of the specific assignment is: to learn how to do DNA extraction and measure DNA quality, to target specific SSR markers within the C. intybus genome, and to run PCR (Polymerase Chan Reaction) using SSR markers and find the difference of SSR markers in various chicory genotypes. The research of the genetic diversity in chicory is significant and genetic markers can be used to conduct the genetic diversity in chicory and help to produce a more effective varieties. Through crossing between chicory genotypes with different genetic background will develop superior varieties combing desired genetic traits. SSR markers can be used in molecular breeding to speed up genetic gain through marker-assisted selection. Twenty-three chicory germplasm from the USDA were used in this research (Table 1). The seeds of the 23 germplasm were grown in the greenhouse of University of Arkansas Research Station in Fayetteville, AR in June, 2014. After 21 days planted, fresh leaves from each chicory were collected from about 10 plants and then bulked into one package, labeled, and refrigerated at -80ºC freezer. Genomic DNA was extracted from fresh leaves of greenhouse-grown plants using the CTAB (hexadecyltrimethyl ammonium bromide) method (Kisha et al. 1997). PCR amplification was performed in a Thermal Cycler following standard PCR procedures with minor modifications. Twelve SSR markers were used in this research (Table2). From this research, the genome DNA was extracted from 23 chicory USDA germplasm; PCR was amplified in the 23 chicory using 12 SSRs; and the different patterns were observed among the 23 materials. The research was an initial for genetic diversity research in chicory. Further research will use more SSR markers to run hundred chicory germplasm to do genetic diversity in chicory.

Funder Acknowledgement(s): George Washington Carver Research Program, University of Arkansas at Fayetteville

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313

Subcategory: Plant Research

The Amplification of GAPDH

Onome Okeh, Dillard University

The objective of this experiment was to isolate a segment of the gene glyceraldehyde- 3 –phosphate dehydrogenase (GAPDH)

from the DNA of two plants, spinach and peace lily, to be sequenced and cloned. The gene that is being cloned in this experiment is GAPC, which denotes the gene that codes for cytosolic GAPDH. A product of both (initial and nested PCR of the pGAP) was analyzed by agarose gel electrophoresis to determine if the amplification of the gene was successful in generating PCR product. Glyceraldehyde- 3 –phosphate dehydrogenase is a house keeping gene; housekeeping genes are genes that are always expressed because they code for proteins that are constantly required by the cell, making them essential to a cell and always present under any conditions. This gene is also an enzyme of glycolysis and gluconeogenesis. Operating in the direction of the glycolytic pathway, GAPDH catalyzes the production of 1, 3- bisphosphoglycerate from glyceraldehyde 3- phosphate. The GAPDH gene reaction sets up the first reaction in which ATP is "harvested" since the product 1, 3 bisphosphoglycerate is a high energy acyl phosphate compound that can be used to drive the production of ATP by a substrate level phosphorylation of ADP. The results showed that no DNA bands were formed, which does not necessarily mean there was no DNA. It is not uncommon for your PCR product to be invisible on the gel. Low amounts of PCR product may be the cause of it being invisible. Funding for this project was obtained via the REU at Mississippi valley state university. Future research studies would link questions regarding the amplification of the GAPDH gene and the effects it may or may not have in peace lily and spinach.

Funder Acknowledgement(s): Funding for this project was obtained via the REU at Mississippi Valley State University.

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314

Subcategory: Plant Research

Determining the Antimicrobial Effect of Gongronema Latifolium and Mangifera Indica on Escherichia coli and Salmonella Typhimurium

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Escherichia coli are gram negative, rod-shaped bacteria. These protozoan parasites are found in the lower intestine of warm-blooded organisms. Most E. coli strains are known to be harmless, but some types can cause serious food poisoning in their hosts. Similarly, Salmonella typhimurium is a gram-negative, rod -shaped bacillus that can cause diarrheal illness in humans. These groups of bacteria are responsible for numerous cases of gastroenteritis, typhoid fever, and food poisoning in the United States and other countries around the globe. Over the years, emphasis has been focused on the discovery of botanicals with antimicrobial potentials. The interests in discovering plants with antimicrobial properties are due to the fact they are economical, sustainable, and have minimal or no side effects, compared to traditional antibiotics. The purpose of this research is to determine the antimicrobial effect of Gongronema latifolium and Mangifera indica leaf extracts against Escherichia coli and Salmonella typhimurium, using Kanamycin antibiotic as the control. We hypothesized that chloroform extracts of Gongronema latifolium and Mangifera indica extracts will inhibit the growth of Escherichia coli and Salmonella typhimurium. Disk and Spot diffusion assays were used to determine the inhibitory effects of chloroform and methanolic extracts of Gongronema latifolium and Mangifera indica leaves against Escherichia coli and Salmonella typhimurium. Result show that Mangifera indica chloroform extract had a greater zone of inhibition on Salmonella typhimurium and Escherichia coli than the methanolic extract. Both Mangifera indica and Gongronema latifolium chloroform extracts had anti-bacterial activities against E.coli. However, the extracts did not have inhibitory effects against the growth of Salmonella typhimurium. Key references: antimicrobial, Kanamycin, Mangifera indica, Gongronema latifolium, Escherichia coli, Salmonella typhimurium.

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315

Subcategory: Plant Research

Sexual Dimorphism in Growth, Reproduction and Defense of Cecropia Obtusifolia Trees

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Decisions about resource allocation may differ among sexes when males and females invest unequally in their offspring. Typically, females invest more in each offspring and have lower growth rates than males, particularly in plants where females invest in fruits and seed and males only in pollen. Cecropia is a neotropical genus of tree comprised of approximately 60 species, all of which are dioecious. The purpose of this study is to examine trade-offs in resource allocation to reproduction, defense and growth in male and female Cecropia obtusifolia. The expectation is that females will defend their investments at higher level than males, causing reduced rates of growth in females relative to males. Research was conducted at the Las Cruces Biological Station, Coto Brus County, Costa Rica. Data from 10 male and 12 female C. obtusifolia were collected on three defensive characteristics: trichome density, leaf toughness, and

trichilium area of sexually mature plants. Wood density (dry mass (g) ml-1) was used as a proxy for growth rate. Results show a significant pattern of differential resource allocation between males and females; however it did not fit the prediction. Females exhibited low levels of defense and slow growth rates but males had the opposite pattern, and this was supported by Principle Components Analysis (PCA). Resource allocation patterns clearly differ between sexes, but additional research is required to fully understand the outcomes. Overall, this investigation provides new information in the study of resource allocation and the evolution of plant phenotypes.

Funder Acknowledgement(s): Funding was provided by the National Science Foundation.

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316

Subcategory: Pollution/Toxic Substances/Waste

Physico-Chemical Characteristics of Urban Water Bodies in New York City

Yeimy Gil, CUNY- York College

New York City has essentially grown into one of the most populated urban areas in the world. This rapid increase in urbanization has taken a toll on local ponds and lakes. In this study, the physic-chemical properties including selected physical and chemical parameters in water samples from two lakes and two ponds located in Queens County, New York City, New York, USA were analyzed to ascertain the influences of urbanization on the surface water quality. Water samples from Oakland Lake (N 40° 45'31", W -73°45'33"), Corona Meadow Lake (N 40o44’19”, W 73o50’46”), Baisley Pond (N 40o40’58”, W 73o47’10”), & Bowne Pond(N 40°46'14", W 73°48'25") were collected weekly basis and analyzed for four weeks in summer 2014 and compared with samples collected on summer of 2013. An YSI and In Situ Rugged Troll Data Logger were used to measure the real-time water quality data. The results showed some variations as with pH of 7.45 to 8.86, conductivity 0.79 to 10.81 µS/cm; temperature 25 to 30 ˚C; dissolved oxygen 10.28 to 15.91 mg/L; total dissolved solids 0.071 to 6.24 g/L; oxidation reduction potential 162 to 199 mV and salinity of 0.05 to 5.37 g/L. The chemical analyses were employed for the characterization of the inputs and outputs generated by the physical, chemical and biological processes developed within the water bodies. Ion chromatography (DIONEX IC-2100 system) were used for the determination of common anions including F-, Cl-, Br-, NO2-, NO3-, PO4- and SO4- and major cations including Na+, K+, Mg2+, Ca2+. Another important chemical parameters including COD (Chemical Oxygen Demand), total phosphorus, ammonium, silica and alkalinity in terms of CaCO3 were determined by using CHEMetrics Vacuvial method coupled with spectrophotometer V-2000, HACH Digital Titrator and the Metrohm Tiamo Titration instrument (Model 888). The results indicated wide variation in basic water quality parameters in lakes and ponds including COD (14.25 to147.27 mg/L), total phosphate (0.0673-0.795mg/L) and alkalinity (9.05-163.025 mg/L). The variation is somewhat linked with the urban development on the landscapes and anthropogenic activities in the lake. This study aims to better understand the influence of urbanization and seasonal operations in the city to measure the extreme climate on the local water bodies including fresh and brackish water.

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317

Subcategory: Pollution/Toxic Substances/Waste

Brownfields and Greenfields: Spatial Technology to Support Sustainable and Resilient Communities

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Brownfields are businesses, factories, and buildings that have been abandoned or condemned for an extended period of time. It is expressed that a community is unsustainable if it consumes resources faster than they can be renewed, and produces more wastes than natural systems can process or relies upon distant sources for its basic needs. It is believed that the majority of these Brownfields are located in areas of low socio-economic development. Virginia has 92 major Brownfields throughout the state. The city of Richmond possesses 45 of the 92 Brownfields. These Brownfields represent areas of urban deterioration and decay, which can be transformed into great economic and employment opportunities for the area known as Greenfields. In order for the city to become more sustainable it needs to move away from the old Industrial type community to a more socio-economic integrated community. We must start by education the communities on thinking about sustainability and becoming more environmentally aware. With Geographic Information System (GIS), we located the Brownfields in Virginia, and separated the counties by ethnicity, which will permit us to accurately create effective policies and planning projects for the Brownfields in those areas.

This presentation will use GIS to confirm the correlation between the locations of the Brownfields with their demographics. Some of the parameters included in this project will be population, density, ethnicity, and other vital statistics such as age and income level. Spatial statistics was used to predict and explain the distribution of the variables and use modeling or regression as a method for supporting the theory of a pattern, correlation or probability. For example, a point pattern analysis was applied to nearest neighbor statistics of the Brownfields. This assisted in determining a relationship amongst the variables. Mapping was done to show the proximity of Brownfields in relationship to Haz-Waste or Toxic-Waste areas. The information will assist in determining whether it would be feasible to develop the Brownfields into future economic communities for school, housing, and businesses. The resulting data will further assist with developing some type of migratory tendency based upon the economic trends within the state of Virginia. Community involvement is a must in order for these areas to thrive. Richmond should consider incorporating our Commercial, Residential and Markets into the neighborhoods.

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318

Subcategory: Pollution/Toxic Substances/Waste

Exposure of the Grass Shrimp, Palaemonetes pugio, to Antimicrobial Compounds Affects Associated Vibrio Bacterial Density and Development of Antibiotic Resistance

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Millie Thomas and John Brooker, College of Charleston, Charleston, SC

Although not usually thought of as pollutants, antimicrobial are widespread in the aquatic environment and may threaten ecosystem and human health. As organisms increasingly come into contact with various levels of antimicrobial compounds antibiotic resistance potential increases due to exposure. To study the impact of antimicrobial, grass shrimp, Palaemonetes pugio, were exposed to 0.11 mg/L and 0.33 mg/L triclosan (TCS), 30 mg/L and 60 mg/L sulfamethoxazole (SMX), and additive mixtures of the two compounds for 96 hours. Effects on survival and sublethal effects on glutathione and lipid peroxidation activity, two biomarkers of cellular stress, were measured in the grass shrimp. Antimicrobial effects on the bacterial community of the shrimp were assessed by measuring Vibrio spp. density and testing bacterial community of the shrimp were assessed by measuring Vibrio spp. Density and testing bacterial isolated for the presence of antibiotic resistance. TCS (0.33 mg/L) and the high mixtures of TCS and SMX caused significant shrimp mortality and significant increase in lipid peroxidation activity. Glutathione activity was not significantly altered by antimicrobial exposure. TCS significantly increased Vibrio density compared to control, while SMX and the mixture decreased Vibrio density. Also, antimicrobial exposures changed the proportion of V. vulnificus and V. parahaemolyticus found in shrimp. An increase in Vibrio antibiotic resistance was observed with shrimp antimicrobial treatment. For TCS, there was > 80% Vibrio resistance in the control treatment, thus the presence of TCS in coastal waters may preferentially increase the abundance of pathogenic bacterial species. The result of this study indicated the need for careful regulation of antimicrobial use and disposal to safeguard against ecological and human health risks related to pathogenic bacteria and development of antibiotic resistance in the environment.

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319

Subcategory: Pollution/Toxic Substances/Waste

The Impact of the Environmental Pollutants Perfluorooctane Sulfonate (PFOS) and Sodium Fluoride on Aquatic Organisms

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This study evaluated the persistent organic pollutant, a perfluorinated compound (PFC), known as perfluorooctane sulfonate (PFOS), and the pollutant sodium fluoride, which is found in many oral care products and placed in drinking water in standard state mandated amounts. The purpose of this study was to show that both PFOS and sodium fluoride have a detrimental effect when introduced into the environment at the standard recommended values set by the Environmental Protection Agency for drinking water due to bioaccumulation. PFOS and sodium fluoride were tested on pre-metamorphic Rana catesbieana, American Bullfrog, tadpoles because frogs are great bioindicators. Ten tadpoles each were placed in 4 separate 26 liter tanks that were filtered and filled with deionized water. Two tanks were labeled with one of the pollutants. A third tank was a combination of the pollutants, while the fourth tank was the control.

Using the standard values recommended by the Environmental Protection Agency (EPA) of 0.40 µg/L for PFOS and 2.0 mg/L for

sodium fluoride, the tadpoles were exposed to 96 hours of PFOS and sodium fluoride for bioaccumulation. The tanks were observed and evaluated to see what adverse effects that bioaccumulation of PFOS and sodium fluoride would have on the vitality and development of the tadpoles. The contaminant PFOS had a substantial impact on the pre-metamorphic tadpoles in the first two weeks of exposure. The mortality rate in the PFOS tank was 40%. Exposure to PFOS/ NaF yielded a 50% mortality rate by week 6. That was the same percentage rate for the PFOS tank over the same period of time. Exposure to NaF over the 6 week period resulted in a mortality rate of 60%. NaF had more fatalities than both PFOS and PFOS/NaF by 10%. There were also tadpoles in the sodium fluoride tank that had bleeding in their gut coils that were not found in the control and PFOS tadpoles. In the contaminated tanks development was retarded or did not occur at all. A total of 20% development was observed in the tadpoles exposed to PFOS and no development of hind limbs in the PFOS/NaF tank. The tadpoles in the NaF tank had 10% hind limb development however, the limbs were underdeveloped and an S-shaped spine was observed, which are deformities. Future work in this research will include analysis of blood concentration, histological analysis, and the use of different values for the pollutants.

Funder Acknowledgement(s): We gratefully acknowledge the financial support of the National Science foundation, grant number F2040013. We would like to thank the director of the research program, Zenora Spellman for this opportunity to enrich our knowledge in proper research techniques and procedures through this program. We also would like to thank the Norfolk State Biology department and the Norfolk State Chemistry department for allowing the use their resources to successfully conduct this research.

Faculty Advisor: Maureen Scott, mscott@nsu.edu

320

Subcategory: Pollution/Toxic Substances/Waste

Comparative Study of Time and Effort in the Management of Two Different Piggery Systems

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Swine or pigs have become one of the many important factors in the Samoan culture. Because of its importance, farmers have built piggeries to sustain and raise their pigs. Farmers popularly use two of the four piggery systems, the deep (dry) litter system and the wash down system. This research was purposed to evaluate and compare the time invested and work effort exerted by a single farmer or by an individual when managing a deep litter system versus a wash down system. Also, this research was conducted in order to determine whether or not the deep litter system proves to be more efficient and sustainable compared to a wash down system. Of the twelve pens in the CNR piggery, this research required the use of only ten pens; five operating under the deep litter system and the other five utilizing the wash down system. With the six weeks given to complete this research at the American Samoa Community College CNR Piggery Unit, it has been postulated that the deep litter system requires less time and less work effort in operating a piggery that uses a deep litter system.

To test our hypothesis, we worked as farmers by having one person manage the dry litter system and the other operate the wash down system. For the dry litter method, the individual responsible was required to ladle carbon materials (wood chips) into pens that showed too much moisture; purpose was to keep the pens dry. The person managing the wash down system was obligated to wash and brush down the animal's waste. Within the six weeks of this research, we have seen a significant difference in time and work when managing a deep litter system versus a wash down system. The operation of a dry litter system considerably reduced a single farmer's time and labor. Daily, it takes about 3 to 5 minutes for a farmer to add wood chips which in turn totals to 19 minutes a week. When turning the mixture of wood chips and manure, it takes a farmer at least 5 to 10 minutes depending on the amount of excess moisture; such totals to at least 30 minutes a week. As part of the deep litter system, the waste alley and compost bins are cleaned out and shifted after every two weeks shifting the compost in each bin. Compost in bin #3 is shifted to bin #4, compost in bin #2 is shifted into bin #3, compost in bin #1 is shifted into bin #2, and the waste in the waste alley is shoveled into bin #1. All efforts and labor in such performance takes approximately 3 ½ hours. Conversely, the wash down system takes approximately two hours per day for pen clean-up (washing and brushing), which results in almost 10 hours per week, similar to a dry litter system.

The results confirm that a single farmer's time and work effort is substantially reduced when managing a dry litter system. This system also proves to be much more efficient and sustainable compared to a wash down system. Further research can be done regarding the infestation of the compost as a breeding ground for other harmful organisms.

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321

Subcategory: Water

Identification of Phreatophytic Ecosystems Depending on Groundwater in Texas based on NVDI Variations

Keisha Baxter, City College of New York
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Groundwater dependent ecosystems (GDEs) refers to any biological life that depends on groundwater for its existence and survival. This study was performed to identify a class of these GDEs known as phreatophytes, which is vegetation that requires access to groundwater in order to survive. Due to increasing use of groundwater, by humans, ecosystems have been forced to survive on lessened amounts of water and several ecosystems have died as a result. In order to mitigate this issue, this research studies an area in Texas, called Spring Branch, that has been proven to by USGS to have GDEs based on ground-based research. This research uses remote sensing and incorporates the use of satellite data product, MODIS Normalized Difference Vegetation Index (NDVI), to study the vegetation's response in the study area. Provided with NDVI study area from 2000 to 2012, two types of analysis were conducted; seasonal and inter annual. Seasonal analysis was performed by identifying and mapping the NDVI of the two consecutive months, within a dry season, having the largest difference in precipitation (PPT) whereas the inter-annual analysis will be conducted between the NDVI images of the wettest and driest years which will be identified based on the Palmer Drought Severity Index (PDSI). The difference between the images were obtained for what is called the Difference NDVI of each analysis. Since we are comparing NDVI when there an abundance of PPT against NDVI when there is little to no PPT, we hypothesize the smaller the difference in NDVI, the higher the potential to be GDE. The seasonal analysis showed very little change in NDVI because of antecedent soil moisture that could have an effect in vegetation conditions for the image corresponding to the end of the dry season. However, inter-annual analysis showed that there is a great deal of locations that have potential to be accessing groundwater in the area. Further analysis will be done by mapping the average NDVI against the difference NDVI, which will provide a grouped result of areas containing GDEs, non GDEs and barren land. This methodology and research validates the use of remote sensing to identify GDEs as well as enable us to locate and create national maps of areas consisting GDEs. These maps can further be used to prevent developers and land users from taking groundwater away from ecosystems that depend on it for their existence.

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322

Subcategory: Water

Flood Prediction Using Multidimensional Analysis of Precipitation and Inundation in the Mekong River Delta

Andrew Fitzgerald, City College of New York

Principal component analysis and non-negative matrix factorization are crucial techniques for understanding higher dimensional data sets. They reduce data to lower dimensions that represent the strongest representative factors. In this project, we applied these techniques to precipitation and inundation data of the Mekong river delta from the CCNY Crossroads Initiative and the Dartmouth Flood Observatory. We expect to find a high correlation between components of these factors. By reducing the dimensions of this data, we were able to effectively visualize trends and relationships between these two variables. Specifically we noticed a high correlation between the components of inundation and precipitation. We will continue observing this multidimensional relationship and hopefully predict anomalous flooding using other dimensional analyses.

Funder Acknowledgement(s): I would like to thank the NOAA CREST REU for funding this project. Special thanks to Michael Grossberg and Hannah Aizenman for their support and mentorship.

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323

Subcategory: Water

Variation in Water Quality Between Urban and Rural Reaches of Wildcat Creek

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Essential to sustaining human populations, water resources in many regions are increasingly stressed. Understanding controls on water quality is important because it may allow us to limit negative impacts and preserve more of our water for human use. In this study, we consider controls on water quality in Wildcat Creek, a small stream located in and adjacent to Manhattan, Kansas, USA. We hypothesized that human activities are affecting the water quality in Wildcat Creek and that impacts in rural areas differ from those in urban areas. During June and July, 2013, we collected water samples from five different sites along Wildcat Creek. Three of the sites are located in a rural area, upstream from town, and two of the sites were located in town. During sampling, we measured the pH, temperature, conductivity, and dissolved oxygen content of the water. We also filtered

samples through 0.45 µm syringe filters for laboratory analyses. In the lab, we used ion chromatography to measure the concentration of cations (Na+, K+, Ca2+, Mg2+, NH4+) and anions (F-, Cl -, Br-, SO42-, NO2-, NO3-, PO43-) and Gran alkalinity titrations to measure alkalinity. We found that the concentration of nitrate and other nutrients were elevated in early June, particularly at rural sites, but that concentrations at each site fell over time. The concentration of nitrate averaged 16.3 mg/L in samples collected on June 4 but only 0.7 mg/L in samples collected on July 8. On those same dates, nitrate levels were 2.5X higher on average in samples from rural sites compared to samples from urban sites. The early spike in nitrate levels, therefore, may reflect agricultural activities along the rural portion of the stream. In contrast to nutrients, the total dissolved solids (TDS) content of samples collected from urban sites was higher than that of samples collected at rural sites by an average of 9% during the study. This difference could be the result of human activities in town that ultimately discharge salts into the stream as well as natural processes. Collectively, these findings demonstrate that different factors impact water quality in Wildcat Creek in rural areas compared to urban areas and suggest that seasonal variation in water quality may exist. Ongoing and future research seeks to examine this possibility by monitoring water quality in the stream for an entire year.

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324

Subcategory: Water

Geospatial Modeling of the Harlem River Pollution

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This study aims to attempt a holistic investigation of water pollution in the Harlem River by conducting chemical and geospatial analyses. The methodology included a combination of chemical and geospatial analyses. In the first phase of the research, random samples of water were collected from the Harlem River and tested for the presence of Ammonia, Fecal-coliform, Enterococcus and E-Coli (bacteria) as well as the turbidity of the water by using a spectrophotometer in the visible (400-700nm) range. The results of the tests were fed into a geo-database for geospatial analyses. In the second phase of the research we created a detailed land cover and land use map of the study area using remotely sensed data sensing in the visible and Near-Infrared (NIR) spectrum. The classified image was integrated with census data such as population density, socio-economic variables for modeling the socio-economic dynamics in the area that may influence the type, amount and cause of pollution in the Harlem River. The anticipated results may be used to show the dynamic factors that may be influencing the pollution of the Harlem River.

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325

Subcategory: Water

A Comparative Study to the 2011/2013 Water Quality Assessments in the Pasquotank Watershed in Northeastern North Carolina with a Sea Level Rise Component

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The Pasquotank River Watershed is found in Northeast North Carolina, beginning in the Great Dismal Swamp at the Virginia/ North Carolina border and flows into the Albemarle Sound. The watershed provides a transition between spawning grounds and the waters of the Albemarle Sound. The sound serves as a nursery area for many fish species and is home to numerous sport and commercial species. Due to indications of rising global temperature and the monitoring of melting ice sheets, these coastal watersheds could be a leading indicator of rising sea levels as their chemical compositions changes. The effects of sea-level rise were also taken into consideration for future monitoring. The 2014 Research Experience for Undergraduates Pasquotank River Watershed Team completed two sets of tests of five tributaries and the river itself. These test points were derived from the 2011 and 2013 Watershed Team research projects, with the addition of four points created to sample further downstream in the Pasquotank River itself. Results were compared with previous readings utilizing a Water Quality Index (WQI). The streams

tested were the Pasquotank River, Newbegun Creek, Knobbs Creek, Areneuse Creek, Mill Dam Creek, and Sawyers Creek. These streams, along with the river, cover a large portion of the watershed and provide a wide area of study for the watershed. Tests performed in the laboratory on this year's samples included pH, salinity, total dissolved solids, and conductivity. Air/water temperature, dissolved oxygen, wind speed/direction, and turbidity/clarity measurements were taken in the field. The results collected were placed online and displayed in correlation to their position utilizing Google Maps. The data were then compared to the 2011 and 2013 project results and examined for any variations or similarities. It was found that the water quality for some water sources remained in their respective ranges from the past years. The others, such as Knobbs Creek, varied from the previous years. Newbegun Creek, with a water quality index of 59, stayed within the two previous teams' WQI of 50 (2011) and 66 (2013). Mill Dam Creek had a very slight increase in water quality from the previous teams' readings 47 (2013) and 48 (2011) but still managed to acquire a bad reading of 49. Areneuse Creek increased from 49 (2011) and 47 (2013) to reach a medium water quality of 57. The Pasquotank River, ranking as the lowest, has dropped significantly from 64 (2011) to 44 (2013) and continued to be lower in 2014 standing at 41 for its WQI. Sawyers Creek remained consistent between 54 (2011) and 50 (2013) at a low medium range with this year's water quality being 51. Knobbs Creek WQI, having the highest water quality reading, increased from the two past readings of 52 (2011) and 50 (2013) with a WQI of 63.

Funder Acknowledgement(s): Linda Hayden, Center for Remote Sensing of Ice Sheets, National Science Foundation.

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326

Subcategory: Water

Quantitative Demonstration of Capillary Water Movement in Porous Media

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The movement of water within soils greatly impacts the sustainability of life on Earth. For instance, the upward movement of moisture driven by capillary forces provides water to plant and tree roots, a process that is essential to plant life. Capillary action also has the potential to reduce water waste from residential outdoor water use. According to the EPA, approximately 29 billion gallons of water are used daily across US households. Up to 30% to 60% of that water is used for irrigation and landscape (with usage increasing in certain areas and seasons). Unfortunately, as much as 50% is wasted due to water loss attributed to evaporation, wind, and runoff caused by inefficient irrigation methods and systems. Our goal is to construct a quantitative demonstration of capillary action to serve as an engaging educational tool for courses in hydrology and groundwater. In addition, we plan on utilizing our sensor instrumentation to study the efficiency of two different wicks from planter boxes provided by Farm Tub. Our experiment begins with an industrial silica sand being packed into a flow cell (a cast acrylic tube 40 inches high and 3 inches in diameter) which holds the porous medium. Five tensiometer and moisture sensors, instrumented on the side of the flow cell, are used to quantify capillary rise in the soil column with the data stored in a data logger and displayed on a computer. The bottom of the soil column is submerged in water to simulate a water table and allowed to undergo capillary rise in order to achieve hydrostatic conditions. We then compared the results obtained by our control model (soil column packed with sand only) and the experimental model (soil column packed with sand and a wick). In addition, we will test both a synthetic and pressed wool wick, in order to determine which material will provide the greatest increase of water content. The pressed wool wick revealed a 17% increase in moisture versus having no wick in the soil column versus the synthetic wick's 5-7% increase. Watering methods that take advantage of capillary rise have potential to reduce water waste and optimize small-scale agriculture in arid regions. The pressed wool wick proved to be the most efficient with other benefits including low cost and low environmental impact. Future work includes the evaluation of alternative wick configurations, different materials, and the study of different porous media to evaluate their potential for capillary rise.

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Mathematics and Statistics

327

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Noise Analysis in Gene Regulatory Network for Time Series Data

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Time series expression experiments are an increasingly popular method for studying a wide range of biological systems. Biological processes are often dynamic, thus researchers must monitor their activity at multiple time points. The most abundant source of information regarding such dynamic activity is time series gene expression data. These data are used to identify the complete set of activated genes in a biological process, to infer as their rates of change, their order, and their causal effects and to

model dynamic systems in the cell. The analysis at network's level will focus on the interactions between genes, and attempt to build descriptive and predictive models for different systems in the cell. For regulatory networks, the components of such models are the genes that are involved in a specific system, and the transcript factors that regulate the system. Such models provide a description of the process under investigation, and the interactions that take place during the activation of the system. Predictive models should also be able to address questions about different disruption of the system. When analyzing the time series expression experiments, the most important issues are to come up and to face many new computational challenges. Algorithms are specifically designed for time series experiments are required so that it can be taken advantage of their unique feature and address the unique problems they raise. Auto regulation which alters the response time and noise sensitivity of single genes to complex regulatory networks that demand understanding at higher scales of network architecture. A Gene Regulatory Network (GRN) is represented by an interaction between a transcription factor (TF) and a target gene (TG). Fluctuations in transcription factor levels or of the signaling molecules that regulate TF activity result in noise in the target genes, leading to noise propagation. Even slight variations around the critical threshold in transcription factor abundance might lead to a radical switching between distinct states of gene expression, thus yielding distinct cellular phenotypes. Noise propagation has also been shown to increase with the size of linear regulatory cascades. It assumes a significant role in deciding the information capacity of a regulatory interaction. Information capacity refers to the number of distinct, stable states in the expression level of a target gene that can be obtained by varying the concentration of a transcription factor. A gene regulatory networks with noise is setup by ordinary differential equation model. Where are the gene state variable, and are the positive rate constants, and are the exponential parameters called kinetic orders. The gene noise is processed by Kalman Filter. Two genes synthetic model and five genes real data model is tested by the suggested model.

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328

Subcategory: Civil/Mechanical/Manufacturing Engineering

Linear Long Wave Propagation Over Discontinuous Submerged Shallow Water Topography

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The dynamics of an isolated long wave passing over underwater obstacles are discussed in this paper within the framework of linear shallow water theory. Areas of practical application include coastal defense against tsunami inundation, harbor protection and erosion prevention with submerged breakwaters, and the construction and design of artificial reefs to use for recreational surfing. Three sea-floor configurations are considered: an underwater shelf, a flat sea-floor with a single obstacle, and a series of obstacles. A piece-wise continuous coefficient is used to model the various sea-floor topographies. A simple and easily implementable numerical scheme using explicit finite difference methods is developed to solve the discontinuous partial differential equations. The numerical solutions are verified with the exact analytic solutions of linear wave propagation over an underwater shelf. The scope of this simplified approach is determined by comparison of its results to another numerical solution and experimental data available in the literature for wave transmission and reflection coefficients. Reflection and transmission coefficients obtained from simulations were found to be comparable to those in literature. It is shown that for small amplitude incident waves, our model is quite good at approximating irregularly shaped obstacles. The efficacy of approximating more complicated continuous underwater topographies by piece-wise constant distributions is determined. As an application, a series of underwater obstacles are modeled and reflection/transmission coefficients determined.

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329

Subcategory: Computer Science & Information Systems

GPS Positioning Algorithm, Its Errors and Solution

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The Global Positioning System (GPS) is a space-centered satellite which consists of 24 basic satellites carrying atomic clocks navigation system that are responsible for delivering location and time information accurately and prudently, anywhere on Earth. The satellite's mission is to transmit synchronized signals from predetermined position in space to the receiver; the receiver uses the information transmitted by the satellite to calculate the accurate coordinates of itself. If three satellites are available, then three spheres are known whose intersection consists of two points. One is the location of the receiver and the other is far away from the surface of the earth, which can be ignored. As a result, the problem is to solve the three sphere equations. One major problem is that the receiver clock is not perfectly in sync with the satellite clock. The only way to fix this error is by

adding one more satellite to solve the inaccurate timing which in turn brings a high range of difference by several kilometers on the positioning. We define d to be the difference between the coordinated time on the (four) satellite clocks and the earth-constrained receiver clock. Two further problems arise when GPS is deployed. One is the conditioning of the system of equations and another difficulty is the transmission speed of the signals, which is not precisely the speed of light (c). Because the signals may encounter blockage by different hindrances on earth before reaching the receiver, this is referred to as multi-path interference. To be more accurate, we increased the number of satellites from four to eight in our calculation.

Our goal was to solve the least squares system of eight equations in four unknown variables (x,y,z,d) using Gauss-Newton iteration method. We used two types of satellites such as tightly and loosely bunched. Results indicated that system becomes ill-conditioned when satellites are bunched closely in the sky. Future research involves working with two or more receivers to compute difference of position instead of absolute position. Errors that are shared by the receivers will be cancelled when we form the differences.

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330

Subcategory: Computer Science & Information Systems

Search for the Most Effective Stock Asset Manager

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Assume that each technical indicator is an asset manager. The most effective manager will be the one that makes the most consistent profit with the least amount of transactions. Given a set of technical indicators, the objective of this project is to determine the most effective asset manager for a group of stocks over a period of time. Technical indicators are metrics derived from past data and they are used to make decisions about buying and selling stocks. This project compared the performance of 5 technical indicators on 20 stocks for the period 2010 to 2013 to determine the most effective manager. Taking into consideration, the Analysis of Variance (ANOVA) t-tests, and the number of trades, we were able to determine the most effective Manager. This project is an attempt to develop efficient objective or mechanical trading methods for an investor.

Funder Acknowledgement(s): Joe Omojola

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331

Subcategory: Computer Science & Information Systems

Will the Recessive Gene Eventually Disappear?

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In this project, we developed a Markov chains model to study the problem of mating the offspring from the same two parents. Since parents can carry dominant genes (A) or the recessive genes (a), the original offspring may carry the genes AA, Aa, or aa. When two of these offsprings are randomly mated and the process continues, we like to investigate if the recessive gene will eventually disappear or will continue generation to generation.

Funder Acknowledgement(s): N/A

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332

Subcategory: Computer Science & Information Systems

Uniquely Bipancyclic Graphs

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A bipartite graph on n vertices, n even, is called uniquely bipancyclic (UBPC) if it contains precisely one cycle of length 2m for every $2 \leq m \leq n/2$. In this note, using computer programs, we show that if $32 \leq n \leq 56$, and $n \neq 44$, then there are no UBPC graphs of order n. We also present the six non-isomorphic UBPC graphs of order 44. This improves the recent results on UBPC graphs of order at most 30. We plan to further our research by continuing our computer search on graphs of larger orders.

Funder Acknowledgement(s): The National Science Foundation

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333

Subcategory: Computer Science & Information Systems

Uniquely Bipancyclic Graphs

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Abstract A bipartite graph on n vertices, n even, is called uniquely bipancyclic (UBPC) if it contains precisely one cycle of length 2m for every $2 \leq m \leq n/2$. In this note, using computer programs, we show that if $32 \leq n \leq 56$, and $n \neq 44$, then there are no UBPC graphs of order n. We also present the six non-isomorphic UBPC graphs of order 44. This improves the recent results on UBPC graphs of order at most 30.

Funder Acknowledgement(s): National Science Foundation

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334

Subcategory: Ecology

Analysis of Predator-Prey Models

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Predator-prey models are utilized by scientists to predict or explain trends in animal populations (i.e. lions/zebras, foxes/rabbits) in predator-prey dynamics. These models are described by nonlinear systems of differential equations. This project involves performing the stability of the equilibrium solutions by linearizing the nonlinear system. The phase portrait, a picture depicting trajectories of solutions, and the dynamics of each population are computed and visualized using the mathematical software Maple. Three mathematical models are discussed in this project. The first one is the Lotka-Volterra model that does not take the competitions within the prey species nor the predator species into account. The second model uses the logistic model in the dynamics of the prey population to consider the situation where preys competing against one another. The third model considered involves competitions within both prey and predator populations. In conclusion, the growth and decline of species in a given condition was determined by the aforementioned models.

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335

Subcategory: Ecology

Using the Power Ratio as an Early Warning Signal to Detect Critical Transitions for Disease Emergence and Eradication

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Eradication of human infectious diseases has been a public health initiative for more than a century. Emerging and re-emerging infectious diseases, such as Ebola, multi-drug-resistant TB, and pertussis, continually threaten lives of people across the world. Predicting when eradication of a disease is almost achieved or when emergence events are likely to occur could give policy makers specific evidence to stop the disease emergence or continue eradication efforts. Early warning signals (EWS) have been studied in many systems such as fishery collapses, economic market fluctuations, and global climate change. In the case of infectious diseases, however, EWS are difficult to use because of inherent periodicities (seasonality or multi-yearly cycling) and under-reporting issues in the datasets along with violations of normality, independence, and stationarity assumptions. We evaluate wavelet-based methods, which make fewer assumptions and allow us to specify which periodicities to study. Wavelets are a method for representing a time-series in terms of coefficients that are associated with a particular time and a particular frequency. The power ratio, the ratio of low frequency waves to high frequency waves as the critical transition is approached, is calculated using wavelet-based analysis. We found that, when using data from stochastic simulations of disease emergence and eradication, the power ratio is more reliable at detecting emergence events than at detecting when the threshold has been crossed for disease eradication. This result held true even when case reporting was at low levels (5, 10, and 50%), which is promising for use as an actual field statistic as we often don't have all the data. Future research will involve testing this method on actual disease data sets for seasonal and non-seasonal infectious diseases.

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336

Subcategory: Education

Searching for Perfect Triangles

Joseph Caine, Harris-Stowe State University

The focus of my research is to search for perfect triangles. Professors Jim Wilson and Carol Sikes, Department of Mathematics

Education, University of Georgia, had defined a perfect triangle as a triangle with sides of integer length and having numerically equal area and perimeter. However, they limited their investigations to only right triangles and conjectured that there are five such triangles.

I was curious about the concept of a perfect triangle and the conclusion reached by Professors Wilson and Sikes. I decided to conduct my own investigation and to extend their work to all triangles (right and oblique) with sides of rational number length. Doing this investigation afforded me the opportunity to apply two very important Theorems that I learned in my Geometry and Trigonometry courses. In addition, as Professor Sikes had noted, perfect triangular flower beds add beauty to a home garden or lawn. The methods of Pythagorean and Heron's Theorems and ideas about solving nonlinear Diophantine equations were used to find solutions to my problem. The results obtained, Nonlinear Diophantine equations were derived whose solutions provided answers to my inquiry. I used different solution approach from Professors Wilson and Sikes, but obtained only four integral perfect right triangles, although Professor Wilson claimed there are five. In addition, I obtained many non-integral perfect right triangles. I obtained five integral oblique perfect triangles and many non-integral oblique perfect triangles. We obtained four perfect right triangles with integer side lengths and five perfect oblique triangles with integer side lengths. However, if we allow rational number side lengths, there are infinitely many perfect right and oblique triangles.

References: Margaret L. Lial, John Hornsby, David I. Schneider & Callie J. Daniels (2013). Applications of Trigonometry and Vectors, Pearson, Trigonometry Tenth Edition (pp. 290-338). Boston J. Wilson and Carol Sikes, EMAT 4690/66980, Department of Mathematics Education, The University of Georgia. http://jwilson.coe.uga.edu/EMT668/EMAT6680.2001/Sikes/emat6690/essaytriangles/essaytriangles.html

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337

Subcategory: Education

The Study of Bayesian Statistics

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The two commonly used approaches to statistical analysis are the frequentist approach and the Bayesian approach. Bayesian Statistics differs from frequentist statistics in that prior knowledge is used along with sample data to estimate a population parameter. The prior knowledge with the sample data creates a posterior distribution used to estimate parameters. The goal of the study is to determine how the Central Limit Theorem of frequentist statistics can be applied to Bayesian statistics given different levels of bias and how large a sample size is sufficient for a robust Bayesian procedure. This research is important because it will address when it is preferable to use Bayesian statistics over frequentist statistics.

We simulated sample data using the statistical package R from a population with sample sizes of 5, 15, 30, 50, 100, and 200. We calculated frequentist confidence intervals and Bayesian credible intervals for each sample estimate and recorded how often the confidence intervals captured the true parameter. We ran 20,000 iterations of these simulations, each with different population distributions- normal, exponential, bimodal, and uniform. Results confirmed that if the sample size is sufficiently large, the sampling distributions of non-normal populations are normally distributed. All population distributions had captured 95% of the population parameter by a sample size of 200. Additionally, unless the data was extremely skewed, the capture rate reached 95% by a sample size of 15. It was observed that regardless of the population distribution, the capture rate of the parameter stayed relatively the same except for the case of bias with small variance.

It was found that assuming normality gave results that were not significantly different than frequentist methods unless the prior was significantly off and there was a high measure of confidence in it. Under those circumstances, the Bayesian method did not capture the population mean 95% of the time even by a sample size of 500. It was also found that small biases in the prior can be corrected by a sample size of around 50. Overall, Bayesian statistics captured the population parameter more accurately with a smaller sample size. But after a sample size of 50, the frequentist approach and the Bayesian approach obtained the same results.

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338

Subcategory: Education

Matrix Based on Convergent Geometric Series

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The infinite Geometric Series is a series of the form The geometric power series converges for <1 and is equal to . Let g be sequence in (0, 1) that converges to 1. The matrix based on convergent infinite geometric series defined as a_nk= (1-g_n)g_n . We denote this matrix by M and name it geometric matrix. M is a sequence to sequence mapping. When a matrix M is applied to a sequence x, we get a new sequence M x whose nth term is given by: The sequence M x is called the M -transform of the sequence x.

The purpose of this research is to investigate the effect of applying M to convergent sequences, bounded sequences, divergent sequences, and absolutely convergent sequences. We considering and answer the following interesting main research questions.

Research Questions: (1) What is the domain of g for which M maps convergent sequence into convergent sequence? (2) What is the domain of g for which the M maps absolutely convergent sequence into absolutely convergent sequence? (3) Does M maps unbounded sequence to convergent sequence? (4) Does M maps divergent sequence to convergent sequence? (5) How is the strength of the M comparing to the identity matrix?

Funder Acknowledgement(s): NSF-MAGEC-STEM Plus

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339

Subcategory: Education

Enhancing Parental Involvement in NC-CCSS for K-2 Mathematics

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In this study, the 2014 REU math team developed and provided a workshop that assisted parents in understanding the North Carolina Common Core State Standards for K-2 Mathematics to assist with student homework assignments. Parent involvement is defined as parent participating in the educational processes and experiences of their children. A chi-square analysis was used to analyze data collected from the pre survey and the post survey administered to participants in the workshop. The study revealed all of the individual components of parent involvement were positively and significantly related to educational goals. The study identified various aspects of parent involvement that yielded statistically significant results in affirming that parent involvement attributed to urban student achievement. These findings were particularly helpful for indicating which kinds of parent involvement influenced academic success. Most notably, parent expectations and styles demonstrated a strong relationship with scholastic outcomes. Parent expectations and styles created an educationally oriented ambience that established an understanding of the certain level of support the child needed to succeed academically. The REU mathematics team focused on three essential questions in this study: (1) What practices will increase parent awareness of K-2 NC-CCSS for mathematics at P. W. Moore Elementary School? (2) What methods can be used to strengthen parent skills in assisting with mathematics homework assignments at P. W. Moore Elementary School? (3) What actions can be taken to motivate parent involvement in the school improvement process focusing on mathematics at P. W. Moore Elementary School?

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340

Subcategory: Education

Application of Structural Equation Modeling to Robotics Education

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Structural equation model is a depiction of the relationship amongst latent variables using a quantitative survey from a theoretical model that have several hypothesis. Structural equation modeling includes multiple regression models made up of many independent and dependent variables. The objective of this project is to determine correlations between latent variables that were constructed from survey questions for students taking part in robotics activities during summer programs at Southern University at New Orleans. The regression model obtained measured the effect of robotics education on academic performance of students. The steps used to build the model are model specification, identification, estimation and testing. We used smart Partial Least Squares (PLS) software to compute the weight, path coefficients, and loadings which gives an understanding of the variance that is needed to explain the predicted variables. The significance of this project is that the influence of robotics activities on education performance was determined through structural equation modeling.

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341

Subcategory: Environmental Engineering

Radio Number for Seventh Powered Path

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Let G be a connected graph. For any two vertices u and v, let d (u, v) denote the distance between u and v, which is the smallest length of any u − v path in G. The diameter of G, denoted by diam(G), is the greatest distance between any pair of vertices in G.A radio − labeling (or multi-level distance labeling) of G is a function f that assigns to each vertex with a label from the set {0,1,2,3,...}such that the following holds for any two vertices u and v: | f(u) − f(v) |≥ 1+ diam(G) − d(u, v) The span of f is defined as maxu,v∈V (G){| f(u) − f(v) |}. The radio number of G, denoted by rn(G), is defined as the minimum span of all radio-labelings for G. The goal of this presentation is to discuss the progress we made towards finding the radio number for the seventh power of any path during a 2014 research program which is an MAA activity funded by NSF (grants DMS-1156582 and DMS-1359016).

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342

Subcategory: Materials Science

Data Analysis of the Test Results of Different High Performance Polymer Materials

Sharniece Vaughan, Virginia State University
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Virginia State University has teamed up with Honeywell Performance Material and Technologies to see the change in physical and mechanical properties of increased deniers. Honeywell has provided high performance polymer-based samples with deniers of 100, 400, and 800. Testing will be conducted on an Instron machine at the VSU Strengths of Material Lab.

Ten individual samples from the 100, 400, and 800 deniers will be cut into equal length in the lab. Each fiber will be stretched until they break to figure out how much strength is in the material. The computer-generated information on the maximum force (fmax), maximum elongation strength (emax), modulus, tenacity, and breaking time will be collected and analyzed using statistical analysis. This will help to understand the physical and mechanical properties, such as the uniformity in the material and the probability distribution of strength. The experience of this experiment can help for product-quality strength verification for Honeywell consumer products like fishing rod wire. The measurable outcome from the experiment will be the relationship between the strength of the material and the increase in denier.

Funder Acknowledgement(s): This study was funded by NSF through HBCU-UP program awarded to Virginia State University

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343

Subcategory: Microbiology/Immunology/Virology

Development of Mathematical Models for a T7 Phage-E. coli System with Vaccination Strategy Implementation

Abigail Smith, Carnegie Mellon

Vaccination is widely considered the most effective method of preventing the spread of infectious disease. Pulse vaccination strategy, the repeated application of a vaccine over a defined population at a set time interval is gaining prominence as a strategy for the elimination of diseases such as measles, hepatitis, and smallpox. In order to study the effectiveness of this strategy, a bench experiment will be designed using E.coli bacteria and T7 bacteriophage, and studying the interactions and mechanisms in a chemostat. Using this system allows us to study the spread of infectious disease in laboratory setting. To test vaccination in system, a concentration of IPTG will be used to induce expression of the rcsA gene (immunity) in E. coli. Results can be generalized from an experimental bench system (E. coli bacteria and T7 phage) by developing a deterministic compartmental model, and then factoring in noise to form a stochastic model. Additional classes were added to track phage populations and experiment with vaccination strategy. Preliminary studies were designed to study early warning signs for approaching a bifurcation point and critical slowing down, by examining the phage being driven to extinction.

Funder Acknowledgement(s): NSF, Odum School of Ecology, University of Georgia

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344

Subcategory: Physics (NOT Nanoscience)

Analysis of Mechanical Vibrations

Destiny Webster, Savannah State University

Mechanical vibrations are modeled by linear or nonlinear second order differential equations or equivalently, by a system of linear or nonlinear first order differential equations. This research involves the study of linear and nonlinear mechanical vibrations. The following types of mechanical vibrations are considered: free undamped, free linearly damped, free nonlinearly damped and forced nonlinearly damped vibrations. The particular case we are considering is an object of mass, m, attached to a spring of stiffness, k. The qualitative behavior of solutions of the system of differential equations is studied through the phase portrait, a picture that shows trajectory of solutions together with critical points. The evolution of displacement and velocity is also computed and visualized using the mathematical software Maple. The goal of this research is to predict the behavior of the motion of the mass on the spring that starts with specified conditions.

Funder Acknowledgement(s): National Science Foundation

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345

Subcategory: Water

Modeling Lab Data Using Deterministic Methods for Multivariate Interpolation

Amber Hines-Adkins, Savannah State University

A scattered set of points from a lab experiment can be improved and represented by using different types of deterministic methods for multivariate interpolation. In order to consider the supplemental data we had to look for the best correlation between the initial data and new data given by the interpolation points. The data analyzed was collected samples from various water sources on the campus of Savannah State University. By applying the interpolation functions, the set of data is used to represent the dissolved oxygen, salinity, and temperature values in order to observe different trends on the graphs. The tool used in the process of looking for the best fit between collected data and chosen interpolation methods is the error function. The numerical procedures were implemented using Microsoft Excel and X-code for an app.

Using a YSI Meter; Salinity, Temperature, and dissolved oxygen was obtained from five different water sources (The Ville Fountain, SSU Marsh, SSU Stream, Hose water, and a drinking fountain) on the campus of Savannah State University in addition to one purified water source (Crystal Geyser bottled water). For each set of data we applied four different interpolation methods. Each method requires knowledge of calculation techniques, such as: recursive sequences, linearization, normalization, least squares method, differentiations, derivatives, minimization methods for the error function. Using an error function and graph properties, we decided which method provides a fitting curve for the initial data. Using Microsoft Excel, we were able to improve the data by adding interpolation points.
The Local Shepard interpolations approximate the initial data better because they use local properties of the points. In comparison, the interpolation method with quadratic spline piecewise functions did not provide expected results because their curvature is discontinuous at each breakpoint. The Non-linear least squares (hyperbolic form) interpolation method also produces accurate results because the data from the experimental tests tend to have horizontal or vertical asymptotes.
Next step in this research will be to implement the numerical procedures of Shepard's interpolation method in an app using XCode.

In conclusion, it was found that Shepard's local Interpolation with Franke-Nielson weights best reproduces the local properties and improves the tubular set of data. This method enables students to integrate the mathematics in lab experiments to graph the fitting curve for the data, to summarize findings and suggesting causes for any trends observed on graphs.

Funder Acknowledgement(s): I thank Dr. Sajwan and Dr. Pride for help in the field. K. Williams and Dr. Chetty provided logistic support. Funding was provided by an NSF-MAGEC-STEM Plus program.

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Nanoscience

346

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Enzymatic Synthesis of Metal Sulfide Nanoparticles

Robert Dunleavy, Lehigh University

Nanoparticles have a wide array of applications in fields ranging from diagnostic imaging to fuel cells. Unfortunately, the conventional syntheses of these nanoparticles occur under harsh conditions in toxic organic solvents. As such, the bacterial synthesis of nanoparticles has received considerable attention for its economic and environmental advantages over conventional syntheses. Through biological techniques, a strain of Stenotrophomonas maltophilia was evolved to produce CdS and PbS nanoparticles. An enzyme in S. maltophilia's genome, cystathionine gamma-lyase (CSE), was thought to be responsible for the observed bacterial nanoparticle synthesis. Experiments were taken to express and purify CSE to observe nanoparticle formation on an environmentally friendly and affordable scale. Molecular cloning techniques were used to transfer the CSE gene from S. maltophilia to E. Coli BL21. Standard protein expression tech-

niques were used and CSE was obtained in high yield and purity. CSE was then incubated with various substrates and metal salts to observe the formation of nanoparticles by absorbance, fluorescence, and X-ray diffraction.

High quality CdS and PbS nanoparticles were produced upon incubation of CSE with cysteine and cadmium or lead salts, respectively. Absorbance and fluorescence showed increasing nanoparticle concentration with increased incubation time while X-ray diffraction identified the nanoparticles as CdS and PbS. Controls in which CSE was incubated with only cysteine or metal salts led to no nanoparticle synthesis. The ease in which these reactions proceed, allows large quantities of nanoparticles to be produced at room temperature and pressure in under a few hours. Future work involves improving the quality of the synthesized nanoparticles and investigating on a mechanistic level why CSE can produce such high quality particles.

References: Zhou et al. "Biosynthesis of CdS quantum dots with extrinsic control over particle size." Submitted.

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347

Subcategory: Biomedical Engineering

Characterization of Gold Nanoparticles for Nanotoxicity Studies

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Nanoparticles have influenced advancement in the fields of science and technology;however there is a limited knowledge on the effects of particles on living biological systems. Nanoparticles possess discrete physicochemical properties that allows for an extensive assortment of distinct applications and result in different effects. Therefore, accurately characterizing the particles produces more accurate understanding of results. The plate-reader, zetasizer (dynamic light scattering) and transmission electron microscope (TEM) are used to analyze gold nanoparticles on the basis of size, shape, concentration, and surface charge. These data provide an accurate understanding of particle properties prior to using the particles to assess nanotoxicity.

Funder Acknowledgement(s): LSAMP; Parris Foundation

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348

Subcategory: Biomedical Engineering

PLGA Nanoparticles as a Delivery Agent for Cancer Cells

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Historically it has been difficult to combat cancer in any for because of its ability to elude traditional forms of medicine, such as chemotherapy, radiation, and surgery. In fact, cancer treatments negatively affect the patient and are, at times, ineffective against preventing cancer entirely. Hopefully, a new form of treatment can be more effective and less hazardous for the patient. In the present study, we wanted to evaluate nanoparticles (NPs) as drug delivery agents to cancer cells. Anti-cancer drug, Doxorubincin Hydrochloride (DOX) was encapsulated in poly (DL-lactide-glycolide) PLGA NPs to allow low doses of the drug to be released into the body over an extended period of time in order to kill cancer cells. Drug encapsulated PLGA and PLGA NPs were prepared using "emulsion" method. The NPs were characterized using Zeta sizer, TEM, SEM, and FTIR. PLGA-DOX NPs were around 205 nm with a charge of -23.4 mV. PLGA alone were around 128 nm and potential of -20.7 mV. Both PLGA–DOX and PLGA are stable based upon their zeta potential. Both PLGA-DOX and PLGA alone were stable based upon their zeta potential. Our results showed 90% drug encapsulation of NPs. FTIR analysis confirmed that DOX was successfully encapsulated in the PLGA. Strong characteristic peak was observed at 3308 cm-1 corresponding to N-H and C-H stretching of pure DOX and a strong characteristic peak at 1756 cm-1 corresponding to C=O stretching. Release of the drug from NPs was evaluated in PBS by continuous shaking and estimating absorbance at 480 nm. In vitro drug release confirmed that 73% of the drug was released by 24 hours. The cell viability of A549 cells in the presence of PLGA-DOX NPs and DOX alone was evaluated in trypan blue assay. At 500 µg/mL of PLGA-DOX, there was at least 70% of cell death. MTT assay of PLGA-DOX at 500 µg/mL showed 30% cell death in lung cancer cells. For PLGA alone, cell viability was 70% at 500 µg/mL in A549 cells and Hep-2 cell viability was 83% at 500 µg/mL. In both trypan blue and MTT assay, the drug loaded NPs caused toxicity to cancer cells, but not to the normal cells. The current results are promising; however, further research is necessary to achieve uniform sized NPs to increase drug loading efficacy in order to have a more efficient way to kill cancer cells.

References: 1. Fairley S. et al. 2013. Intl. J. nanomedicine. 8:2085-2099.
2. Khemani M. et al. 2012. Anls Bioll Res. 3:4414-4419.
3. Mirakabad F. et all. 2014. Asian Pacific J Cancer Prev, 15

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349

Subcategory: Biomedical Engineering

Modification of the Co-Precipitation Method to Synthesize Iron Oxide Nanoparticles with Higher Specific Absorption Rates

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Thanks to advances in nanotechnology, it has become possible to synthesize, characterize, and especially modify the surface of nanoparticles for biomedical applications. Due to their promising properties, several investigations have been carried out in the biomedical field using nano-scaled iron oxide magnetic nanoparticles, usually called ferrofluids, such as magnetite (Fe3O4). The properties of iron oxide nanoparticles are remarkable, particularly for their promising role in the biomedical field especially in diseases like cancer. However, the preparation method of these nanoparticles has become a challenge primarily because their properties are strongly influenced by particle size, shape, agglomeration and size distribution. These nanoparticles have demonstrated superparamagnetism characteristics at room temperature, in which is obtained an accurate ratio and pH range when compared to the conventional protocol. The hypothesis of this project is that by optimizing the conventional co-precipitation synthesis protocol, nanoparticles with a smaller hydrodynamic diameter can be produced, along with less agglomeration, higher magnetization properties and a higher Specific Absorption Rate (SAR). To this end, an experimental design was developed to investigate the effect of temperature and peptization on the resulting SAR values. Focus was given to temperature at a range of 20˚C-30˚C and 80˚C along with the condition of peptization, incorporating the use of an ultra-sonicator probe. To increase the magnetization properties of the particles sodium hydroxide (NaOH) was added in a scaled down co-precipitation synthesis with two different experimental set ups. Nanoparticle characterization techniques like Dynamic Light Scattering (DLS) and UV-Vis spectroscopy were carried out to measure the hydrodynamic diameter and the iron concentration, respectively. Preliminary results indicated a decrease in the diameter of the nanoparticles at room temperature and a more effective peptization. By understanding and optimizing the conventional co-precipitation protocol, our findings will improve the heating efficiency of the nanoparticles, which will increase their potential for biomedical applications.

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350

Subcategory: Materials Science

Gas Adsorbate-induced Magnetic Modifications in Superparamagnetic Clusters

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Wayne Archibald, University of the Virgin Islands, St. Thomas, USVI, in association with Brookhaven National Lab, Upton, New York

Ferromagnetic metals such as Nickel (Ni) have a permanent magnetic moment and gas phase adsorbates bonded to the material affect the magnetic properties of the metal. In this study we address the effect of a set of adsorbates such as Hydrogen (H), Lithium (Li), Beryllium (Be), Boron (B), Carbon (C), Nitrogen (N), Oxygen (O) or Fluorine (F) on the permanent magnetic moment of a Ni4 magnetic cluster. Transitional metals are often used in nano-devices making it important to gain a better understanding of the effects of gas-phase adsorbates on the magnetism of these metals.

To conduct research we use GPAW, a Density Functional Theory-based code, to analyze the magnetic properties on the clusters. We calculate magnetic moments for the clusters both with and without the adsorbate to gain insight into the adsorbate-induced magnetic quenching. It is expected that the adsorbate-induced metals will have a lower energy and be more stable than the cluster lacking the adsorbate, but may undergo magnetic spin quenching. More research needs to be completed in order to attain results. In this experiment the adsorbates placement uses bridge geometry, meaning it joins two Ni atoms. In future studies, we plan to try different geometries, such as top, internal, and hollow for the placement of the adsorbate. Also, in future research, we plan to study the effects of the adsorbates on other transitional metals such as Iron and Cobalt.

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351

Subcategory: Microbiology/Immunology/Virology

Exposition of Foreign Peptides on Qβ Coliphage for Au Nanoparticle Binding

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It is known that Au can be used in the treatment of cancer in nano form as a probe to both target and treat cancerous tissues. And although Au itself can be used in the treatment, an anti-cancer biodrug can be coated onto the Au. However, two problems exist. One, nanoparticles tend to aggregate in vivo and are cleared by the immune system. The only way to prevent aggregation is to keep the nanoparticles separated in vivo. The second problem arises with the nature of biodrugs themselves. Biodrugs are made from the same biomolecules that make up the body, as such; they are also subjected to the same enzymes that degrade biomolecules in the body. This leads to indiscriminate distribution, degradation, and a risk of under-medicating. To compensate, a larger dose of the biodrug is given; however, toxicity becomes the risk. Since it is known that certain peptides (nano-tags) bind Au, we hypothesize that displaying these nano-tags on the surface of our bacteriophage Qβ, and allowing them to bind Au will prevent aggregation. This Au can then be coated with an anti-cancer biodrug, and the Au will convey protection to the biodrug. To achieve this, the genes of three gold-binding peptides: Au0 (LKAHLPPSRLPS), Au1 (VSGSSPDS), and Au2 (TGTSVLIATPYV) were inserted separately into the genome of Qβ at the end of the A1 gene. The resulting recombinant phages, pQβAu0, pQβAu1 and pQβAu2, were transformed with HB 101 E. coli. The plaque assay provided the titer and phage morphology, and RT-PCR confirmed the tag gene size for each construct. A binding assay allowed different concentrations of Au to bind to the recombinant phage. Confirmation and visualization of the phage-nanoparticle complex was verified via Transmission Electron Microscopy (TEM). The next phase is to focus on coating the Au nanoparticles with chemotherapeutic biodrugs.

Funder Acknowledgement(s): NSF

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352

Subcategory: Microbiology/Immunology/Virology

The Inhibition of Different Isolated Strains of Streptococcus Pneumoniae using Penicillin and Silver Nanoparticles

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Streptococcus pneumoniae is a lancet shaped gram-positive bacterium that can cause bacterial pneumonia, otitis media, bacteremia, and meningitis. Children and the elderly are at risk for contracting the bacterium because of their low or underdeveloped immune system. Despite the use of vaccines and antibiotics, pneumococcal infections remain a major cause of morbidity and mortality. This continual infectivity is likely due to the organism changing as science advances. The literature definitively shows that over time bacteria tend to become less susceptible to antimicrobials due to genomic changes. Our goal was to investigate the efficacy of penicillin and silver nanoparticles in inhibiting the growth of planktonic S. pneumoniae clinical isolates which were collected more than 20 years apart. We predicted that the strains isolated more recently would be less susceptible to antimicrobials due to mutations that the organism acquired over time. Using broth culture we found the minimum inhibition concentrations (MIC) of penicillin of the older S. pneumoniae isolate to be 0.25mg/mL while the younger isolate was 0.125mg/mL. The growth of the organism in the presence of silver nanoparticles remains under investigation. Our initial results for penicillin are contrary to the initial hypothesis. This could be due to the isolates having different progenitor bacteria or the exposure to antibiotics in the research laboratory over the years.

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353

Subcategory: Nanoscience

Investigating the Electronic Properties of Doped CVD Graphene

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Graphene has a very small bandgap and understanding its electronic properties will help to promote its use in transistors and other devices. It is necessary to study this material, since it has novel properties such as high thermal conductivity and high carrier mobility. It is difficult to mass-produce graphene using the exfoliation technique but Chemical Vapor Deposition allows for greater wafer sizes to be produced. Thus, it is necessary to investigate the electronic properties of doped CVD graphene. A thermal/ebeam evaporator was used to deposit the dopant amounts onto the surface of a single layer sample. Three samples were doped with one metal each, 0.5Å of gold, 1Å of silver and 1Å of titanium. A Hall measurement system was used to measure the carrier type, carrier mobility and carrier concentration. All samples were found to be p-type and compared to our pristine graphene sample, the titanium doped, gold doped and silver doped samples exhibited an increase in carrier mobility of ~19%, a decrease of ~24% and a decrease of ~8% respectively. Vienna Ab-initio Simulation Package (VASP) was used to understand the band structure and density of state (DOS) of graphene doped with different metals. This showed that there was indeed a shift in the Fermi level for the gold and titanium. At 0 eV, it was observed that there are available states and the band-gap was opened further. Moreover, Near-edge X-ray Absorption

Fine Structure (NEXAFS) Spectroscopy was used to analyze the molecular orientation and the electronic structure of our samples. The pristine graphene sample and the doped samples illustrated that there was a slight shift in the position of the π* resonance peak in the doped samples when compared to that of the pristine graphene sample. Differences were also noticed in the interlayer states of all the samples. Future research will be done to examine the electronic properties of n-type doped CVD graphene with different layers. Also, we will assess how these metals affect the structure of the Brillouin Zone and to observe their effects on its structure using NEXAFS. Finally, we will study how to fabricate electronic devices using CVD grapheme.

Funder Acknowledgement(s): NSF, HBCU-UP

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354

Subcategory: Nanoscience

Device Integration of Lithium Niobate Microring Resonators Patterned with a Silicon Hard Mask

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Lithium niobate (LN) is a promising candidate for integrated optical devices due to its combination of strong electro-optical and nonlinear optical properties. Ring resonators made of LN reduce device size and allow for nonlinear applications such as optical storage, second harmonic generation, telecommunication, and sensors. This project highlights work done to address two significant issues, the first dealing with the fabrication process non-uniformities and roughness and the second with device integration. A silicon layer was chosen as a potential hard mask because it can be deposited at high thicknesses, and the improved selectivity and hardness allows for the fabrication of a thicker LN structure. The device coupling efficiency, which is essential in nonlinear optics experiments, may be enhanced by improving the coupling between the waveguide and fiber. For this application, SU-8 waveguides were overlaid on the sample and attached to the existing waveguides to act as coupling pads for a lensed fiber. Cross section polishing is performed on the cleavage of SU-8 pads to minimize coupling loss. These methods described above will make the fabrication and optical test of LN devices more robust and increase the device performance by improving modal confinement and tunability. We demonstrated fabrication of a LN device by use of a silicon hard mask and RIE with smooth sidewalls and a high resolution. This method has been used to show the potential to fabricate both ring resonators as well as a photonic crystal cavity structure using a silicon mask accompanied by RIE. The next stage for the silicon mask will be to optimize the silicon mask thickness and the LN RIE process to create a steeper sidewall by tuning the RF power. The design process can be modified to deposit electrodes in order to electrically tune the resonator so as to create a fully functional and tunable modulator for potential use in telecommunications.

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355

Subcategory: Nanoscience

Fabrication and Characterization of Biodegradable Poly(e-caprolactone) Nanofiber Scaffolds for Bone Tissue Regeneration

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This research aims to develop polymeric nanofibers that can be used as tissue scaffolds. Nanoscale fiber scaffolds provide an optimal template for cells to seed, migrate and grow. The goal is for the cells to attach to the scaffolds, then replicate, differentiate and organize into normal healthy tissues as the scaffold degrades. In this study, non-woven poly (ε-caprolactone) (PCL) and hydroxyapatite (HA) nanofibers with different wt % compositions were prepared by electrostatic co-spinning technology. It was hypothesized that PCL and PCL/HA scaffolds will mimic the nano-features of the natural extracellular matrix (ECM). To test if these scaffolds mimic the properties of natural ECM, we used TRAMP C2 cell lines derived from transgenic adenocarcinoma of mouse prostate (TRAMP) mice. The scaffolds were analyzed by MTT assay at different time points to verify cell toxicity/ proliferation. Characterization for morphology of the electrospun fibers were observed using scanning electron Microscopy (SEM) and SEM micrographs were analyzed using image analysis software. The fibers were characterized for thermal behavior using Differential Scanning Calorimetry (DSC), and for chemical structure using Fourier Transform Infrared Spectroscopy (FTIR). Thus, our objective is to develop biodegradable scaffolds for bone tissue that mimics the size scale and chemistry of the ECM with an interconnected pore structure, and enhanced mechanical properties.

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356

Subcategory: Nanoscience

Double Pulse Laser Deposition of Polymer Nanocomposite Films for Optical Sensors and Light Emitting Applications

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The objective is to determine the visibility of creating operationally polymer nancomposite films for sensor and light emitting applications using the innovative modified double pulse laser deposition (DPLD) for host and dopant. The existing pulse laser deposition vacuum chamber has been modified to accommodate two laser beams of contrasting wavelengths for the situ ablation of two targets: a polymer host and a rare Earth-based highly efficient upconversion emitting inorganic dopant. Nanocomposite films of acrylic polymer and of the compounds of the rare Earth elements were fabricated by the proposed method with near-infrared (NIR) laser radiation (1064-nm wavelength) ablating the polymer targets and visible radiation (532-nm wavelength) ablating the inorganic targets. The devised nanocomposite films were characterized using X-ray diffraction (XRD), atomic force microscopy (AFM), ultra-violet visible optical absorption spectroscopy, and reflected high energy electron diffraction (RHEED). It was revealed that the produced polymer nancomposite films maintained the crystalline structure and the upconversion fluorescence properties of the initial rare Earth-compounds mainly due to the preferred control of the deposition process of the materials with essentially different properties. The prospective method can be potentially used for making a wide variety of composite films.

Funder Acknowledgement(s): US-Airforce, US-ARMY, NASA, LS-LAMP

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357

Subcategory: Nanoscience

Immuno-Stimulating Potential of PLA-PEG Nano-encapsulated Outer Membrane Protein of Chlamydia Muridarum

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Recently we reported PLA-PEG [poly (lactic acid)-poly (ethylene glycol)] encapsulated with peptide M278, derived from the outer membrane protein (MOMP) of Chlamydia muridarum, enhanced adaptive immune responses, which are required for protective immunity against Chlamydia infection. To date, the most promising subunit candidate vaccine is MOMP because it contains many antigenic T- and B-cell epitopes. Encouraged by these findings, we encapsulated the full MOMP, in PLA-PEG to characterize its immune-stimulating properties in vitro on mouse macrophages. We hypothesize that PLA-PEG nano-encapsulated MOMP will be more immunogenic since it contains more antigenic regions then M278. Here in this study, we used 1% poly vinyl alcohol (PVA) combined with the PLA-PEG copolymer and MOMP (500 µg) for encapsulation. Bovine serum albumin (BSA) at also 500 µg encapsulated within PLA-PEG served as a negative control. We showed that encapsulation of MOMP in PLA-PEG resulted in a high encapsulation efficiency of 65.74% which is in agreement with our previous findings. In vitro release of the encapsulated BSA showed an accumulative 58.63% release over a period of 12 days which is also congruent with our previous reports. Currently studies are ongoing to characterize the immune-potentiating property of nano-encapsulated MOMP using mouse macrophages. Results from these studies will lead closer to development of a vaccine against Chlamydia, the most prevalent sexually transmitted bacterial infection.

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358

Subcategory: Nanoscience

Determining Optimal Characteristics for CIGS/CdS Solar Cells through AFORS-HET Simulation Program

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Copper-Indium-Gallium-Selenium (CIGS)/ Cadmium sulfide (CdS) solar cells may provide greater energy conversion efficiencies due to the high absorption coefficient and the adjustable bandgap of materials. We used automat for AFORS-HET, a numerical simulation program for modeling heterojunction solar cells and measurements, to investigate the effect on solar cell performance by modifying structural parameters and chemical composition which directly affect the bandgap energy. The open-circuit voltage (Voc), short-circuit current (Jsc), efficiency (Eff), and fill factor (FF) were investigated. We specifically studied the photovoltaic properties dependent on 1) bandgap of light absorbing layers (CIGS/CdS), 2) layer thickness, and 3) doping concentrations. Our results found an optimized range of values for the CIGS bandgap (1.42eV-1.46eV), doping concentration (1x1019cm-3), and layer thickness (11000nm). In addition, I re-

searched the effect of the CdS and ZnO layer thicknesses on FF and EFF and recorded an increase in Eff by decreasing the Zinc Oxide (ZnO) layer thickness. Our future work will consist of investigating the internal and external quantum efficiency for a range of optimized device parameters obtained from this work. Results will give insight how the layer thickness, the doping concentration, and the bandgap of CIGS affect quantum efficiency. CIGS solar cells present a promising avenue of research for developing more efficient solar cells.

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359

Subcategory: Nanoscience

Pulse-Laser Deposition Using Two Layers: How Would it Impact Us?

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Much success has been made using the process of laser ablation in the production of devices and new medical systems. Laser ablations were used to study the various film thickness profiles. Previous research has verified that film-thickness profiles obtained in single PLD are calculated by using the well-known solution of the gas-dynamic equation which describes the expansion of the plasma plume in vacuum. The time for plasma formation is supposed to be short compared with the time of expansion, and the film depends on the initial dimensions of the plume and the adiabatic exponent of the vapor.

To obtain the theoretical model, the laser itself and its relationship with the plume that will be created must be considered. The radius of the plume Ro can be approximated by the radius of the laser spot. The height of the plume varies as well as the intensity of the emission of the nano-particles that will be emitted from the material being tested on as result of the frequencies used. Hence, this becomes a variable as well as the velocity of the particles. In addition, time is also a variable because it depends on the frequency of laser.

Unfortunately, single PLD has caused uneven coverage of the film produced. In addition, high defect or particulate concentration in various areas of the substrate has occurred. It is also not well suited for large-scale film growth because all particles, depending on the frequency, allocates at one point, and if a higher frequency is use, the particles might obtain a higher amount of energy and thus pocket of films will produce on the substrate instead of one even film.

Hence, the goal of this research is to make the extraction of the films more efficient by using two lasers. By doing this, the emission of particles from two different materials may provide the avenue to create a more even thin film and start the possibility of creating a compound of different elements from the atoms of each two materials. Furthermore, using two lasers may decrease the amount of time needed to produce a film. Because a plume will be produced from each laser striking the sample, there will be a certain portion where both would intersect and have individual equation. The frequency of the lasers will play the role in determining which particles are possessed more within the film. Once a mathematical model can be found, researches will have an easier job in creating thin films because they will know what variables to fluctuate to get a desire result.

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360

Subcategory: Nanoscience

Flourescently Labeled Glycol Chitosan-5 β -Cholanic Acid Nanoparticles for In Vitro Tracking

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Glycol chitosan-5β-cholanic acid nanoparticles are favorable candidates for disease treatment given their micellar nature and ability to encapsulate hydrophobic drugs making them more bioavailable, or more easily absorbed. The purpose of this study was to create a nanocomplex in order to determine whether or not these nanoparticles have the ability to differentially permeate the membrane of mammalian cells and decide if they have the potential to become drug delivery systems for cancer treatment. The nanoparticles were synthesized through conjugation of 5β-cholanic acid to glycol chitosan by dissolving the two substances in methanol and water, respectively, adding the solutions together and allowing it to stir for one day at room temperature. The 5β-cholanic-chitosan conjugate was then dialyzed and freeze-dried. A fluorescent probe, cyanine 3, was added to the conjugate by dissolution in dimethyl sulfoxide, stirring, dialyzing and freeze-drying. The nanocomplex particle size was found to be about 130 nm, through dynamic light scattering, making it small enough to be used in various bioimaging techniques. The nanocomplex was then dissolved in cell culture media, which was delivered to osteoblast and mammary carcinoma cells with varying exposure times of 15 minutes and 2 hours. The nucleus and actin of the nanoparticle-exposed cells, along with

untreated control cells, were stained with immunofluorescence and the cells were imaged using a light microscope. The preliminary imaging results showed that the nanoparticles were able to enter both the breast cancer cells and the osteoblasts, however they accumulated much more in the mammary carcinoma cells. Therefore, given that breast cancer tends to metastasize to bone, it is reasonable to say that if the nanocomplexes are loaded with a drug only the breast cancer cells would be adversely affected. Overall, the results indicate that glycol chitosan based nanocomplexes may have the potential to be used as a targeted drug delivery system for breast cancer treatment. In the future, a drug encapsulation study will be performed to determine how effective the nanoparticles are at encapsulating and delivering the drug to breast cancer cells.

Funder Acknowledgement(s): National Science Foundation

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361

Subcategory: Nanoscience

Tumor-targeted Magnetic Nanoparticles for Thermo-Controlled Drug Release

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This research was focused on the synthesis and characterization of a tumor-targeted drug delivery system (DDS) with thermo-responsive properties for the delivery and controlled release of hydrophobic anticancer drugs. Iron oxide magnetic nanoparticles (IO-MNPs) dissipate heat during the application of an alternating magnetic field (AMF). We coated IO-MNPs with the bi-functional copolymer block of biotinylated poly(ethylene glycol) (PEG) and poly(D,L-lactic acid) (PLA) for potential thermo-responsive drug release during the application of AMF. Hydrophilic PEG permits the transport of the DDS along the bloodstream and will be the responsible for providing the tumor-targeting properties by conjugation of an anti-body to its surface that will allow specific cell targeting. The magnetic core of the IO-APS nanoparticles constitutes 92-93%, as determined by thermo-gravimetric analysis (TGA).Gel Permeation Chromatography (GPC) was used to determine the molecular weight (MW) of PLA-PEG copolymer that range between 35-38 kDa for copolymers made with low MW PLA (10-18 kDa) and 37-43 kDa for copolymers with high MW PLA (18-24 kDa). The micelles hydrodynamic size was determined using the Dynamic Light Scattering (DLS). The hydrodynamic sizes for self-assembled and covalently attached micelles were 416.22 nm and 212.02 nm respectively. MNPs and micelles with APS show a positive zeta potential and with OA show a negative zeta potential. In conclusion, the MNPs were functionalized with APS or OA and coated with the PLA-PEG copolymer block in order to form the micelles. For the future, we need to optimize the micelles size, characterize the PLA-PEG copolymer block using NMR and determine the appropriate copolymer chain length for thermo-controlled drug release and colloidal stability studies.

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362

Subcategory: Nanoscience

Fast and Facile Synthesis of Stable and Biocompatible Silver Nanoparticles Stabilized by Polyethylene Glycol

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The role of green synthesis methods of nano-particles is very significant in the field of nanotechnology. Herein, we report the synthesis of stable and bio-compatible silver nano-particles by a fast and facile, one-step process involving polyethylene glycol. Silver nano-particles show enhanced properties, when supported on a substrate and incorporated into an organic or inorganic matrix. Silver nano-particles were prepared using silver nitrate (AgNO3) as a precursor in an aqueous solution of polyethylene glycol (PEG) which acted as both a reducing and stabilizing agent. The reducing re-activity of PEG is sensitive to its molecular weight, thus a study has been made on establishing the optimum length of PEG that exhibits maximum reducing abilities. Therefore, different molecular weight PEG, ranging from 200 to 8000 daltons have been be tried. Ethylene glycol and PEG 200 were used as a reducing agent and were found to be ineffective in their role in synthesis of silver nano-particle even at high temperatures (>150° C). However, under the same conditions, PEG 1000 was able to reduce Ag+ to silver nano-particles. Further studies demonstrated that the reducing properties of PEG increased with the chain length of the polymer chain of PEG. The size of the nano-particles depended on the reaction temperature and concentration of the precursor apart from the chain length of PEG. The properties of the synthesized silver nano-particles were studied at different reaction times. The ultraviolet-visible spectra were in excellent agreement with the obtained nano-particle studies by scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM) and size distributions. The silver nano-particles were characterized by using Fourier transform infrared (FT-IR) and zeta potential measurements. The use of bio-compatible reagents, such as PEG provides green and economic features to this work.

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363

Subcategory: Nanoscience

Using LIBS for Nano-materials Analyzation and Quantification

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Laser induced breakdown spectroscopy (LIBS) has been used since the late 1980s as an analytical breakdown technique. LIBS evaluates the relative abundance of each constituent element, or to monitor the presence of impurities. LIBS may be used to detect the major and minor elements of a particular material. The technique can be used to analyze solids, liquids, aerosols, and other materials. In the present study, LIBS was used to detect, analyze, and quantify silver nanoparticles. A pulsed Neodymium Yttrium Aluminum Garnet (Nd:YAG) laser operating at 532 nm was used to perform the experiments. The laser has a pulse length of approximately 8 ns. The silver nanoparticles were prepared and deposited onto pure silicon and aluminum substrates. In this experiment we used five different concentrations of Ag nanoparticles which included 1.0, 0.50, 0.25, 0.10, and 0.050 µg/mL. The wavelengths 328.07 nm, 338.29 nm, 520.91 nm were used for the analysis of the Ag nanoparticles. The typical precisions using Andor Shamrock 303i ranged from 5% to as high as 39% Relative Standard Deviation (RSD). The precision using a non-intensified CCD Avantes Spectrometer was within the same range using silicon as a substrate. The precision ranged from 19% to as high as 55% RSD using pure aluminum as the substrate. The calibration curves for Ag nanoparticles gave linear results with r-squared values ranging from 0.91 to 0.99 from both spectrometers. An ongoing study is also in preparation to determine if LIBS could be used for the analysis of nanoparticles inside of human cells.

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Physics

364

Subcategory: Astronomy and Astrophysics

Studying the Gas Cycles that Govern Galaxy Evolution

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We aim to study the formation and evolution of galaxies. Our goal is to determine the accuracy of cosmological simulation data (Ford et al. 2013) by comparing to "real world" galaxies. By examining the circumgalactic medium (CGM), a dynamically complex, multi-phase, metal enriched gaseous reservoir surrounding galaxies, we can learn about the cycles of gas and how they govern galaxy evolution. We employed a technique referred to as quasar (QSO) absorption lines, in which a quasar resides behind a galaxy and the CGM gas imprints absorption patterns in the spectrum of the distant quasar. These absorption lines can reveal the gas temperature, metallicity, and kinematics, and can help determine the global behavior of the galaxy. The purpose of this project is to measure the distribution of various ions (chemical elements) in the CGM as a function of distance from the galaxy in the cosmological simulations. We examined galaxies with masses of 1011, 1012, and 1013 M⊙ (solar mass) to measure the densities for ions from hydrogen, magnesium, carbon and oxygen. We present our work for the magnesium ion. We found that the cosmological simulation data (Ford et al) models are consistent with the observational data for distances further from the galaxy. However for closer in the simulation data are under-predicted.

Funder Acknowledgement(s): New Mexico-AMP

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365

Subcategory: Astronomy and Astrophysics

Identification of Young Low Mass Stars and Brown Dwarfs in our Solar Neighborhood

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Ultracool dwarfs (spectral types M7-L8) are faint objects with surface temperatures of ~1300-2500 K and masses that are 0.03 -0.1 times the mass of the Sun. These ultracool dwarfs include both low-mass stars that burn hydrogen in their cores and brown dwarfs which are not classified as stars because they are

unable to sustain hydrogen burning. Distinguishing between these classes of objects is difficult. Low mass stars should, according to stellar models, be nearly indistinguishable from brown dwarfs with the same surface temperature; thus, it is essential to identify and characterize young ultracool dwarfs for further analysis. In this study, we identify young (~700 million year old) ultracool dwarfs through a combination of colors and spectral features. We obtained our sample of ultracool dwarf candidates from Sloan Digital Sky Survey spectroscopic and photometric data that was cross-matched to near-infrared photometry from the Two Micron All Sky Survey Second (2MASS). Young ultracool dwarfs were selected initially based on the difference in J and Ks 2MASS photometric colorbands. Larger J-Ks colorband differences, which are on the redder end of the electromagnetic spectrum, imply youth due to reduced H2 absorption in the Ks band relative to the J band. The reduced absorption is a consequence of low surface gravity which is a characteristic of young puffy ultracool dwarfs that have not compacted yet. To confirm low surface gravity, we examined spectra of "red" ultracool dwarfs for spectral features indicative of low surface gravity. Both atomic and molecular features (Na I, K I doublets, VO, and FeH) were utilized as low surface gravity indicators. We present an initial list of young objects and examine the correlation between different youth diagnostics for ultracool dwarfs. Identifying young ultracool dwarfs is essential for characterizing their contribution to the stellar density of the Milky Way galaxy.

Funder Acknowledgement(s): Ohio State University Graduate School

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366

Subcategory: Astronomy and Astrophysics

X-Ray Flares from Galactic Centers as Emissions of Dynamic Supermassive Black Holes

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Sagittarius (Sgr) A* is a compact astronomical radio source, discovered at the Milky Way center near the border of the constellations Sagittarius and Scorpius. According to the motions of stars around the galactic center, astronomers believe that Sgr A* is a supermassive black hole with mass of about 4.3 million solar masses. Sgr A* is usually quite faint and emits steadily at all wavelengths including X-rays, but in 2001 a rapid X-ray flaring was detected from the direction of Sgr A*. Recently, NASA Chandra X-ray Observatory and other space missions such as Swift and NuStar have revealed that Sgr A* flares X-rays at a rate of about once a day. The brightest X-ray flare observed emitted ~ 10^40 ergs of X-rays and lasted thousands of seconds. The conventional explanation to these mysterious events that occurred at the Milky Way center is due to the falling of objects such as asteroids, comets, planets, and/or stars into the massive black hole at the galactic center. But the physical process of how the falling objects produce the observed X-ray flares is still unknown, because astronomers still don't know why the falling objects, torn apart (rather than compressed) by the black hole tidal force, heat up to 100 million degrees Celsius so suddenly on a regular basis. This study provides an alternative explanation for the observations of X-ray flares from Sgr A* according to the black hole universe model that was recently proposed by Zhang. The results indicate that X-ray flares from galactic centers can be understood as emissions of dynamic supermassive black holes. A supermassive black hole, when accreting matter, becomes dynamic and breaks its event horizon, which leads to the inside hot (or high-frequency) blackbody radiation leaking out and produces X-ray flares. We will calculate the energies of X-rays emitted by a supermassive black hole at the galactic center when objects of various sizes from asteroids/comets to planets to stars fall into it. Through these calculations, we will explain the current measurements of X-ray flares from Sgr A*. We will also make predictions, possible to occur at our galactic center, and compare the results obtained in this study with the measurements of strong X-ray flares from other normal and active galactic centers. We aim to develop a possible mechanism for the origin of the X-ray flares from galactic centers and deepen our understanding of black hole dynamics, galactic activities, and cosmological evolutions.

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367

Subcategory: Geosciences and Earth Sciences

Calibration of a Cavity Ring Down Spectrometry Setup for Measuring Aerosol Optical Properties

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Aerosols are solid or liquid particles that are suspended in the different types of air masses in the atmosphere. They possess different physical and chemical properties, such as the ability to absorb and scatter light, which depend on how the aerosol was formed, its origin and the type of aerosol. One of the major uncertainties in climate forcing is due to aerosols forcing- a consequence of lack of accurate optical properties measurements at all wavelengths of the solar spectrum. The goal of the experiment is to measure the optical properties of biomass burning aerosols, specifically those produced from cooking and forest wildfires that contribute to the Earths radiation budget and its impact on climate.

For the determination of the optical properties of ambient aerosols our Cavity Ring-Down Spectrometry and integrating Nephelometry setup needs to be calibrated and conduct a systematic analysis of sources of systematic errors. For the calibration, scattering PSL spheres were used to determine errors throughout the system's setup since the scattering coefficient should be equal to the extinction coefficient for purely scattering samples. This setup was used to determine the extinction of scattering and absorbing polystyrene latex (PSL) spheres of 390 nm and 404nm respectfully and a soot sample of 400 nm. The extinction coefficients obtained for the scattering 404 nm PSL spheres, 390 nm absorbing PSL spheres and the soot sample were: 1.337E-05 m-1, 9.569E-05 m-1, and 2.200E-05 m-1 respectively. The Single Scattering Albedo was also obtained for the lab standards, which were 0.7077 for the scattering PSL spheres and 0.0643 for the absorbing PSL spheres. Momentarily, we have determined the soot sample can attenuate light but less than what our PSL spheres are capable of attenuating after comparing extinction cross-sections. The system is now used to measure optical properties of soot and error correlations need to be determined for the 400 nm PSL spheres and be applied to our soot particles' data. Future work will consist of completing the error correlation for this particle size and for bigger sizes (500, 600 and 700nm scattering PSL spheres). Soot samples will also be analyzed using our CRDS and integrating nephelometry setup to determine their optical properties. These samples will also be analyzed under Scanning Electron Microscopes (SEM) to be able to observe their morphology and how it can change from stage to stage during the burning of the biomass.

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368

Subcategory: Materials Science

A Theoretical Investigation of Ferromagnetism in Doped Transition Metal Dichalcogenide WSe2

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Two-dimensional (2D) transition metal dichalcogenide represent new class of novel materials which have high carrier mobilities and large energy gaps. Due to these novel properties, these materials can be used as platform to study the interaction between ferromagnetism and charge conduction for potential applications in spintronic devices. In order to investigate the ferromagnetic properties, theoretical simulations based on density functional theory methods were conducted to understand the interaction between magnetic dopants in the host material. The study focuses on introducing 3d transition metals in WSe2 to produce ferromagnetism. Specifically, only dopants like Mn and Fe are able to generate long range ferromagnetism, while other elements only product paramagnetic or antiferromagnetic interaction like in the case of Ni. The nature of the ferromagnetic interactions is also shown to be different between Mn and Fe. For Mn, the ferromagnetism is mediated by the parallel spin-spin coupling between the magnetic impurities and the delocalized p-states of Se in the valence band. For Fe, the interaction between Fe and Se's p states is shown to be antiferromagnetic. In addition, the results also reveal that the ferromagnetic interaction is strongly dependent on the spatial positions, distances and concentrations of dopants. These theoretical results can provide useful guidance for engineering ferromagnetism in 2D transition metal dichalcogenide for advanced nano-electronic devices.

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369

Subcategory: Materials Science

Organic Piezoelectric Material Red

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Piezoelectric materials have wide applications in various technologies due to their useful property of converting mechanical energy directly into electrical energy. Currently inorganic piezoelectric materials are being widely used, the problem with these materials is that they contain expensive heavy metals and biohazardous materials, which not only increases the manufacturing cost, but are also harmful to the environment and our health. In the last few years there has been an increased interest for discovering safer organic alternatives to their inorganic counterparts.

Croconic acid was found to be ferroelectric in 2010. At CSUSB we began looking at various salts of this acid for newer materials with ferroelectric properties. Computational chemist at CSUSB (Dr. Kimberly Cousins) found that a particular salt of Croconic acid (Red) had potential to be piezoelectric along all of its crystallographic axis. After being synthesized, the powder x-ray diffraction confirmed that the crystal grew in the correct structural phase as predicted from theory. To test the piezoelectric behav-

ior of the material we created a simple, two parallel plate capacitor with Red as the dielectric material, and thermally evaporated gold electrodes. Appling AC voltage at 1 Hz to the sample and looking for displacements, we were able to detect piezoelectric responses on each axis of the material. The resulting graph, strain Vs Electric field (butterfly curve), is used to find piezoelectric constants. We recorded the piezoelectric constant to be 2E-6 cm/KV and 3E-5 cm/KV for the c and b Axis respectively. The problem is that the best butterfly curve obtained on the a-axis is not symmetrical, so we can consider two different piezoelectric constants from this curve; 1E-4 cm/KV and 8E-6 cm/KV. To compare these values a standard PZT disk was used under similar experimental conditions, which yielded a piezoelectric constant of 2E-4 cm/KV. So the biggest piezoelectric constant obtained from the a-axis curve is in the same order of magnitude as one of the conventional piezoelectric materials. The next step from here would be to try various other electrical testing methods to obtain more symmetric results, such as making thinner samples and testing them with an atomic force microscope for a more detailed observation of the displacement. This material is worth pursuing further since the preliminary testing reveals that this could be a promising piezoelectric organic material.

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370

Subcategory: Materials Science

Powder X-Ray Diffraction on Organic Materials

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Piezoelectric materials have tremendous device applications because of the transfer electrical energy to mechanical energy. However, most piezoelectric materials are inorganic, incorporating heavy elements (e.g. Ba, Ti) and some bio hazardous materials, such as lead, not only increase the device manufacturing cost, but are also harmful to the environment. We are trying to find an organic piezoelectric crystal to replace the inorganic counterparts that are currently in use. A salt of Croconic acid (Red) was predicted to be a piezoelectric material by first principle DFT calculation using the software VASP, a computational tool for solving quantum mechanical electronic structure. In general, crystals could grow in different phases with different properties and not all polymorphs are piezoelectric. X-ray diffraction is used in this study to identify whether the crystals grown in the lab are in the same structural form as that predicted by computational theory. By using Powder X-Ray diffraction we were able to determine if Red has grown with the predicted piezoelectric crystal structure making it a promising piezoelectric candidate for future device application. With the use of X-Ray diffraction I tested various polymorphs of the crystals out of which only one had the structure conforming to the piezoelectric crystal structure predicted by theory. In total there were three categories of crystals, one of Red with normal morphology, another with unusual morphology, and the third doped with Iron. Each crystal was crushed in a fine powder form and placed on a microscope slide which was then mounted on the sample holder of an X-ray diffractometer. The X-ray source was a copper Kα with an operational voltage of 45kV and current of 40mA. The X-Rays were incident with an angle ranging from 5° to 90°. The experimental data was plotted as the reflected intensity in counts per second on the y-axis versus twice the reflection angle (2θ) in degrees on the x-axis. Each plot had a small peak starting at fifteen degrees followed by the highest peak located at twenty two degrees. Even though all three crystals had different morphologies, they turned out to have the same crystal structure. Therefore, they should all have the same piezoelectric properties. My future plans are to use the X-Ray diffraction spectrometer to test other crystals.

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371

Subcategory: Nanoscience

Wavelength Dependance of Nanoparticle Enhanced LIBS on Stainless Steel Samples

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Laser-induced breakdown spectroscopy (LIBS) is a form of atomic spectroscopy that uses plasma generated from focusing the laser beam on various materials. There are several known applications of nanoparticles and due to their properties they are the focus of many research areas. Recently it has been shown that the deposition of nanoparticles onto metallic surfaces can enhance the emission from in a LIBS experiment [1,2]. The purpose of this project is to investigate the influence that the excitation wavelength has on nanoparticle enhanced LIBS. In this project, five types of National Institute of Standards and Technology (NIST) standard reference materials (SRMs) were used. The SRMs are stainless steel samples. It is a solid circular disk that has varying concentrations of chromium, magnesium, silicon and nickel. The initial set of LIBS experiments were performed using the fourth harmonic, 266 nm, of the Neodymium Yttrium Aluminum Garnet (Nd:YAG) laser. The laser energy that was used was 20 mJ. The emission was produced using a single shot from the laser. The spectrum was acquired using an Andor Shamrock 303i spectrometer. Each spectra was acquired approximately 1.5 μs and the plasma was formed and with a gate

width of 2.0 μs. It has been shown by several research groups that the LIBS intensity and analytical performance is influence by the irradiation wavelength. In this project we will report the calibration curves produced using the three harmonics of the Nd:YAG laser, 266 nm, 532 nm and 1064 nm. We will compare this with data acquired using nanoparticles. We focus on the effect that the nanoparticles have on the emission intensity, reproducibility and calibration curves produced using the SRMs.

References: [1] De Giacomo, A., Gaudiuso, R., Koral, C., Dell'Aglio, M., & De Pascale, O. (2014). Nanoparticle Enhanced Laser Induced Breakdown Spectroscopy: Effect of nanoparticles deposited on sample surface on laser ablation and plasma emission. Spectrochimica Acta Part B, 98, 19-27.
[2] Tognoni, E., Palleschi, V., Corsi, M., & Cristoforetti, G. (2002). Quantitative micro-analysis by laser-induced breakdown spectroscopy: A review of the experimental approaches. Spectrochimica Acta Part B, 57, 1115-1130.

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372

Subcategory: Physics (NOT Nanoscience)

Optical Transitions of Eu Ions in GaN: The Puzzle of the 634 nm Peak

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GaN doped with Eu is an important material for future use as the active layer of red LEDs. After excitation, the major emission, in the spectra takes the form of 3 peaks centered on 621 nm. These peaks are assigned to the 5D0 to 7F2 transitions of the majority defect center, Eu1. However, the spectra also shows a much smaller peak at 634 nm. This peak is roughly 20 times smaller than the ones at 621nm, but becomes comparable in strength in the emission of the most efficient LEDs. While this observation underscores the relevance of this emission peak for application, its origin remains unclear.

In literature, the 634nm peak is often assigned to the 5D1 to 7F4 energy level transition. However, the peak is present with the same strength under resonant excitation conditions (see figure) for which only the 5D0 state is excited. Excitation of the 5D0 would require additional energy and the questions arises where the additional energy comes from.

To address this question, temperature dependent measurements using confocal spectroscopy were performed. While we find a significant reduction of intensity for all peaks and a broadening of the 621nm peaks, the relative ratio of the integrated emission strengths at 621nm and 634nm is barely changed. This excludes thermal activation as the main process.
Data recently collected, as well as old data, was further analyzed to determine if the strength of the 634nm peak is dependent on sample growth conditions and annealing. For both cases, we were able to exclude an effect.

Finally, we were able to exclude the possibility that the 634 nm peak is a phonon-assisted transition. Such transition would be shifted by the phonon energy (11meV and 66meV) from the 621nm lines. In fact, we see such a replica (see figure) shifted by 11meV. The 634 nm peak on the other hand does not show any signs of splitting into the 3 peaks, and is only 40meV from Eu1 instead of 66meV.

At this point, the origin of the 634 nm peak is still open, but we speculate that it might be related to a different Eu sites and/or a center reconfiguration during the optical excitation process. Further investigation needs to be done to determine what affects the 634 nm peak and what causes the high intensity found in the most efficient red LEDs.

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373

Subcategory: Physics (NOT Nanoscience)

Optical Imaging of Single DNA Molecules

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To date, the primary means of imaging DNA is through fluorescence labeling. However, chemically attaching the fluorescent dye to the DNA alters its dynamics. Thus it is important for us to be able to image DNA in a non-invasive manner in order to further study its structure and interactions. This project aims to demonstrate the imaging of unlabeled straightened DNA using a polarization based microscopy technique. Optical images are compared to images taken using atomic force microscopy (AFM). Initial attempts to optically image did not show DNA; however, changing the sample substrate and laser could render images of DNA. Such an imaging technique could be of tremendous benefit to next generation sequencing techniques such as nanopore sequencing.

Funder Acknowledgement(s): UC LEADS Program

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374

Subcategory: Physics (NOT Nanoscience)

Beam-Normal Asymmetry of Pion Electroproduction in the $\Delta(1232)$ Region

Brandon Buncher, College of William and Mary

We made theoretical calculations of the normal beam spin asymmetry in the reaction $ep \rightarrow e'\Delta(1232)$. The $\Delta(1232)$ is a nucleon excited state with spin $\frac{3}{2}$, and decays rapidly into a proton or neutron plus a corresponding pion. The normal beam spin asymmetry has the incoming electron polarized perpendicular to the scattering plane, and is defined as $A_n=\frac{N_R-N_L}{N_R+N_L}$, where N_R (N_L) is the number of electrons scattered in the positive (negative) direction relative to $\hat{p} \times \hat{s}$, where $\hat{p}$ is the unit vector in the direction of the electron's momentum and $\hat{s}$ is the unit vector in the direction normal to the scattering plane. The normal beam asymmetry is small and proportional to the electron mass, and is present even in the one-photon exchange approximation. There is experimental data on A_n available as a byproduct of the Q_{weak} experiment, though the relevant formulas are not present in the literature. We have derived the formulas, and have evaluated them in terms of the standard multipole amplitudes, which are the basic amplitudes for pion electroproduction, $ep \rightarrow e' \pi N$ (including $\Delta(1232)$ production and subsequent decay). The one-photon exchange calculation yields no asymmetry when only the electron is observed; however, the two-photon exchange yields an asymmetry. The one-photon exchange approximation can yield an asymmetry when only the pion is observed because of the final state interaction, and calculations are in progress.

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375

Subcategory: Physics (NOT Nanoscience)

Lattice Kirigami

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Kirigami expands upon origami by allowing not only folds, but also cuts, into materials. My project explores and develops a simple set of kirigami rules for cutting and folding honeycomb lattices. We consider origami-like structures that are extrinsically flat away from zero-dimensional sources of Gaussian curvature and one-dimensional sources of mean curvature, and our cutting and pasting rules maintain the intrinsic bond lengths on both the lattice and its dual lattice. Through experimentation by folding, cutting, and pasting the edges of paper, we find that a small set of rules is allowed, providing a framework for exploring and building kirigami. We believe that these rules provide the basis for constructing more complex, three-dimensional structures out of initially flat, incompressible materials. Our kirigami structures introduce new mechanisms to manipulate the geometry of materials from the macro to the nano-scale, for the beauty of kirigami is that it is scale-independent. Future research goals would be to apply our design rules to create more complex three-dimensional structures, and to materials more intricate than paper that could self-assemble into a target geometry given some simple external stimulus such as heating or swelling.

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376

Subcategory: Physics (NOT Nanoscience)

Calculating the Density of Radiation in the Dark Sector

La'Shant'e Grant, Savannah State University

This research involved proposing a model in which dark matter forms into an atomic structure. In order for the formation of "dark atoms" to be energetically favorable, there must be a type of radiation associated with the force holding them together to transfer energy. The mass density of dark radiation was calculated by finding the binding energy per atom. Because an additional component to radiation in the dark sector comes from annihilation between dark matter and dark anti-matter, we calculated the fraction of dark radiation coming from the formation of dark atoms. Two scenarios for the asymmetry were proposed between dark matter and dark anti-matter, in order to find an estimated value for the density of dark radiation. In the first scenario we let $n_L \sim n_B$, and we found $\rho_{rad} \sim 3 \cdot 10^{-20}\ kg/m^3$, where ξ is the ratio of the dark lepton and dark baryon masses and α_D is the dark fine structure constant. In the second scenario we let $\frac{\rho_{DM}}{\rho_B} \sim \frac{m_L}{m_B} \cdot \frac{n_L}{n_B}$, and we found $\rho_{rad} \sim 3 \cdot 10^{-20}\ kg/m^3$ for a GeV size dark baryon mass and $\rho_{rad} \sim 3 \cdot 10^{-17}\ kg/m^3$ for a TeV size dark baryon mass. Because the density of the known universe is ~ 9.9*10-27 kg/m3, this model was utilized to calculate a dark radiation density to seven to ten orders of magnitude larger than the density of the universe.

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377

Subcategory: Physics (NOT Nanoscience)

Stabilization of a Photoassociation Laser

Ariel Medina, University of Washington

At temperatures close to absolute zero, ultracold molecules are slow moving and experience chemical interactions that are quantum mechanical. For their unique properties, ultracold molecules can be used for things such as high precision spectroscopy and as qubits in quantum information processing. The objective of this project is to produce a stable laser beam from the photoassociation laser, to then produce ultracold RbCa molecules in the magneto-optical trap (MOT), and since RbCa molecules are yet to be studied intensively as other ultra-cold molecules, their research is very importnat. Stabilizing the photoassociation laser beam includes stabilizing the wavelength of the laser, and this is a critical requirement for the photoassociation of RbCa molecules. RbCa requires a wavelength less than or equal to 780 nm, thus the laser system needs to be flexible enough to scan a wavelength of 780 nm. For this specific photoassociation laser system, a temperature controller, laser diode controller, mirrors and lenses, and an optical isolator needed to be incorporated in order to effectively send the laser beam into the tapered amplifier (TPA), which ultimately will be used to send the laser beam into the magneto-optical trap (MOT) where RbCa molecules will be formed for data collection.

The photoassociation laser was able to scan a range of 779-781nm at the beginning of the set up, but ultimately the range fell to 779-780 nm and one explanation as to why this could have happened is that the wavelength of the laser beam changed after it refracted from the diffraction grating. This is possible because the knobs used to adjust the diffraction grating is very sensitive to touch and to disturbances. A temperature change of the laser could also be the reason why the range of the wavelength decreased because temperature changes the cavity of the laser, thus changing its wavelength.

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378

Subcategory: Physics (NOT Nanoscience)

Designing, Making, and Testing Sample Holder for Electron Parmagnetic Resonance

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Electron paramagnetic resonance (EPR) is a spectroscopic tool used to study properties of materials with the presence of unpaired electrons widely used in Physics, Material Science, Chemistry and Biology. EPR works by shining EM radiation and applying external magnetic field into sample material. By detecting reflected EM radiation, EPR allows to observe the behavior and local environment of electrons. However, measuring liquid tends to cause a spurious result because of light passing through sample liquid and reflecting at the bottom of sample holder. It is because EM radiation acquires some phase as it passes through the sample before being measured by the detector. In addition, sample with a high concentrations or large volume cause refractive broadening, which makes a large change in the refractive properties. My goal of this project is designing, making and testing new sample holders geometries which allows us to be able to measure liquid sample with least spurious effect in the continuous-wave EPR. First, I designed multiple different sample holders using SolidWorks and made sample holders following the designs from Teflon rod in physics machine shop. Sample holders were characterized by CW-EPR with a standard sample and performance judged based on high amplitude with low noise and no distortion of signal lineshape. We find that by altering the geometry of the bottom surface we were able to observe changes in both signal amplitude and quality.

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379

Subcategory: Physics (NOT Nanoscience)

Statistics of Ionospheric Amplitude Scintillation and Its Correlation With Phase Scintillation Over Bahir Dar Using GPS-SCINDA During Solar Maximum Phase

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Ionospheric scintillation is one of the earliest known effects of space weather, and has a large-scale impact on radio communications and technologies today. These scintillations can reduce accuracy of GPS receiver's pseudo-ranges, phase measurements, and result in complete loss of lock on a satellite. Scintillations are most likely to occur during solar maxima, affecting equato-

rial and auroral regions. This paper presents a study of ionospheric scintillations throughout the Bahir Dar equatorial region during solar maximum, using the data collected from GPS-SCINDA dual-frequency receivers. The analyzed data is used to study the scintillation index (S4) and the vertical TEC (vTEC) retrieved by the receiver over a four month period (February 2014 to May 2014). The objective was to find the correlation between the scintillation index S4 and the vTEC. Most of the data we considered had a positive correlation. In addition, the S4 value proved to vary by day and by month.

Funder Acknowledgement(s): Howard University GEAR-UP

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Science and Mathematics Education

380

Subcategory: Astronomy and Astrophysics

Swift Observations of the Recent X-ray Activity of Eta Carinae

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The extremely massive Luminous Blue Variable binary star, Eta Carinae, lies 7,500 light years away, deep within the Homunculus nebula where vigorous Wind-Wind collisions between the primary star and the companion star generate high-energy gases that produce X-rays. Complex X-ray variations occur near periastron, the point of least stellar separation between the two stars. The exact nature of Eta Carinae's X-ray minimum activity, which occurs every 5.54 years due to the binary orbital motion, is still unclear. A detailed understanding of the mechanisms of the X-ray deep minimum stage and the associated differences in column density in each cycle will contribute to a clearer understanding of the wind-driven mass-loss from this unique system. Understanding the variability in Eta Carinae's high-energy spectrum during this period gives us a better understanding of the system's physical and stellar properties.

We present the processing techniques and background estimation methods used to process and analyze weekly observations made by the Swift Gamma-Ray Burst Explorer X-ray Telescope during Eta Carinae's most recent periastron passage in 2014. We also present analysis of Eta Carinae's current column density and compare it to that of previous cycles. While we expected that Eta Carinae's flux level during this periastron passage would mimic that of previous cycles, we have detected important differences. In over 18 years of observing with RXTE/Swift, the maximum X-ray flux of Eta Carinae in the 2-10keV band occurred on June 21, 2014, at a level of 3.53±0.13×10-10 ergs s-1cm-2. On July 20, 2014 a detected flux of 8.3±0.5×10-11 ergs s-1cm-2 strongly suggests that the 2 –10keV flux is declining as Eta Carinae approaches periastron. As Eta Carinae begins its recovery from the periastron passage, we will continue to monitor its flux level and neutral hydrogen column density to track deviations from previous cycles which may offer hints at the structural details of the system.

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381

Subcategory: Astronomy and Astrophysics

Neutron Stars

Ruel Mitchel, University o f the Virgin Islands

We present preliminary work on identifying the nature of X-ray sources in the globular cluster NGC6717. Previous work has suggested that one or more of the detected X-ray sources may be quiescent low-mass X-ray binaries, a binary star system comprised by a main-sequence star in orbit with a neutron star. Studying neutron stars gives us access to exotic jurisdictions that we can't explore here on Earth. A neutron star is a compact object that has roughly the mass of our Sun crammed in a ball approximately 10 kilometers in radius. A teaspoon of neutron star matter would weigh a billion tons on Earth, and they have magnetic fields trillions of times as strong as Earth's. Since we cannot sustain such conditions in laboratories, we observe neutron stars with telescopes to determine their properties and better understand these exotic forms of matter. Using NASA's Chandra X-Ray Observatory, SWIFT, and Hubble Space Telescope, we determine the flux of all X-ray binary sources in the NGC6717 globular cluster. We also analyze the X-ray variability of each source and search for any significant outbursts. I will display my results in examining this globular cluster using the data I analyzed from these telescopes. These data, together with previous studies of qLMXBs in other globular clusters (e.g. Guillot et. al. 2009), will help to constrain the dense matter equation of state.

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382

Subcategory: Education

Enhancing Parent Involvement in NC-CCSS for K-2 Mathematics

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In this study, the 2014 REU math team developed and provided a workshop that assisted parents in understanding the North Carolina Common Core State Standards for K-2 Mathematics to assist with student homework assignments. Parent involvement is defined as parent participating in the educational processes and experiences of their children. A chi-square analysis was used to analyze data collected from the pre survey and the post survey administered to participants in the workshop. The study revealed all of the individual components of parent involvement were positively and significantly related to educational goals. The study identified various aspects of parent involvement that yielded statistically significant results in affirming that parent involvement attributed to urban student achievement. These findings were particularly helpful for indicating which kinds of parent involvement influenced academic success. Most notably, parent expectations and styles demonstrated a strong relationship with scholastic outcomes. Parent expectations and styles created an educationally oriented ambience that established an understanding of the certain level of support the child needed to succeed academically. The REU mathematics team focused on three essential questions in this study: (1) What practices will increase parent awareness of K-2 NC-CCSS for mathematics at P. W. Moore Elementary School? (2) What methods can be used to strengthen parent skills in assisting with mathematics homework assignments at P. W. Moore Elementary School? (3) What actions can be taken to motivate parent involvement in the school improvement process focusing on mathematics at P. W. Moore Elementary School?

The long-term goal is to build stronger parent support systems in Kindergarten, 1st grade, and 2nd grade Mathematics in Pasquotank County Public Schools using the North Carolina Common Core State Standards. Continuation of this parent involvement workshop will be conducted at P. W. Elementary School during the 2014 - 2015 academic school years. Using the same research methods, attendance in the workshops will be enhanced by greater assistance by classroom teachers soliciting parents of Kindergarten through 2nd grade levels.

Funder Acknowledgement(s): Linda B. Hayden, Principal Investigator, Elizabeth City State University

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383

Subcategory: Microbiology/Immunology/Virology

A Model of River Blindness Highlighting Host and Vector Interactions

Dominic Gray, Norfolk State University

Onchocerciasis, or River Blindness, is a vector-borne disease that impacts about 25 million people worldwide. About 99% of cases are present in 31 African countries, and the rest are present in Yemen and 6 American countries. This disease is transmitted through bites of the Simulium blackfly infected with the helminth Onchocerca volvulus. O. volvulus can reproduce in a host for more than 10 years, producing millions of microfilaria. Since the Simulium blackfly is native to fast running water, conditions in Africa and Latin America near rivers are favorable for transmission. Those infected by this disease may have vision impairment, skin rashes, nodules under the skin, or in some cases, may show no signs of illness. Due to the high volume of cases in regions of poverty and little research elsewhere, this disease has been placed on the World Health Organization's list of Neglected Tropical Diseases. Here a model is proposed describing the spread of River Blindness in the scope of host-vector interactions. Non-linear compartmental models showed the host-vector interactions. The model for the host is an SIRS model where the vector population is divided into Susceptible, Infected, and Recovered classes. The model for the vector is a SI model where the vector population is divided into Susceptible and Infected classes. Parameters are manipulated in a series of MATLAB simulations. The diseases's reproduction number, R_0, is calculated using the Next Generation Operator (NGO) method. Typically, when $R_0 > 1$, an outbreak will not occur in the population, and when $R_0 < 1$, will not propagate in the population. The results of the simulations and mathematical inference to emphasize the need in studying this neglected tropical disease are presented. In the future, the efficacy of this model will be tested with data extracted from endemic areas and necessary changes will be made to better fit the data.

References: Van den Driessche, P., Watmoug, James 2002. Reproduction Numbers and Sub-threshold Endemic Equilibria for Compartmental Models of Disease Transmission. Mathematical Biosciences 180(2002) 29-48. \\ Basanez, Maria-Gloria, Ricardez-Esquinca, Jorge 2001. Models for the population biology and control of human onchocerciasis. TRENDS in Parasitology Vol.17 No.9 September 2001. \\ Chubb, Mikayla C., Jacobsen, Kathryn H. 2010. Mathematical Modeling and the Epidemiological Research Process. Eur J Epidemiol (2010) 25:13-19.

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384
Subcategory: Nanoscience

Nanotechnology Videogame for Middle School Students

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Some middle school students in Puerto Rico, whose economic status is limited, experience a lack of interest to pursue college studies in science and engineering. Throughout the last decade the field of nanotechnology has positioned itself in one of the most promising areas of science. In the past years, the UPRM CREST: Nanotechnology Center of Biomedical, Environmental and Sustainability Applications has been working in this field. UPRM CREST seeks to reach those middle school students in order to motivate them to pursue careers in STEM (Science, Technology, Engineering, and Math). Since gaming has shown potential value in education, this work's goal is to develop a nanotechnology video game accessible to middle school students. Many studies demonstrate that gaming, in addition to its entertainment aspect, is an excellent medium to address specific social problems. The game currently under development is called Nanito App. The main characters are "Nanito" and "Nanita" who are characters in nano-scale. The game under current development is based on the expected knowledge and interests of CREST participants in the outreach program. The story-line of the game is about a scientist who is experimenting with nanotechnology in his laboratory. Each of the experiments is a different level of the game in order to demonstrate one nanotechnology application per level. The game engine for game development is Unity and the software architecture is a pipeline. The current completed phases of the game are the world design and content design. The phase in progress is level design. The next phases are game writing and audio design. Information about middle school gamer's experiences will be collected and analyzed in order to incorporate feedback in the design of the game. Nanito App will be released free of cost.

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Social, Behavioral, and Economic Sciences

385
Subcategory: Physiology and Health

Adapting the Forced Swim Test to Assess Stress Responses in Drosophila Melanogaster

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The forced swim test (Porsolt, 1977) was developed on rodents, and has been used as an indicator of behavioral despair. We adapted this assay for the model system Drosophila melanogaster, and exposed flies to several stressors known to neurologically affect mammalian systems (oxidative stress, sleep deprivation, social isolation, and starvation). We demonstrated that male and female flies aged for five days (when they are sexually mature), and then stressed for one day, display different behavioral outcomes in this paradigm. We then assessed whether exposure to stress when immature would affect outcome in this paradigm if flies were tested when mature ("Early Life Stress"). Exposure to stress during early life can in some cases increase resiliency to later stressful events, or increase vulnerability. We developed this model in a genetically tractable organism to aversive environmental conditions. Newly eclosed male and female flies were collected and maintained separately under identical conditions for 5 days (sexually mature) and then exposed to a stressor, or stressed immediately after collection to control or stress conditions (1 day, sexually immature). 30 animals were screened for each population and stressor. Early Life Stress – flies were stress after eclosion, and then aged for 5 days before analyses. Flies were placed in polystyrene vials containing either 2% yeast, 5% sucrose in 1mL water (control for stress), water only (starvation stress), or yeast/sucrose paraquat on a filter circle. For sleep deprivation, animals were placed in vials yeast-sucrose, stably attached to a set at 300 rpm under a constant light source. Animals exposed to social isolation were individually placed glass tubes with yeast-sucrose; the tubes were capped, placed in a rack, and kept in a dark cabinet. Animals were maintained under control or stress conditions for 24 hr at 25°C prior to behavioral analyses. Chamber slides were used for the forced swim test arena. Each well was filled with 0.08% SDS, and a single fly was gently aspirated into the chamber until it settled into an individual well. Each fly was videotaped for 5 min. The parameters measured were average bout duration, number of bouts, and latency to first bout. Oxidative stress increased the duration of bouts for both males and females, and starvation increased duration for males. In the number of bout parameter, starvation increases bout number in sexually mature females. For the latency to immobility parameter, both immature and mature populations were affected. Starvation and sleep deprivation decreased the amount of time until the first bout in immature females, but did not affect mature females. In conclusion, Drosophila models stressed during early

life respond similarly to immature animals. This suggests that stress received at 1 day, which only had an effect on latency, were not affected by any of the induced stressors when assayed immediately after stress.

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386

Subcategory: Physiology and Health

Pschopthy-linked Narcissism, Heart Rate Change, and Aggression in Preadolescence

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Emerging throughout early childhood or adolescence, psychopathy is a recalcitrant clinical construct that is very similar to antisocial personality disorder. It is usually preceded by a formal diagnosis of conduct disorder prior to 18 years of age. Following its emergence from gene-environment interactions, psychopathy exhibits a variable constellation of personality, psychophysiological, endocrine, and neurobiological abnormalities, alongside aversive psychosocial characteristics including routine amorality, social deviance, reactive (RA) and proactive aggression (PA) as well as pathological narcissism. Surprisingly, tendencies toward criminality and other maladaptive predatory behaviors can be reliably detected among children ages 6 through 13 by psychometrically evaluating three pivotal subscales – impulsivity (IMP), callous-unemotionalism (CU), and psychopathy-linked narcissism/pathological narcissism (PN) using the Antisocial Process Screening Device. Prior literature suggests that in adults, PN is associated with aggressive behavior and that two fundamental categories of social aggression may be characterized by distinct psychophysiological profiles. In this study 253 eight and nine-year old boys and girls (57%) residing in Brooklyn, New York were recruited and their psychopathic traits and levels of social aggression were assessed. It is hypothesized that (1) after controlling for CU and IMP, PN should be positively associated with both RA and PA, and (2) among children with high PN, low to moderate heart rate reactivity during an emotional self-regulation task should also be associated with high social aggression. After multiple regression analysis, findings suggest both hypotheses are correct. More specially, PN is the strongest predictor of PA when controlling for CU and IMP, $\beta = .505$, $t(253) = 8.567$, $p < .001$. Thus findings extend the narcissism-aggression association in preadolescents, and further suggest that less psychophysiological fluctuation may be linked to elevated aggression irrespective of gender. Subsequently, findings also lend support for controversial research in clinical psychiatry which asserts PN as the primary trait responsible for the development of psychopathic/antisocial personality disorder. Future research aims to acquire better understanding between PN, psychophysiology and social aggression via larger sample sizes and various measurements of autonomic nervous system activity.

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387

Subcategory: Physiology and Health

The Ability of Eating Habits to Predict Cardiovascular Reactivity to Stress

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The present study examined the ability of eating habits to predict cardiovascular reactivity to stress. Since cardiovascular disease is the second leading cause of death in the United States, it was hypothesized that there would be a negative correlation between eating habits and heart rate, systolic and diastolic blood pressure. Specifically, participants with negative eating habits would have higher heart rates, systolic and diastolic blood pressures. The Eating Style Profile questionnaire will be used to measure seven eating styles. The seven styles are Emotional eating, Fresh Food vs. Fast food, Food fretting, Task snacking, Sensory, spiritual nourishment, and Eating Atmosphere and Social Faire. The questionnaire consists of 42 questions assessing the 7 eating styles. A Hypertension Diagnostics Pulsewave CR 2000 cardiovascular profiling instrument was used to measure heart rate and blood pressure as the particpants viewed a racially noxious scene digital video disc (DVD) . The scene depicted African Americans treated unfairly by Whites clearly because of their race. Heart rate and blood pressure were taken prior to the scene (pre stressor period), during the scene (stressor period), and while the participant recovered from the scene (recovery period). Each period lasted three minutes and measurements were taken 80 seconds into the period. A Multiple Regression Analysis revealed that emotional eating significantly predicted heart rate during the pre-stressor and stressor periods. The negative association revealed that emotional eaters tend to have higher heart rates. This finding may be attributed to the association of emotional eating with unhealthy food choices which leads to high heart rates. In addition, the multiple regression analysis revealed that eating atmosphere significantly predicted systolic and diastolic blood pressure during recovery period. The positive association revealed that participants with a calm and fun eating atmosphere had higher blood pressures.

This finding may be attributed to the notion that most students eat in the school cafeteria for the purpose of socializing with their peers, which may lead to higher blood pressures. In conclusion, the circumstances around the consumption of food contribute to health outcomes. Since on-campus students have different meal plans than off campus students, future studies should examine differences in eating habits between students living off campus and students living on-campus.

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388

Subcategory: Social Sciences/Psychology/Economics

Top-Down Control of the Phase of Alpha-Band Oscillations as a Mechanism of Temporal Attention

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Successfully executing an action in response to an event often requires attending to the particular point in time when that event is going to occur. Temporal expectation driven by bottom-up stimulus rhythmicity has been shown to improve accuracy in target detection. However, it is less clear whether top-down temporal attention can also benefit early sensory processing, and if so what the underlying neural mechanisms might be. The instantaneous phase of alpha oscillations (9-13 Hz) measured over visual and parietal cortex via scalp electrodes prior to the presentation of a masked stimulus can predict whether or not it will be perceived, suggesting that certain phases of the alpha cycle lead to optimal visual processing. We investigated whether alpha phase is also relevant to the ability to deploy attention to moments in time. To test the hypothesis that knowing when a stimulus will appear improves visual processing by biasing individuals' alpha phase towards their optimal phase for detection, we collected electroencephalography (EEG) recordings while participants completed a target discrimination task in which some targets appeared at a predictively-cued latency, while others appeared at an unpredictable latency. We found that top-down temporal attention improved perceptual processing, demonstrated by a significant increase in accuracy following a predictive cue at the short delay. The concurrent electrophysiological data revealed accompanying modulation of the phase of alpha such that phase differences were seen prior to target onset between predictively and unpredictively cued trials at both latencies. Importantly, the phase during these attended time windows was significantly biased towards that optimal for stimulus detection for each individual participant (defined as the phase at which detection was best). These data demonstrate a functional consequence of the phase of alpha, suggesting that these oscillations are not merely a noisy byproduct of an idling system, but rather a feature under top-down control that may serve as a mechanism for directed attention. Future research will explore brain regions that may underlie such control of the posterior alpha rhythm.

References: Mathewson, K. E., Gratton, G., Fabiani, M., Beck, D. M., & Ro, T. (2009). To see or not to see: Prestimulus alpha phase predicts visual awareness. Journal of Neuroscience, 29, 2725-2732.
Rohenkohl, G., Cravo, A. M., Wyart, V., & Nobre, A. C. (2012). Temporal expectation improves the quality of sensory information. Journal of Neuroscience, 32, 8424-8428.

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389

Subcategory: Social Sciences/Psychology/Economics

The Effects of Multitasking on Decision Making

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Many people believe that they are capable of multitasking. Although most people would not consider multitasking as a stressor, research demonstrates that multitasking can negatively affect performance (Junco & Cotton, 2012). Multitasking takes up attentional resources because people must divide their attention among the different tasks. Given the emphasis in today's society, we examined how divided attention acts as a stressor when people are making decisions.

In particular, a dynamic decision making task was chosen to use, a Water Purification Plant simulation. This task is a resource allocation and scheduling task and simulates a water distribution system. This task is called a dynamic decision making task because the environment the user has to decide on changes based on their previous actions. Because things are always changing in our environment, a dynamic decision making task replicates choice used in a more natural environment. Participants were asked to complete either only the dynamic decision making task or that task along with a secondary task simultaneously. The secondary task required them to generate out loud random numbers at a set interval. This seemingly simple random generation task is effective at dividing the participants' attention, and makes it challenging to complete both tasks.

Based on previous research, we expected that requiring the participants to complete two tasks simultaneously would lower

their performance on the dynamic decision making task because adding stressors to an environment typically decreases performance in making decisions. We also expected the natural learning curve that is present when practicing a task to be disrupted when required to complete another task simultaneously. We compare the results of this study with previous research where people make decisions under pressure, specifically with divided attention. The potential significance of this project is that it will contribute to the theory of how decision making processes are affected by the presence of additional attentional demands, specifically in situations that include divided attention. Additionally, we extend these findings into many current areas of research such as texting and driving, worker performance, and the education system.

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390

Subcategory: Social Sciences/Psychology/Economics

The Effect of Different Levels of Pressure on the Social Behavior and Communication of Subterranean Termites (Reticulitermes sp.)

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Subterranean termites typically communicate with each other through Rapid Oscillatory Vibrations (ROV). Also, their social behaviors can be observed through their number of contacts when placed in an environment with neighboring termites. The purpose of this study is to analyze how pressure correlates with the social activity of subterranean termites. It was hypothesized that as the pressure was increased that the amount of contact and ROV would decrease, therefore they would have an inverse relationship.

To observe these termites, we had to set up the camera to record their movements and the vacuum pump to change the pressure. The camera was placed to overlook the vacuum pump, and the vacuum pump was attached to a vacuum plate that the termites were placed on to simulate the different atmospheric conditions. Once the vacuum was set up, the ten termites in a petri dish were placed in the vacuum chamber, and the pressure would be adjusted. Right before we started to record the termites, we numbered them from 0-9, and used a random number generator to determine which termites to watch. The termite's movement would be recorded and then coded with respect to number of contact with other termites and ROV, and we repeated this for each experiment. We then found the number of contacts per minute of movement, and ROV per minute of movement.

After the experiments were conducted, an ANOVA test was run on the data, and it was determined that the results were not significant due to the F Ratios.. The F Ratio of contact/min: $F(2/18) = .469$, therefore it is not significant. The F Ratio of ROV/min: $F(2/18) = .634$, also not significant. As shown by this data, our hypothesis that termites would make more contact as the pressure decreased was not proven. In terms of future experiments regarding the social behavior of termites, there could be a wider range of pressures used in a similar experiment, or even adding temperature as an independent variable in order to observe that influence on termites.

References: Suiter, D.R., S.C. Jones, and B.T. Forschler, 2002. Biology of Subterranean Termites in the Eastern United States. University of Georgia Cooperative Extension Service (CAES) Bulletin 1209.

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391

Subcategory: Social Sciences/Psychology/Economics

Motivation in Digital Game-Based Learning

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Typical classrooms are comprised of students with various learning styles. Therefore, it is reasonable to have multiple teaching strategies that ensure maximized accommodation of each student's learning needs. The school systems, for a long time, have often neglected logical-quantitative modes of instruction among others and have been bias toward linguistic modes. Howard Gardner's Multiple Intelligence theory suggests that each student has a different mind and consequently remembers, performs, understands and learns in dissimilar ways (Gyan-Mante, 2013). If students' needs are appropriately met, then learning is better facilitated—leading to higher occurrence of positive reinforcement—and motivation eventually increases. Digital games provide means of incorporating the main intelligence learning styles such as visual/spatial, bodily/kinesthetic, musical/rhythmic, interpersonal, intrapersonal, linguistic and logical/mathematical into everyday teaching. Therefore, Ha: Effective use of educational digital games as instructional tools positively increases students' motivation and engagement during learning

and performing educational tasks. To test this hypothesis, a 14-item questionnaire adapted from the Motivated Strategies in Learning Questionnaire (MSLQ) (Pintrich & DeGroot, 1990) was administered to 12 students, generally between 6-9 years old, as a pre-test and then as a post-test after having them play an educational digital game based around the concept of friction in relation to speed, "Bugs on a Plate." The adapted version of the MSLQ measured intrinsic motivation, extrinsic motivation and task value. The pre-test vs. post-test T-TEST showed statistically significant values at the $p \leq 0.05$ confidence interval for task value, but not intrinsic and extrinsic motivation. Therefore, the null hypothesis was rejected. For further investigation, future studies of a larger sample size and more longitudinal in nature are anticipated.

References: Gyan-Mante, Richard. 'Gardner's Theory of Multiple Intelligences.' Educapsycho. N.p., 29 Mar. 2013. Web. 24 July 2014. http://educapsycho.wordpress.com/
Pintrich, R. R., & DeGroot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance, Journal of Educational Psychology, 82, 33-4

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392

Subcategory: Social Sciences/Psychology/Economics

Impact of Resources and Education on Hand Washing Behavior Among Young South African Students

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Despite its perceived simplicity, the promotion of hand washing for disease prevention remains a challenge, particularly in resource-limited settings. Many schools may have the resources for hand washing, but cultural customs or minimal education may prevent students from regularly practicing hand washing behaviors. Alternatively, students may lack access to the resources necessary for hand washing behavior to become established. A quasi-experimental study was used to test the hypothesis that access to key hygiene and sanitation resources in combination with educational programming would increase hand washing behavior more than educational programming alone. This study was conducted in two rural, neighboring primary schools in Vhembe District, Limpopo, South Africa. A resource intervention was conducted at School A, which included improvements in hygiene and sanitation facilities that increased access to soap and running water. Subsequently, education programs to promote knowledge, skills, and critical thought, developed in collaboration with local educators, were delivered at both schools. Pre-intervention observations (T0), including total counts of hand washing and hand washing paired with toilet facility use, were made at both School A and School B. Follow-up observations were made after a resource intervention at School A (T1), and after an education program at School A and School B (T2). At School A, significant increases in hand washing occurred following the resource intervention (total counts: T0=359, T1=712; t=3.61, p=0.018). Additional increases in total hand washing behaviors occurred following the education program (T2=1095, t=3.88; p=0.015). In contrast, at School B, with the education program alone, smaller increases in total hand washing were observed (T0=249; T1=324; t=2.08, p=0.065). The results support that access to key hygiene and sanitation resources, such as soap and running water, are necessary to achieve more substantial change in disease prevention behaviors, like hand washing. While education assists to both promote and sustain these behaviors at the individual level, education alone may not produce significant behavior change. The effect of the resource intervention and education programs on sustained hand washing behaviors of young students should be further assessed and the impact of similar efforts examined in different age groups.

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393

Subcategory: Social Sciences/Psychology/Economics

Olfactory Working Memory in Rats

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Working memory is defined as the capture of information that will be used during a brief delay. In humans, visual working memory has a capacity of 4 ± 1 items (Elmore, et al., 2011). Working memory is often studied with animals, but it is not clear if these studies tap into working memory as studied in humans. It has been observed to be impaired in aging studies. Olfactory memory, by the other hand, is the recollection of information acquired through the olfactory sense. It potentially has a large capacity, since we are always interacting with the environment, but it has a rapid decay (short term memory).

April et al. (2013) have suggested that olfactory memory in rats has unlimited capacity (at least 72 items). We used an Odor Span Task Assessment to test the hypothesis that olfactory working memory has a limited capacity. Using a working memory paradigm that is similar to that used in humans and thus likely to translate to human studies of cognitive decline, we are willing to answer the question. The experiment was conducted with 12 Sprague Dawley rats. We used lids infused with different scents and cups that could be baited (with food) or empty. The lid will be on top covering the cup completely on a circular open field arena. Rats were initially trained with an increasing list of odors from which they must select a new odor to be rewarded. Next, a change detection assessment was used (one old odor, one new odor were presented) with a memory load in every trail that increased throughout daily sessions. The span, which can be defined as the number of correct choices before the first error, and the longest run, which is the sequentially correct choices were the measurements for this experiment. The data shows that they were improving session by session in getting the correct choices. The longest run increased as a function of sessions. Additionally, selection of the novel odor was at chance on the first session but above chance after training, with an accuracy of ~90% ($p<.001$). It was expected that the rats would open every cup (by guessing) but what we actually observed was that rats were remembering the old odors. Ultimately, the development of an olfactory working memory model in rats may be a useful tool to explore the biological basis of memory loss in humans. Future directions are aimed at examining if there is dependence between olfactory and spatial working memory as well.

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394

Subcategory: Social Sciences/Psychology/Economics

Does a More Realistic Approach to the Shooter Task Reveal Similar Biases in the Decision to Shoot?

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Unarmed black men are three times more likely to be shot by police officials than armed white men. Understanding the factors that influence police officers' judgments to shoot unarmed targets is a question with considerable societal importance. Previous research using a "shooter task" has demonstrated that race and context (i.e., dangerous or safe environments) may bias decisions to shoot (Correll et al., 2002; 2011). However, such research has typically relied on stimuli with little relevance in the real world, such as presenting still images of targets on a small computer screen. Due to the real world implications of this question, we have tested whether similar biases are obtained with more realistic stimuli.

In our version of the shooter task, participants will be sitting in front of a 72 inch projector screen and shown images of individuals shooting guns or raising harmless objects. Participants were given a button box labeled "Shoot" and "Don't Shoot" and told to only shoot individuals with guns and avoid shooting those without guns. Insofar as life-size projected images are more realistic than small pictures, they may provide better estimates of the magnitude of biases in the decision to shoot outside the laboratory. We failed to replicate previous findings by target race; however participants did have higher error rates. Nonetheless, we did replicate past work showing reaction time differences. In the future, by exchanging the button box for a model gun that measures the participants speed and accuracy, the data may further our understanding of the factors that may influence the decision to shoot with the eventual goal of reducing accidental shootings of unarmed targets.

References: Correll, J., Park, B., Judd, C. M., & Wittenbrink, B. (2002). The police officer's dilemma: Using ethnicity to disambiguate potentially threatening individuals. Journal of Personality and Social Psychology, 83, 1314-1329.
Correll, J., Park, B., Judd, C. M., Wittenbrink, B., Sadler, M. S., & Keesee, T. (2007). Across the thin blue line: Police officers and racial bias in the decision to shoot. Journal of Personality and Social Psychology, 92, 1006-1023.

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395

Subcategory: Social Sciences/Psychology/Economics

Anticipatory Nostalgia

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The purpose of this study is to introduce anticipatory nostalgia, expecting to miss something in the future, as distinct from personal nostalgia, missing aspects of one's past. Personal nostalgia has been associated with psychological benefits. This study explores whether anticipatory nostalgia has similar benefits or has negative correlates, given its emphasis on the future. To examine this question, 147 undergraduate students at Lemoyne College completed the Survey of Anticipatory Nostalgia, a new survey to measure the hypothesized construct of anticipatory

nostalgia, the Nostalgia Inventory (Batcho, 1955; 2007), a dispositional measure of personal nostalgia, and a brief form of the PANAS survey of positive and negative affect. To attain measures of test-retest reliability, participants were invited to return after 4 weeks to retake the surveys (50% return rate). Consistent with the literature, the Nostalgia Inventory yielded an acceptable level of internal consistency as measured by Cronbach's alpha and split-half reliability and acceptable four-week test-retest reliability. Comparable reliability levels were obtained for the new Survey of Anticipatory Nostalgia. Scores on the two surveys were moderately correlated. Mean ratings of personal nostalgia correlated with the PANAS cheerful rating, whereas mean ratings of anticipatory nostalgia were associated with the PANAS rating of lonely. These initial findings suggest that anticipatory nostalgia can be distinguished from personal nostalgia. A more fully developed survey to measure anticipatory nostalgia will facilitate research to explore the extent to which anticipatory nostalgia serves either psychological benefits or less healthy correlates.

Funder Acknowledgement(s): Le Moyne College

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396

Subcategory: Social Sciences/Psychology/Economics

Increasing Supervised Delivery to Reduce Maternal Mortality in Apam, Ghana

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The African western coast is an area where access to medical care is limited. In these areas, conditions that are typically non-life threatening or are treatable have elevated mortalities. Of particular interest to our group is maternal mortality during and after pregnancy. In Apam, Ghana efforts have been made for the past several years to decrease maternal mortality by increasing supervised delivery. We propose that an increase in medical support has resulted in the decline in maternal mortality. The test group, including medical professionals, such as midwives, doctors, as well as pregnant women and the district director's prospective. Interviewing these people has given insight into ways to continue to reduce maternal mortality in rural Apam, Ghana at St. Lukes Catholic Hospital. To obtain the knowledge and opinions of the community's medical professionals and pregnant women, interviews were conducted with a structured set of questions. The questions were specific to the interviewee and included at least 12 questions geared to the target population. Our results indicated that unsupervised delivery was a high factor associated with maternal health. Poor midwife-patient relationship was a contributing factor to the increase in unsupervised delivery. Interesting, birthing position was identified as a key factor in the selection of health services. Assessing the interviewee's knowledge of maternal mortality, the importance of supervised delivery, and problems that intervene with supervised delivery in Apam, can give insight to the issue in other rural areas in the country.

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Technology and Engineering

397

Subcategory: Air

Flow Visualization of a Joined Wing

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The primary objective of the research project was to investigate the effect of joined-wing on the trailing vortices of an aircraft. Trailing vortices cause downwash on the wing which is responsible for the induced drag. Induced drag depends on the lift during aircraft operation at high angle of attack i.e. high lift conditions. Furthermore, trailing vortices are the primary source of wake turbulence and are a safety hazard for the aircraft following the lead aircraft. By reducing or eliminating the trailing vortices, the induced drag on the wing can be reduced and improve the aerodynamic efficiency and safety of an aircraft. A reduction of the induced drag can also improve the range and endurance of the aircraft.

Tests were conducted at three Reynolds numbers in the Auburn University 45 cm x 45 cm cross-section test section water tunnel on a scale model fabricated on a 3D printer. Flow visualization using dyes and hydrogen bubbles revealed the flow of a joined-wing model.

Results show that the joined-wing reduced the vortices on the wing and moved them further aft to the tail of the aircraft. It also moved the vortices closer together. Future research needs to be done to see the exact effects to the lift and drag of this aircraft. Following the testing of the model in the wind tunnel, the numerical data on the lift and drag curve the resulting data will then be compared to the lift and drag curve for an equivalent finite wing.

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398

Subcategory: Astronomy and Astrophysics

Determining the Limiting Magnitude of the Virgin Islands Robotic Telescope

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We present a limiting magnitude study of the Virgin Island Robotic Telescope (VIRT) located at the Etelman Observatory. The goal of the limiting magnitude study is to determine the required exposure time to detect a source of a given brightness. Due to the brightness of the night sky, the relationship between exposure time and brightness sensitivity is not linear. This study will also identify the point of 'diminishing returns' for the telescope, the point at which an increase in exposure time no longer produces a significant increase in brightness sensitivity. We present a limiting magnitude plot of brightness versus exposure time that demonstrates an approximate limiting magnitude of ~20. The data analyzed was collected exclusively at the Etelman Observatory in St Thomas, USVI and data reduction and analysis were accomplished using NOAO's IRAF utilities and the Smithsonian Astrophysical Observatory's DS9 image display tool. These results were obtained for the “open” filter position but future work analysis will include similar studies in standard UVBRI broadband filters.

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399

Subcategory: Astronomy and Astrophysics

Radio Frequency Interference (RFI) Blocker

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Understanding and mitigating Radio Frequency Interference (RFI) is an essential part of the Space Geodesy Project. RFI can interrupt, disturb, or limit the effective performance of electrical equipment. There are four SGP techniques at the Goddard Geophysical and Astronomical Observatory (GGAO); Very Long Baseline Interferometry (VLBI), Doppler Orbitography Radiopositioning on Satellite (DORIS), Satellite Laser Ranging (SLR), and the Global Navigation Satellite System (GNSS). An RFI blocker is being developed to mitigate interference between the equipment in use for the four techniques at the site. In order for these techniques to tie together and operate simultaneously without complications, there needs to be an effective blocker to prevent any unwanted noise. RFI is an issue at many locations that use SGP techniques, not just GGAO, so the question of, “what is an adequate RFI blocker,” is definitely one that needs to be answered. The primary objective was to figure out what material would have the best RF properties, as well as wind loading properties. Wind loading properties are important because this material would be deployed outside, which means it would need to be able to withstand turbulent winds and any other weather that may occur.

The three materials up for testing were AL100, stainless steel mesh with 18 holes per square inch, and stainless steel mesh with 100 holes per square inch. To test the RF properties, each material was placed in a Waveguide Analyzer, which was then hooked up to a PNA Network Analyzer. The PNA Network Analyzer measures the S-parameters, or transmission coefficients. The S-parameters that were important for this test were the S11 (return loss) and S21 (insertion loss). The test frequency range was 300MHz-18GHz to include all frequencies of the beacons and radars. This range of frequencies cannot be covered with a single waveguide size. The second RF property test was done with an S-band Waveguide Analyzer. The 100 Mesh and 18 Mesh materials were tested, just in a more specified and condensed frequency range that included the DORIS operating frequency~2035 MHz that interferes in the VLBI frequency range 2-14 GHz. The wind loading tests were done on a Jet Stream 500 wind tunnel located at my alma mater, South River High School. All three material samples were approximately 3’’x3’’ and placed inside of a tape and cardboard frame for stability purposes. All of the materials were tested in the wind tunnel at angles ranging 5°-40° from vertical and against wind speeds up to 80 miles per hour. Ultimately, the material that was chosen was the 18 Mesh because of its durability, ability to give sufficient blockage, and its cost. We ran into some issues during the testing phase that we have to correct, so we will have to do some of the tests over again to be able to correctly deploy a long term effective blocker. We currently have an 18 Mesh test blocker deployed at GGAO.

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400

Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Reactor Design: Kinetic Modeling, Construction , and Testing

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Sustainable production of biofuels and chemicals has been considered one of engineering's greatest challenges for the last decade. This challenge does not only rely on the search for new raw materials from which we can obtain biofuels and chemicals, but also in the design of equipment that could make their production more cost-effective in order to increase their potential for large scale processes. In this work we will present the process for the construction, modeling and testing of novel batch photobioreactors. These reactors were used for the growth of metabolically engineered microorganisms for the production of commodity chemicals. In this particular case we used different lactate producing strains of cyanobacteria under different conditions of CO2 concentration and temperature.

These reactors were built using 1L glass bottles and stainless steel and glass ports for sampling, mass, and temperature controlling. The reactors were surrounded by fluorescent tube lamps. This reactor design reduced costs from $10,000.00/L to $333.00/L for each reactor. The functionality of these reactors was measured by means of bacterial growth and production of lactic acid. The bacterial growth was quantified with optical density measurements and the concentration of lactic acid was quantified a using lactate assay kit. Batch photobioreactor modeling was based on the use of an unstructured non-segregated, empirical model based on the assumptions uniform light distribution, perfect mixing, constant volume and light limitation. The kinetic model was fitted to the data using least squares fit. The bacterial growth curve followed a linear trend as predicted and was proven to be light limited also as predicted by the model, but light distribution was not uniform throughout the mixture. Although the lactate producing strains were able to produce lactic acid the outcomes were not as expected since we obtained values that were below detection levels at the beginning of the experiment. The reactors were proven to be effective in terms of bacterial growth but not necessarily in terms of the production of lactic acid. Further studies must be made for the quantification of lactic acid using HPLC chromatography in order to obtain more accurate results.

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401

Subcategory: Biomedical Engineering

Engineering Light-Controlled Pigment Output Systems for a K-12 Lab Module

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Bacterial photography, a synthetic genetic circuit protocol that enables a lawn of bacteria to sense light and form images, has great educational potential but was previously not tailored for use in K-12 classrooms. The system fuses a light sensor from Synechocystis (algae) to a two-component system in E. coli, allowing the sensor to elicit transcription of a chromogenic reporter. However, the original strain does not have a recently optimized light-sensing system, producing lower quality images. Additionally, it utilizes an expensive substrate, S-gal, which is undesirable for educational distribution. To produce a reliable and accessible K-12 lab module, we combined the optimized light sensing systems with various visible reporters to determine which strain would produce more reliable and higher contrast bacterial photographs. For the red/dark and red/green light systems, we replaced the current GFP output with visible reporters including LacZ, which enzymatically produces the black pigment beta-galactosidase, bFMO, which enzymatically produces the pigment indigo, and eforRed, which codes for a red chromoprotein from coral. Using the Salis Lab RBS Calculator, we computationally designed strong ribosome binding sites, and using the Golden Gate cloning technique, we constructed these new plasmids. Bacteria containing these systems were added to molten LB agar, mixed with appropriate antibiotics, and plated. These plates were placed in light and dark chambers for 1 day. Visual observations without any aids were recorded since most K-12 classrooms do not have image analysis software. The red/dark light system with indigo showed the highest contrast images and was selected to continue with further optimization. We then tested static versus shaking pre-culturing, pre-culture period, and incubation temperature, and we found that static pre-cultures, if they were pre-cultured for 1 or 2 days, produced high quality photographs if the plates were incubated at 37˚C. These results are important for the accessibility and reproducibility of bacterial photography in a classroom setting, which require robust lab modules with materials found in a common high school lab, and will enable it to reach over 1,500 students this school year.

Future work includes instituting standard pre-culture conditions for each light and reporter system as well as developing new systems with pigments, such as violacein, that do not readily diffuse out of the cell, resulting in blurry images.

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402

Subcategory: Biomedical Engineering

Understanding the Migratory Patterns of Human Fibrosarcoma Cells and Murine Mesenchymal Stem Cells upon Topographical Changes of Shape Memory Polymers

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Shape memory polymers (SMP) are a class of "smart" materials that can transform between two distinct conformations through an external stimulus, such as heat or electricity. Their usage in bioengineering has led to a promising area of research that lies at the interface of cell and mechanobiology, providing insight into specific fields such as cancer and tissue regeneration. This project involves creating new tools that are anticipated to provide new insights into cancer therapies and tissue development, two processes that exist in dynamic environments. Thus, one of the many appealing features that highlight the usage of shape memory polymers is their dynamic functionality, allowing for accurate studies on how cells behave within the topographical environments of the human body, especially during metastasis. This study has been primarily focused on examining the migratory patterns of both human fibrosarcoma and murine mesenchymal stem cells via live imaging of fluorescently labeled cells and an intra-laboratory derived cell-tracking algorithm. A recent publication within our group has shown that changes in SMP topography preferentially drive cells' cytoskeleton to orient in tandem with the applied topographical change of the scaffold. Upon this, thermoplastic polyurethane SMPs are prepared by electrospinning at a diameter of 700-900nm to serve as a scaffold for the aforementioned cell lines, a diameter range critical in minimizing environmental stress. Through utilizing these scaffolds, this project has been driven under two related hypotheses that are being tested simultaneously. Each test, with either static or dynamic polymers, contains unaligned, aligned [controls], or 50/50 unaligned/aligned [experimental] electrospun scaffolds. The first hypothesis analyzes the overall migratory rate, in that cells will preferentially migrate faster on scaffolds with aligned fibers than on scaffolds with unaligned fibers due to the presence of a consistent track for cell's motor proteins. Furthermore, the second hypothesis will be predicated on the first and expanded through integrating a time effect to examine how previous exposure to scaffold fiber alignments will effect those cells' migration on new architectures. Through this component of the study, we anticipate that cells seeded on unaligned fiber topographies will eventually migrate onto aligned topographies, resulting in a slower migratory rate relative to cells that are permanently seeded on aligned fibers.

Funder Acknowledgement(s): James H. Henderson; Henderson Laboratory

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403

Subcategory: Biomedical Engineering

Performance Study of Adaptive Filtering Algorithms for Noise Cancellation of ECG Signal

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Research shows that Electrocardiogram (ECG) computer programs can perform as well as or better than human observers in observing ECG measurement and coding, and these programs can even replace the cardiologist in epidemiological studies and clinical trials. A problem arises in clinical settings because in order to replace the cardiologist, these computer programs must be able to remove ambient noise while also maintaining signal sensitivity. Our objective was to remove the contaminating signal in order to both obtain and interpret data more accurately. These real-time computer systems also must be fault tolerant to ensure reliability. This paper proposed such a fault-tolerant adaptive filter for noise cancellation of ECG signals. Also included is a comparison of both performance and reliability of non-fault-tolerant and fault-tolerant adaptive filters. After experimental testing, it was shown that the fault tolerant adaptive filter not only successfully extracts the ECG signals, but is also a very reliable system for this purpose.

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404

Subcategory: Biomedical Engineering

Optimizing Bacterial Photography Protocols in the High School Classroom

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Our lab has previously created bacterial photography, a process by which a petri dish of bacterial engineered to sense light is grown while exposed to a pattern of red light. Cells exposed to red light produce pigment while cells left in the dark do not, which creates an image on the petri dish (bactograph). However, the published bacterial photography experimental procedure lacked a highly-detailed, jargon-free protocol that utilized common laboratory equipment. By analyzing well-established science classroom experimental protocols, we optimized the published bacterial photography experimental instructions for use in a newly-developed bacterial photography science kit.

First, the new protocol adjusted the concentration of chemicals, removing excess quantities to require only the amounts required by the experiment, optimizing not only the contrast of the bacterial photograph but also the cost. To determine these optimum quantities, bacterial photographs were taken along a wide range of chemical concentrations, and through digital image analysis, we quantified the contrast between the induced and inhibited pigment production states. Second, the new protocol utilizes equipment standard in basic sciences classrooms, bypassing the use of dry heating blocks, micropipettes, and 3-D printed masks, which are found in research laboratories, with water baths, bulb pipettes, and transparency masks, respectively. Third and finally, the new protocol increased reproducibility by providing detailed directions worded for non-scientists along with a comprehensive manual providing background information, technique illustrations, and troubleshooting tips.

To assess the viability of the new protocol and bacterial photography kit, we invited 24 local area high school biology teachers to perform the experiment. The kit received a nearly unanimous response confirming that the new protocol was easy to follow and the required equipment was available in the average high school science classroom.

The bacterial photography protocol has become affordable and robust enough to be performed by inexperienced hands in basic laboratory settings, allowing bacterial photography to be used as a modern microbiology teaching kit to give students a hands-on, cutting edge experience with current molecular biology concepts. Future research includes adapting the bacterial photography experimental kit for low-resource classrooms.

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405

Subcategory: Biomedical Engineering

Creating and Standardizing Bacterial Photography in the Classroom

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Bacterial Photography is an educational activity which excites students about STEM fields by allowing them to take pictures using bacteria. Unfortunately, bacterial photography in the K-12 classroom has been held back by bulky and expensive hardware (costing thousands of dollars). In order for bacterial photography to be viable, the hardware must be cost-effective and usable in the classroom setting. Previous bacterial photography chambers have produced low quality photographs or no images at all. In order to create a bacterial photograph, individuals need to have E. coli cultures housed in a chamber that shines directional 640 nm light onto bacteria, for example from a LED, which represses production of an enzyme which produces the blue colored indigo pigment.

We used rapid prototyping techniques to create a new chamber. We first decided on which type of LED to use for the photographs. A 640nm 14V built-in resistor LED was selected because the LED is able to be subjected to varying voltages and would not need an external resistor to function; thus reducing cost. Next we determined the dimensions of the conical chamber. The diameter of the chamber stayed constant at 62mm in order to form a very tight fit with the petri dish. Multiple chambers were created with varying heights ranging from 20-70mm in 10mm increments. The height was varied in order to determine which height offered the best quality image while also minimizing the amount of material required to make the chamber. Bacterial photographs were then created using the same culture of bacteria. Quality was determined using qualitative measurements and image analysis. A chamber at the height of 30mm provided the optimal bacterial photograph relative to the other chambers. Finally, we determined the ideal voltage and light intensity. Additional photographs were created using different voltages, and using the same analysis methods as before, we determined that 12V created the best quality photograph with an intensity of 0.0054 W/m^2 (determined using a photometer).

In conclusion, we determined that bacteria in a 30 mm tall chamber exposed to a light intensity of 0.0054 W/m^2 produced a high quality bacterial photograph that can be created in the classroom. With the creation and standardization of a bacterial photography chamber, bacterial photographs are now feasible in a classroom setting. Future work includes creating more bacterial photography kits and shipping them to classrooms across the nation.

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406

Subcategory: Biomedical Engineering

Lysis at the Point of Care in Low Resource Settings

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Low resource clinicians face several challenges in diagnosing disease at the point of care, including finding an efficient and inexpensive way to lyse cells. One of the way diseases can be diagnosed is by DNA amplification, but first amplifiable DNA must be released from the cell. Staphylococcus Epidermidis is a bacterium that is very difficult to lyse. I examined three methods of S. Epidermidis cell lysis that are feasible to use in low resource settings by measuring the amount of amplifiable DNA recovered from the lysed cells. The three methods used were: a Bead Beating machine, the Omnilyse, and a boiling water bath. A bead beater is a mechanical method of lysing cells requiring electricity. An Omnilyse is a battery operated portable machine with glass beads to lyse the cells. The boiling water bath used was a beaker on a hot plate. All of these methods have comparable cost per samples value, and can be operated with relatively simple training. I used three to five intervals of time during which the S. Epidermidis cells underwent the different lysis techniques: 30, 60, 90, 120, and 360 seconds. I found the Omnilyse outperformed the bead beater and hot bath. It was 31.23 percent more efficient at extracting amplifiable DNA, making it the best of the options tested for point of care diagnosis.

Future expansion of experiments could include testing the lysis methods with different bacteria to determine if the efficiency of recovery of amplifiable DNA is comparable to S. Epidermidis' efficiency, with other bacterium like Mycobacterium Marinum, or Methicillin-Sensitive Staphylococcus Aureus.

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407

Subcategory: Biomedical Engineering

Development and Construction of Optimized Microscope Rotational Disk

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Cell adhesion is often measured using microfluidic devices and optical microscopy, allowing real time observation of how cells bind and detach (Thomas et al, 2004). An alternative approach is to use a rotating disk, which allows simultaneous measurement of a wide range of flow conditions, including time-variant, or pulsatile flow. In this project we develop a device to combine a rotating disk with real-time optical microscopy to measure adhesion of cells in defined flow conditions in a closed rotating system. Multiple applications of this medical equipment will allow for the least amount of volume of sample used (thus saving time and money); the device will be able to perform pulsatile flow (flow with periodic variations); and the device will allow for multiple shear stresses on a sample in a single experiment (in real time). It can be used to measure nano-forces between bacteria or other cells to cells or model surfaces. The information learned with this method will further develop solutions in combating problems relating to adhesion of bacteria or cells in our body, such as infection, thrombosis, and inflammation.

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408

Subcategory: Biomedical Engineering

Targeted Muscle Reinnervation Sensation Mapping Tool

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Amputees lack sensory feedback, which can make it difficult for them to navigate the environment. Targeted Muscle Reinnervation (TMR) presents a possible solution because patients reported that phantom limb sensation was triggered when the reinnervated area was touched. Currently, TMR sensation mapping is done by hand, which is long and tedious. An automated method of sensation mapping could be implemented to save

time and increase the accuracy and consistency of the data collection process. Our approach is to design a tool that can automate data collection. The TMR Sensation Mapping Tool is a user interface that digitally collects sensation data from patients who have undergone TMR surgery. In order to test the software, the TMR Sensation Mapping Tool was used in an experiment that tested how well individuals could differentiate between static and dynamic sensations. The results showed that subjects were 95% accurate when identifying dynamic sensations, compared to 24% for static sensations. This could be explained by the fact that the element of movement plays a large role in human cognition and their perception of objects. The TMR Sensation Mapping Tool was found to be an effective means of data collection because it helped produce accurate results in a timely manner. In addition to becoming a TMR Sensation Mapping Tool for TMR patients, this experiment has resulted in further scientific questions that could be addressed with the TMR Mapping Tool, such as how well people can perceive object orientation, placement, and materials, combined with static and/or dynamic sensation.

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409

Technology & Engineering

Subcategory: Biomedical Engineering

Investigation of Mechanism of Interaction of Antimicrobial Peptides with Bacterial Membrane

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Antimicrobial peptides (AMPs) are small proteins that are capable of destroying bacterial cells by penetrating through their lipid-rich outer membranes. AMPs can act as an alternative to antibiotics that have become increasingly inefficient due to increasing bacterial resistance. Despite their importance, mechanism of AMP action in disrupting bacterial membrane has remained elusive. It is unclear how the charge, amino acid sequence, length, and secondary structure of the AMPs can influence their antimicrobial activity. In this work, we use a coarse grained molecular dynamics approach to determine the molecular mechanism of AMP action on outer membrane of Gram negative bacteria. A coarse grained model of bacterial membrane rich in lipopolysaccharide was developed and benchmarked against atomistic representation. Self-assembled bacterial membrane was tested with a range of AMPs to determine their membrane activity. Simulations are in progress, and the results will provide a molecular level description of the nature of interactions that lead to membrane disruption. Understanding mechanistic function of AMPs will lead to improved designs of more effective peptides. Future research effort is on understanding how AMPs directly suppress biofilm formation.

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410

Subcategory: Biomedical Engineering

Electrical Stimulation of Contractile Electrospun Scaffolds for Skeletal Muscle Tissue Engineering

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Over 500,000 traumatic injuries to peripheral nerves and skeletal muscle occur each year. Muscle autografts are considered the standard treatment for functional restoration of muscle tissue for large tissue defects, however, this procedure can result in a loss of muscle volume and function at the donor site. The Musculoskeletal Tissue Regeneration (MoTR) Laboratory is developing a new biodegradable, biocompatible conductive scaffold for muscle tissue regeneration. This is important because if electrical stimulation is applied, it will not only promote cell proliferation and tissue organization of the cells but, it will also trigger a mechanical response in the scaffold itself that can aid in cell alignment. Previous research in the MoTR lab has shown that electrospun polycaprolactone polymer scaffolds with uniformly distributed electroactive hydrogel will bend in an electric field. The hypothesis for this study is if a banding pattern of hydrogel solution is applied to the scaffolds, when placed in an electric field, it will bend only at the specific bands of hydrogel. This should lead to an accordion-style contraction and better movement. Sample strips of scaffolds with various banding patterns were suspended in saline solution between two platinum electrodes and a constant current was applied. The results of this study showed that the scaffolds with banding patterns were able to move in an electric field, however, there is no clear trend between size of banding patterns and percent change in length. In addition, a low-cost electrical stimulation bioreactor was built in determine cell proliferation of the precursor muscle cells seeded onto these contractile scaffolds in electric field. This preliminary study showed that groups with electrical stimulation had a higher cell viability than groups without electrical stimulation. Future work will include changing the design of the scaffold in order to improve the amount of contraction that occurs in response to electrical stimulation. Additionally, contraction measurements will be obtained using a different methodology than was previously used.

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411

Subcategory: Biomedical Engineering

Chromosomally-based Phycocyanobilin Synthesis in a Freely Distributable E. coli Strain

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We have integrated an optimized phycocyanobilin (PCB) gene cluster into the Escherichia coli genome in an MTA free fashion in order to create a stable strain which can be distributed and used for bacterial photography as a part of a K-12 classroom experiment. PCB is a heme derivative required for light sensing in bacterial photography which is produced via two cyanobacterial genes, pcyA and ho1. Currently, these genes are maintained by a medium-copy plasmid, which mutates easily and impedes growth of the cells due to PCB production, depleting necessary intracellular metabolites. This results in a large range of variation between bacterial photographs taken with cells from the same stock. Chromosomal integration could decrease mutational frequency and result in a more stable strain which will create consistent, successful photographs. To increase the strain's stability, the genes pcyA and ho1, were integrated into the chromosome of E. coli via the P186 phage integrase and verified by PCR. The strain with integrated PCB production was shown to sense light comparably to the plasmid based strain when measured with a fluorescent reporter via flow cytometry. In order to overcome usage restrictions, the genes required for PCB production were subsequently isolated from the Synechocystis PCC6803 genome and combined with a chemically synthesized gene block containing bacteriophage 186's integrase gene and chromosomal attachment site as well as an antibiotic resistance marker. Thus, a new strain with integrated PCB production which can be freely distributed was created. Its performance was evaluated with fluorescent and pigment-producing reporters. Creation of stable, PCB-synthesizing bacterial strain that is free of MTA restrictions will allow for distribution of a reliable bacterial photography kits and enable more repetitive optogenetic experiments in the future. Future work includes more fully characterizing the functionality of chromosomally-integrated PCB synthesis, integrating the entire bacterial photography system, and testing integrated PCB production with other optogenetic systems.

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412

Technology & Engineering
Subcategory: Biomedical Engineering

Magnetic Microspheres for Arterial Embolization and Hyperthermia.

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Cancer-related death is the leading cause of deaths taking 1 out of 8 lives worldwide. At the current rate global cancer burden is expected to nearly double to 21.4 million cases and 13.5 million deaths by 2030. The current cancer treatments are invasive in nature and usually weaken the patient. From surgery to chemotherapy and radiotherapy, healthy cells surrounding the cancerous cells always end up being damaged or destroyed. Cancer cells generally perish at around 43ºC whereas normal cells are not damaged at even higher temperature. Therefore, hyperthermia has been suggested as a novel, minimally invasive cancer treatment method. Various techniques for heating the tumors have been attempted. However, deep-seated tumors cannot be heated effectively and locally using those techniques. These microspheres are the best hope of providing a useful attack on deep-seated cancerous cells. Titania (TiO2) microspheres containing magnetite (Fe3O4) nanoparticles where created in hopes of obtaining particles with a diameter or 20-30 µm so that when placed under an alternating magnetic field they could solve the cancerous cell issue through hysteresis loss. This entire process was done through a sol-gel method in a water-in-oil emulsion. The magnetite nanoparticles, where either bought or created through a co-precipitation process. The commercially available particles where obtained from Sigma Aldrich Corporation and the ones created followed the co-precipitation reaction: Fe2+ + 2Fe3+ + 8OH- = Fe3O4 +4H2O to completion resulting in black precipitate particles. These magnetic nanoparticles were then introduced into an oil phase consisting of kerosene, span 80 and span 60 and stirred vigorously. Water phase consisting of methanol, titanium tetraisopropoxide (TTIP), and diethanolamine (DEA) was also added. Once the solution was prepared it underwent a heat treatment process at both 150ºC and 500ºC for 3 hours after having being dried at 36.5ºC. Magnetite containing TiO2 microspheres were synthesized via a sol-gel process from TTIP in water-in-oil emulsion resulting in particles 5-8 µm in diameter with very rough surfaces. When placed under an alternating magnetic current, the microspheres should be able to generate an acceptable amount of heat. Heat-generating magnetite (Fe3O4) -Titania (TiO2) microspheres would be useful for hyperthermia of cancerous tumors. For clinical applications, the diameter of microspheres and/or the amount of magnetite (Fe3O4) will be further increased in order to produce a higher heating ability necessary to heat and attack deep-seated cancerous cells.

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413

Subcategory: Cancer Research

Multi-cellular In Vitro Models for Characterization of Tumor Targeting Efficacy of Nanoparticle Systems

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Reciprocal signaling among tumor and surrounding cells has been shown to contribute to drug resistance through the secretion of factors that allow tumor cells to block drug influx or alter genetic expression profiles. Previously, in vitro analysis of MNP cell specificity in multi-cell culture was not feasible due to the lack of discrete compartments within the same culture chamber. The use of nanoparticles to target the tumor microenvironment is of great interest in medical applications. Nanoparticle technology brings possible the development of drug therapies with cell specificity in order to reduce side effects. Before proceeding to studies in animal models, it is important to understand the behavior between the nanoparticle and tumor cells. To overcome the tumor microenvironment barrier in cancer therapy it is imperative to evaluate the efficacy of anti-tumor strategies in multicellular environments. Our previous studies show that co-culture and migration studies in multi-compartmentalize microfluidic devices mimicked cellular interactions observed at the tissue level providing a platform in which to study the molecular biology of diseases at the multi-cellular level, and evaluate the efficacy of potential drug candidates and strategies for clinical application (1-2). Thus, we designed an array of micro-well clusters and microchannel array to evaluate toxicity and cell specificity of magnetic nanoparticles (MNPs) coated with tumor targets: epidermal growth factor and RGD. Synthesis and Characterization of magnetic nanoparticles has been described in our previous publications (3-4). Epithelial, fibroblast and macrophage cell lines were selected based on the pathophysiological characteristics described for normal and cancerous tissues. Cell toxicity was evaluated for each cell type in monoculture to determine maximum concentration of MNPs prior to multi-cellular studies in micro-well clusters. Cells were co-culture in traditional 2-dimensions or embedded in 3-dimensional matrix while interacting within adjacent compartments during treatment with fluorescent MNPs. Confocal microscopy imaging shows co-localization of MNPs for each cell type.

Future studies will involve simultaneous detection of cytokines associated with tissue inflammation and MNP uptake in macrophages culture in cell clusters to determine a correlation among inflammation, and MNP active cell targeting /internalization. This multicellular approach will allow us to optimize cell-nanoparticles interactions to improve tumor targeting efficacy.

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414

Subcategory: Cell and Molecular Biology

Functionalizing Polyacrylamide Hydrogels with Matrigel Using Lift-off Techniques

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Heart disease remains a leading health issue. However, the heart differs from the majority of organs in that it fulfills a mechanical role, as well as a biological one. Therefore, to understand the health of the heart, it is essential that we understand its physical properties, as well as its biological properties. The behavior of healthy heart muscle tissue is incompletely studied. This makes it more difficult to diagnose and treat heart disease. It is also impossible to know if induced pluripotent stem cell cardiomyocytes (i-PSC CMs) have reached maturity without a marker of healthy, adult cell behavior. Cardiomyocytes are placed on polyacrylamide (PAAm) substrates of known stiffness in order to determine their mechanical properties. Polyacrylamide is not biologically compatible and must be functionalized with proteins in order for cells to attach. The patterns formed by the proteins on the gel surface also allows for control over cell size and shape. Usually cells are seeded on matrix proteins such as laminin and fibronectin, but the protein mixture Matrigel is also commonly used. Many methods involve “stamping” protein using patterned PDMS. However, this technique results in uneven fidelity of patterning and protein deposition. The patterns used are also confined geometrically by the stability of the PDMS structure. It was thought that a MAPL technique devised for fibronectin and glass could be modified for the patterning of PAAm hydrogels. Testing found that PLL-PEG lift-off techniques can be used to pattern Matrigel. This technique resulted in more uniform protein deposition than resulted from stamping. As a final proof of concept, i-PSC CMs were seeded on test gels and the results used to determine the most effective incubation concentration.

References: A. J. S. Ribeiro, Y. Ang, A. Denisin, D. Srivastava, B. L. Pruitt. Elongated cell shapes enhance maturation of iPSC-CMs

cultured on polyacrylamide hydrogels: cell structure and biomechanics. World Conference of Biomechanics, 2014.
E. Delamarche, H. Schmid, B. Michel, H. Biebuyck. Stability of molded polydimethylsiloxane microstructures. Adv. Mater. 1997, 9, No 9, 741-746
L. Feller, J.P. Bearinger, L. Wu, J.A. Hubbell, M. Textor, S. Tosatti. Micropatterning of gold substrates based on poly(propylene sulfide-bl-ethylene glycol), (PPS:PEG) background passivation and the molecular-assembly patterning by lift-off (MAPL) technique. Surface Science 602 (2008) 2305-2310

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415

Subcategory: Civil/Mechanical/Manufacturing Engineering

Testing of a Narrow Gap Detector Designed for a Sensitive X-ray Polarimeter

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Time projection polarimeters are gas detectors where incident X-rays interact with a gas atom to produce a photoelectron whose direction is correlated with the polarization of the incident X-ray. By imaging the path of many photoelectrons the polarization of the incident X-ray can be determined. The next generation of time projection polarimeter incorporates a narrow gap detector to minimize the diffusion in the transfer gap between the gas electron multiplier and the readout strips. We report on the testing performed to bring the narrow-gap design to Technology Readiness Level (TRL)-6. TRL-6 testing included random and sine burst vibration tests and thermal cycling tests. In addition, thermal shock tests and creep tests were performed to further demonstrate that the design would meet requirements, particularly flatness, throughout the life of a 2 year mission. The post-test inspection following the vibration testing showed no degradation or loss of flatness. Thermal Shock testing showed no indication that the extreme temperature had any effect on the detector. Creep testing showed no positive or negative trends in flatness. Thermal cycle testing also showed no change in detector behavior. All the requirements have been met and the narrow gap polarimeter is at TRL-6.

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416

Subcategory: Civil/Mechanical/Manufacturing Engineering

Mechanical Properties on Concrete with Fly Ash and Nano-Silica

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New technologies for the construction industry are required to comply with increasingly stricter environmental regulations. For instance, reducing cement demand in concrete fabrication lowers carbon dioxide emissions caused by its production. Industrial waste materials, such as fly ash (FA), possess cementitious properties. In effect, FA resembles cement paste once in contact with water. However, due to a slower reaction, FA decreases the rate of development of properties in concrete at early age. Strength development at early age in the presence of FA motivated this research by incorporating a mineral additive to counteract any loss of strength. Nanostructured silica (nS) having an average of 69nm in diameter have been used to that purpose. It was found that geometric features and size of FA and nS improved the workability, porosity and strength of concrete.

Density, compressive and tensile strength results are obtained for 7, 28 and 98 days of curing. A statistical design is developed from the results acquired by PC, FA and nS components. An optimization model is developed based on these results. This model generates a controlled experimental design centered on the resistance as a dependent variable of the components of PC, FA and nS, with a constant factor of w/b. Future work will continue to analyze other mechanical properties of concrete, such as flexibility, hardness, creep deformation, fatigue, and durability of concrete.

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417

Subcategory: Civil/Mechanical/Manufacturing Engineering

The Experimental Determination of Poisson's Ratio

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A key material parameter is the Poisson's ratio. This ratio defines a material ability to deform under load without changing its volume. This parameter is required in the design of compo-

nents of bicycles, cars, airplanes, but also in designing components of the civil infrastructures, such as bridges, roads, and buildings. Asphalt binder represents the black, adhesive material that holds together the aggregates in asphalt mixtures, the material used to build asphalt pavements. Experimental determination of Poisson ratio for asphalt binders is difficult and an estimated value is currently used in pavement design calculations. In this work, a new, simple method is proposed, based on small changes to a current standard method used for asphalt mixtures. Accurate determination of this ratio improves the design process and the performance and durability of asphalt pavements. Three different methods were used in the determination of Poisson's ratio. All three methods show a value of approximately 0.5 for Poisson's ratio when the binder is tested at -18˚C, and a value ranging between 0.47 and 0.5 at -24˚C. The experimental determination of Poisson's ratio has resulted in the validation of the estimated value that has been used in the design of roads. With this knowledge, models of road failure can be developed in a more accurate sense. This allows for more reliability in predicting the performance of asphalt pavements. The McNair Scholars program based out of the University of Minnesota - Twin Cities, funded this project.

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418

Subcategory: Civil/Mechanical/Manufacturing Engineering

Effects of Visible Light on Sleep

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Audio alarm clocks wake the sleeper abruptly and often to an unpleasantly dark early morning room. A Raspberry Pi microprocessor was used to wirelessly control LED light bulbs in order to simulate the rising sun to wake a sleeper to a partially lit room without need for an audio alarm before the actual sunrise occurred. The Raspberry Pi was programed to cause the LEDs to slowly increase in brightness over the course of half an hour each morning. The wake time was chosen by the user by creating a Google Calendar event entitled "wake" which served to trigger the Raspberry PI which was polling the calendar database in a loop. Additionally, the multicolored lights were varied away from white to visually match the color of the sun in order to more accurately simulate real sunlight. Although terms such as "alert" and "drowsy" are highly subjective, the relative "alertness" or "drowsiness" of the sleeper when the sunrise alarm clock was used was documented and compared to a control which used an audio alarm clock in a dark room. Daylight is one of the main environmental clues the human body uses to sync its internal clock. Thus, simulating a sunrise in an otherwise dark room in the morning should leave the sleeper feeling more alert, less drowsy, and less disoriented. This claim was shown to be true by experimental data. Additionally, even if the promising results of the experiment are simply due to the placebo effect, it seems undeniable that waking to a lit room is more "pleasant" than waking to a pitch black room. Preliminary results suggests that simulating the sunrise as is worth considering as a refreshing alternative to typical audio alarm clocks. Future research ideas include analyzing the effects of using additional senses to wake the sleeper. For example, aromas such as coffee could be used to signal the brain to wake up or subtle vibrations could be applied to the sleeper's bed to gently wake them from their sleep.

Key References: 'LED Light Sunrise Alarm Clock @Raspberry_Pi #piday #raspberrypi.' Adafruit Industries Blog. N.p., n.d. Web. 02 Oct. 2014.
'LED Light Sunrise Clock with Raspberry Pi.' LED Light Sunrise Clock with Raspberry Pi. N.p., n.d. Web. 02 Oct. 2014.
'WeggUp - A Sleeping Cycle and Light Alarm Clock.' Instructables.com. N.p., n.d. Web. 02 Oct. 2014.

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419

Subcategory: Civil/Mechanical/Manufacturing Engineering

Convective Heat Transfer Studies Over Asymmetric Airfoil

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The accumulation of ice on plane wings during flight has caused difficulty in maintaining a constant altitude, forcing pilots to use up more fuel in times of operation. A way to mitigate this is to use heaters that will melt the ice on the surface of the airfoil during flight. To look more into this problem, convective heat transfer experiments were conducted to determine the convective heat transfer coefficient of an asymmetric airfoil in a wind tunnel at various wind speeds and angles of attack. The airfoil was placed in the 61 cm x 61 cm test section of an open circuit-Eiffel type wind tunnel, which could create wind speeds at around 41 m/s. The airfoil was constructed from balsa wood and was covered by flexible heating pads, that exposed it to thermal energy, covered with aluminum, and thermocouples, that monitored temperature changes. With the data collected, the Nusselt Number was correlated with the Reynolds Number and the Prandtl Number, and the convective heat transfer coefficient was determined at different flow speeds along with angles of attack between 0 to 20o. In this study, the experiments conducted as validated also in literature, shows that the Nusselt number increases along with the Reynolds number on the airfoil's surfaces and that there is an increase, to a certain extent,

with increasing angle of attack. Future research will include investigating the effect of deicing of airfoil under varying convective heat transfer rates.

References: Dag, Y., Mensah, P., Akwaboa, S., "Determination of Convective Heat Transfer for Subsonic Flows over Heated Asymmetric Airfoil NACA 4412," Proceedings of the 15th International Heat Transfer Conference, IHTC-15.
Ito, S., Eckert, E. R. G. And Goldstein, R. J., "Aerodynamic Loss In A Gas Turbine Stator With Film Cooling," J. 1 Ngrg. Power, Vol. 102, Pp. 964-970, 1980, Journal Paper.
Goldstein, R. J. And Yoshida, T. "The Influence of a Laminar Boundary Layer and Laminar Injection On Film Cooling Performance," J. Heat Transfer, Vol. 104, Pp. 355-363, 1981, Journal Paper.

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420

Technology & Engineering
Subcategory: Civil/Mechanical/Manufacturing Engineering

Effect of an Insulator on the Friction Stir Welding Process

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The objective of this study was to increase the initial temperature and create a greater preheating effect in front of the tool in the friction stir weld (FSW) process, through the use of an insulator placed between the work pieces and fixture, in order to increase tool life by decreasing material yield strength. Soft metals are commonly joined using the FSW process, but because of inefficient tool life, harder materials like steel are not commonly joined. The principal theory of the study was proved through simulating the FSW process with and without an insulator utilizing Siemens NX Advance Thermal Simulation package. Two friction stir welds were conducted using aluminum, one with a layer of sand between the aluminum and the fixture base. Thermocouples were placed at the start point and upstream of the start point of the weld at the same distance from the weld center line. Results showed an increase in initial temperature and temperature of the area in front of the tool in comparison to the non-insulated weld. Future experiments will utilize an insulator with a lower thermal conductivity. These results could lead to efficient friction stir welding of harder materials such as steel at a relatively low cost.

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421

Subcategory: Civil/Mechanical/Manufacturing Engineering

Development of High Contrast Electrochromic Windows

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Electrochromism is the ability of a material to undergo a reversible and consistent change in its optical properties, particularly optical transmittance(T). This change in T is induced by an external voltage of modest amount that results in either oxidation or reduction. The electrochromic window (ECW) is one such device that exhibits transmittance change. The ECW is structurally similar to a lithium ion battery, consisting of three primary components: the working electrode (WE), the electrolyte, and the counter electrode (CE). The WE is the electrochromic layer and upon the application of voltage, changes its optical properties. The electrolyte functions as the ion conducting layer, containing and transporting lithium ions between the electrodes. Finally, the CE serves as the ion storage layer and balances charges, thus improving the durability of the ECW. The merit of using the ECW for future windows in residential and commercial buildings is to control the solar heat gain coefficient, thus, saving summer cooling energy for the buildings.

In this study, poly ProDOT-Me2 is the WE, the electrolyte is poly methyl methacrylate based electrolyte, and vanadium oxide is the CE. We focus on the optical property of transmissivity: the amount of light that can pass through a substance. The purpose of this research was to develop ECWs with high optical contrast of 50% or greater by optimizing the fabrication of the electrodes. The WE and CE were prepared using chronoamperometry and characterized using chronocoulometry through an electrochemical workstation. Transmittance was measured within the range of 300 to 800 nm using a spectrophotometer. To assemble the complete ECW, the WE was placed onto the CE with the electrolyte sandwiched in between and the edges sealed with epoxy adhesive. Our findings demonstrate that the fabricated CEs exhibited high transmittance, around 70%. The WEs had low transmittance of 5% or below in the opaque state and maximum transmittance of around 65% in the light state. Although the electrodes were successfully developed, when assembled into the complete ECW, optical contrast measured less than 50%. We conclude that a high contrast ECW was not achieved in this research. The WE and CE were not optimized by the fabrication parameters. Therefore, the complete ECW underperformed. Future research involves continued testing of different parameters for electrode film thickness and improving processing conditions.

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422

Subcategory: Civil/Mechanical/Manufacturing Engineering

Thermal Cycling Life Analysis of Thermal Barrier Coating with NiCoCrAlY+Hf+Si Bond Coat Material

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Thermal Barrier Coatings (TBC) are widely used as a protective coating for turbine parts. Typical thermal barrier coatings consist of two layers, top and bottom. The bottom layer is called Bond Coat which acts as a bonding between the metallic substrate and the top coat and also protects the metallic substrate from corrosion and oxidation. The top layer is a ceramic topcoat which acts a thermal barrier for protecting the turbine components. Two main processes that are widely used to fabricate the top coat of these systems are atmospheric plasma spraying (APS) and Electron beam physical vapor deposition (EB-PVD). YSZ is a traditional TBC top coat candidate for gas turbine applications from 1970s (Vassen et al 2009). However, its performance and use is disadvantaged by adverse effect of sintering and phase transformation at elevated temperatures above 1200˚C. Due to sintering effects the strain tolerance reduces with an increase in the Young's modulus which leads to higher stresses in the coatings and thus leads to a reduced thermal cycling life (Vassen et al 2009). Also Gd2Zr2O7 Gadolinium Zirconate (GZ) shows promising thermo physical properties, i.e., lower thermal conductivity than YSZ and high thermal stability. In order to reduce oxidation in-situ of the TBC a new formulation of the bond material made of NiCoCrAlY+Hf+Si is being investigated in this work.

In this study, experiments aimed at establishing the thermal cycling life performance of YSZ+GZ top coated TBC with the new bond coat formulation of NiCoCrAlY+Hf+Si was conducted. Thermal cycling experiment was carried out in CM 1700 bottom loading furnace at Southern University with the TBCs tested at 1100˚C. The furnace is programmed for a "ramp up-dwell-ramp down" cyclic operation. In each cycle the furnace is heated (ramp up) from room temperature to 1100˚C in 30 min and isothermally soaked (dwell) at 1100˚C for 60 minutes followed by cooling (ramp down) to room temperature in 15 minutes. Preliminary results show that thermal cycling life of the newly formulated TBC performed better than traditional YSZ with bond coat material of only NiCoCrAlY. The thickness of Alumina layer formed in between the bond coat and top coat was also reduced in comparison with traditional TBC indicating reduced oxidation in-situ. Further research can be conducted on the effect of varying the amount of Hf+Si added to the bond coat material.

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423

Subcategory: Civil/Mechanical/Manufacturing Engineering

A PLM Implementation for Integrated Product Design and Manufacturing Process

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Modern industries are under extreme pressure to create an innovative process to design and manufacture products in an agile and flexible way. A promising solution to enhance speedy movement is to integrate product design and manufacturing using product life management (PLM) software with its powerful computer-aided design (CAD) and computer-aided manufacturing (CAM) capabilities. The objective of this study is to investigate the hypothesis of PLM's ability to lessen the lead time of the manufacturing process by applying where applicable.

Two separate experiments were completed to test the hypothesis; the first being "Reverse Engineering using a PLM Integrated Process," the other being "Manual Design and Code Writing vs. PLM Integrated Design and Manufacturing."

The first experiment aims at testing the feasibility of PLM in product design and manufacturing. It incorporated PLM software with coordinate measuring machine (CMM) in reverse engineering of a high precision, three dimensioned block. This block was first modeled in PLM with hand dimensioning, then the PLM model were verified and modified with CMM on dimensions and geometric features data. The verified PLM model was sent to a 3D-print machine for rapid prototyping. This experiment successfully concluded with an identical 3D-printing dimensioned block to the original block. The second experiment addresses the efficiency of PLM aided manufacturing. It included two individual trials- generating numerical control (NC) code with or without PLM. We created an original design first by hand drawing and then manually generated NC code for that design. Next, the same design and NC code were created using PLM software completely. Both trialed parts were fabricated with their own NC codes on a Haas computer numerical control (CNC) mill.

This experiment shows more specifically the time that can be saved using PLM software in the manufacturing process. An hour and half of manual code writing equivocated to PLM software's creating CNC code for the same design in less than ten seconds. Lessened lead time enables production to respond to customers' demands efficiently. PLM based digital design and manufacturing not only saves time but aids companies in managing product efficiently and cost-effectively, from ideation, design and manufacturing. For the future research, integrating

PLM directly via wireless connectivity from mobile app to CNC Mill could decrease design to manufacture time further.

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424

Subcategory: Civil/Mechanical/Manufacturing Engineering

Simulation and Optimization of Geometric Parameters on a Small-scale Solar Updraft Tower

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Because of the growing energy crisis, renewable energy technologies are paramount. The solar updraft tower is a renewable energy power plant that uses solar irradiance at the base to create an updraft through a tower and turbine to generate energy. I investigated the optimal geometric parameters and redefined peak performance for a small-scale solar updraft tower. A mathematical model that describes the flow was used and the performance of a solar updraft tower was computed. I varied five geometrical parameters during the modeling and simulation process including chimney height, chimney diameter, chimney divergence angle, solar collector height, and air inlet height. The diameter of the solar collector was fixed to maintain the scale of the model. I found that the maximum air velocity through the solar updraft tower was with a chimney height of 2.3 m – 3.0 m, a chimney diameter of 10.6 cm, a chimney angle of 1-3°, a solar collector height of 30.4 cm, a solar collector angle of 16°, an air inlet height of 5.1 cm, an air inlet baffle of 2.5 cm, and a fixed solar collector diameter of 2.3 m. I constructed a pilot solar updraft tower with a chimney height of 3.0 m, a chimney diameter of 10.1 cm, a chimney angle of 0°, a solar collector height of 30.5 cm, a solar collector angle of 16°, an air inlet height of 1.0 m, and a fixed solar collector diameter of 2.3 m. I tested the pilot solar updraft tower and found a consistent maximum velocity and temperature of 1.9 m/s and 72˚C. With these parameters, I raised the fluid velocity and temperature 17–31% over comparable models. The height and angle of the solar collector were the most important physical variables for the solar updraft tower design. In conclusion, my findings have significantly improved the efficiency of a small-scale solar updraft tower. If applied to large-scale models, these findings could lower global energy costs. In the future, I plan to compensate for the absence of the soil's insulation, which small scale roof top solar updraft towers lack and large scale solar updraft towers are constructed on, by using 6.4 mm aluminum plates at the solar collector base. Models and simulations show that with the incorporation of metal plates the interior temperatures will reach above 104˚C during peak operating conditions. I will incorporate a therm-electric system, which will use the plates to create a temperature differential to generate electric voltage.

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425

Subcategory: Civil/Mechanical/Manufacturing Engineering

Forward Kinematics Analysis and Design of a Hexapedal Locomotion Robot

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A hexapod is an insect-inspired, versatile six-legged robot that is able to utilize each of its legs independently. This capability enables it to exhibit a wide range of gait motions. Indeed, a hexapod can stabilize itself on four of its six legs, allowing the two other legs to be used to accomplish other tasks. The algorithms developed and utilized to control the motion of hexapods may not only reveal insights into the development of neurological insect theories, but also have engineering implications for extraterrestrial explorations. The purpose of this research is to design the mechanical control system of a hexapedal locomotion robot to ensure the collection and deposit of regolith simulant within a simulated Martian environment. Specifically, forward kinematics is used to formulate an algorithm that enables its stabilized motion through the calculation of the optimal angles for each joint of the hexapod legs. The design of a working hexapod robot prototype is first accomplished using Computer Aided Design software, which is then 3D printed for the entire mechanical structure. The six legs of the robot are each composed of two mechanical links, in turn connected by actuators acting as joints. Hence, twelve actuators must be controlled to achieve movement. For each leg, an actuator is tasked to raise the lower segment, while the other controls the rotation of the upper one. The synchronized rotation of each segment about two perpendicular axes enables the hexapod to walk successfully. The rotational angles required for overall motion and gait are computed using forward kinematic equations, which are then utilized in an algorithm that controls all twelve actuators. The expected result of this project is to implement a fully functional set of legs that provide the hexapod the ability to perform stable controlled motion from point to point. This accomplishment ensures the robot's expected performance of its tasks during the collection and deposit of regolith throughout an unknown environment. The expected result of this project is to implement a fully func-

tional set of legs that provide the hexapod the ability to perform stable controlled motion from point to point. This accomplishment ensures the robot's expected performance of its tasks during the collection and deposit of regolith throughout an unknown environment. In the future, a semi-autonomous system, in which the human operator would only need to issue high-level commands.

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426

Technology & Engineering

Subcategory: Civil/Mechanical/Manufacturing Engineering

Recovering Energy from Exhaust Systems

Bereket Berhe Kahsai, Virginia State University

In gasoline-powered vehicles, over 62 percent of the fuel's energy is lost in the internal combustion engine. These engines are very inefficient at converting the chemical energy (fuel) to mechanical energy, losing energy to engine friction, pumping coolant fluid into and out of the engine, and wasted heat. The proposed research's focus is on recovering some of the wasted heat by converting it directly to electrical energy. The converting device is a solid state thermoelectric device that induces electrical voltage by applying different temperatures across the device. Higher temperature difference will provide higher energy. The electricity generated by the thermoelectric device can be used to power other electrical systems in the vehicle or to charge a battery. Literature surveys will be conducted for selecting an appropriate thermoelectric device for the application. The characteristics of the thermoelectric devices will be evaluated to find optimum conditions to get maximum efficiency. The thermoelectric device will be tested by altering the temperature difference by means of heating and cooling devices to record voltage produced. Upon optimizing the thermoelectric devices and their voltage production, a new exhaust system will be proposed for highest efficiency of the system. The final goal will be to design an exhaust system with embedded thermoelectric devices to harvest the maximum possible wasted energy from internal combustion engines. This research can revolutionize the automotive industry by decreasing fuel consumption and increasing fuel economy.

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427

Subcategory: Civil/Mechanical/Manufacturing Engineering

Adapting Actuated Traffic Signal Control Settings with Queue Lengths from Probe Vehicles

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Advancements in detection technology provide accurate real-time queue length measurements at signalized traffic intersections. Currently, there are limited methods that utilize queue length information in real-time to enhance the performance of signalized intersections. This study presents a method that adjusts maximum green times in an actuated signal control based on the queue lengths obtained from probe vehicle data. The proposed method is implemented on a single intersection with random arrivals and evaluated by VISSIM-a microscopic traffic simulation environment and C++ point queue simulations. Several numerical examples are given to test the performance of the method at five different demand profiles and heuristic's parameter values. The method is compared with a typical fully-actuated signal heuristic. Based on the numerical experiments, the proposed queue length-based method provides significant improvements in terms of average intersection queue lengths for random vehicle arrivals. On average % 51 to % 83 reductions in queue lengths are achieved for major and minor streets respectively. The queue length estimators also closely match the performance of a signal where known queue lengths information is given. For instance, for traffic demand profile 1; queue length estimation compared to the known-queue length resulted in errors ±1 vehicle for major and minor streets. In the same demand profile, the typical signal light is 2 and 20 cars off the known-queue length control for major and minor streets respectively. Performance of the proposed method is evaluated also for various probe penetration levels, which expectedly results in increased efficiency as probe proportion increases unlike a typical signal which retains at a constant or declining level of performance.

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428

Subcategory: Civil/Mechanical/Manufacturing Engineering

Comparison of Elastodynamic Analytical and Meshfree Numerical Solutions of Steel Beams Subjected to Blast Loading

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Numerical methods have been in development for some time now and have been a principal technique for modeling structures undergoing complex loading conditions, for example, blast loads. Recent developments have led to more advanced numerical methods called meshfree methods where the structures are modeled by discrete points without structured mesh. Meshfree methods are shown to be particularly effective for problems involving large deformation and fractures, such as in modeling structures undergoing blast loads. The aim of this work is to compare analytical solutions of steel beam deflections to those predicted by meshfree numerical methods and thereby verify the applicability of these methods for beams undergoing blast-loading conditions. Analytical solutions for beam deflections are derived based on elastodynamic Euler-Bernoulli beam theory subjected to transverse blast load where the blast waves are treated as planar. In the meshfree modeling, general three-dimensional elastodynamic solution are obtained for comparison with the analytical solution. The results showed that the meshfree solution agrees well with the analytical solution for those beam structures where Euler-Bernoulli beam theory applies. This study also identifies the appropriate discretization in meshfree method and the beam geometry suitable for applying Euler-Bernoulli beam theory. Future work will be to consider the meshfree analysis of non-linear elastoplastic-damage behavior to understand the inelastic response of beams subjected to blast events.

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429

Subcategory: Civil/Mechanical/Manufacturing Engineering

The Launch and Recovery of a Dual-Payload Exploration to Near Space

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The High Altitude Research Platform (HARP) is a research platform with the objective of understanding the effects of near space conditions on experiments carried to near space. The HARP Design, Launch, and Recovery (DLR) team's task is to undertake the design, fabrication, launching, tracking, and recovering of the payload modules. The DLR team focused on creating adequate space within the payload modules for the research groups; Sustainable Energy, Battery Technology, Termite Behavior, Bio-materials, and Robotics. In order to keep gross platform weight under Federal Aviation Administration launch regulations (CFR 2014, Title 14, 101.1) for Unmanned Free Balloon flight, the team constructed a source of light and sturdy frame for the payload module housing. The HARP attained a maximum altitude of 78,602 feet above sea level, and traveled approximately 50 miles from Laramie, Wyoming to Carr, Colorado. During the decent of the payload there was an increase in the decent rate, because burst balloon fragments fell on top of the parachute. Resulting in partial loss of payload due to high impact during landing recovery.

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430

Subcategory: Civil/Mechanical/Manufacturing Engineering

Evaluation of Path-tracking Algorithms for Autonomous Vehicles

Daniel Okegbu, Howard University

The future of autonomous vehicles today is more promising than ever before. The high demands for a robotic machine to perform tasks that are beyond human capability have illuminated the interest to further improve the efficiency of the navigation system, hence the path tracking algorithms. In this study, simulated modules from two widely used methods, the "follow-the-carrot" and the "pure pursuit" algorithm, were investigated to better understand robotics and autonomous machine. These two algorithms are the fundamental of a path-tracking algorithm and it simple facilitates the navigation of an autonomous vehicle. An understanding of both algorithms can be applied to other applications such as defense, aerospace, undersea, and biomimetic mobility.

This study focused on the derivation of kinematic equation for each algorithm and the implementation of its model using MATLAB Simulink. The characteristic behaviors of each algorithm at

different angles, speeds, and distance were examined based on the simulation of the developed kinematic models. The development of the path-tracking algorithm accounted for the vehicle's nonhomolonic constraints and geometrical shape. Additionally, the studied algorithm does not account for the dynamic effect of a moving vehicle. The result of this study shows that at an elevated angle, the "follow-the-carrot" method reached a target point quicker than the "pure pursuit." However, the "follow-the-carrot" method fell into a continuous circulation when it had to reach a target point that was a short distance. The "pure pursuit" method applied a calculation of an arc's curvature to the steering wheel mechanism of the vehicle, which guaranteed that the vehicle would reach its target point even at a shorter distance.

Future work for this research work will include designing a robotic vehicle to test the "follow-the-carrot" and the "pure pursuit" algorithm. The "follow-the-carrot" method can then be improved by adding on to its algorithm a reverse motion. This will allow a vehicle to logically reverse away from a target point if the distance is too short.

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431

Subcategory: Civil/Mechanical/Manufacturing Engineering

Queue Length Estimation from Probe Vehicles: Effect of Different Arrival Distributions

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Queue length is one of the fundamental performance measures of signalized intersections. Accurate prediction of such measures in real-time enables better control through efficiently allocating the available capacity (i.e., green time) such that a defined performance metric is optimized (e.g., minimize total delays or minimize the maximum queue length). This research focuses on queue length prediction at an isolated intersection in real-time, based on data from probe vehicles (i.e., vehicles equipped with GPS and wireless communication technologies). The study contributes by embedding the bunching effect of traffic and incorporating various distributions into queue length estimation formulations. The accuracy of the estimations at various probe percentage and arrival rates is explored. In particular, vehicle arrival distributions are investigated from the literature such as Negative Binomial, Generalized Poisson, Geometric Bunch, Inflated Generalized Power, and Cowan M3 which are incorporated into the queue length estimation derivations either directly or approximately and compared to the results with Poisson arrivals. The study aims to analytically carry out the formulations (calculated in MATLAB) when overflow queue is ignored. When overflow queue is considered, point queue C++ and VISSIM simulations are used to compare various arrival distributions. In addition, approximation formulas for mean and variance of the overflow queue are revised according to the arrival distributions used. Unlike developed models with Poisson assumption, some of the derived models are able to mimic the scenarios with over-dispersion. Several figures for average queue length, error of the queue length estimations, and behavior of the location of the last probe vehicle position under various volume-to-capacity ratios and probe proportions are given.

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432

Subcategory: Civil/Mechanical/Manufacturing Engineering

LWA:Mitigating Corrosion in Concrete

Emily Schneider, Framingham State University

In 2013, America's "GPA" for infrastructure was D- By 2020, an estimated $3.6 trillion will be needed for full restoration Worldwide, corrosion causes over $100 billion in damage annually Corrosion of rebar is initiated when exposed to chloride ions; this damages the protective oxide film on metal surfaces Expansive products such as rust forms, forcing concrete to crack, shortening the infrastructures life-span Cinnamaldehyde, a bioactive agent, can reduce the corrosion of metals but has negative effects when included in a cementitious mix Soaking lightweight aggregate (LWA) in Bioactive agents prevent this interference by slowly releasing the oils into the mix.

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433

Subcategory: Civil/Mechanical/Manufacturing Engineering

Queue Length Estimation from Probe Vehicles: Unknown Arrival Rate and Probe Proportions

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In this research, several models are developed to generate queue length estimations under unknown arrival rates and probe proportions. Traffic signals today are generally optimized based on the data collected for a fixed period of time. The proposed method in this study uses probe information to estimate flow rates so that possible deviation from the assumed flow rates can be evaluated. For example, flow rate may have increased over time and consequently the signal may not be operating under optimum settings. For every signal operating in traffic networks, flow information is crucial to monitor and operate the system more efficiently.

The research compares the developed primary parameter estimators of the arrival rate and probe proportion p at traffic signals using some of the fundamental information (e.g., location, time, and count) that probe vehicles (i.e., vehicles equipped with GPS and wireless communication technologies) provide. For a single queue with Poisson arrivals, analytical models are developed to evaluate how estimation error changes as percentage of probe vehicles in the traffic stream varies. When the overflow queue is ignored, closed-form solutions are obtained for the squared error loss. In addition, the study investigates the incorporation of the developed models in queue length estimation from probe vehicles at signalized intersections. Models are evaluated using point queue C++ and VISSIM microscopic simulations. C++ point queue simulations are run for cycle-to-cycle and multiple cycle applications. VISSIM simulations are run for only cycle-to-cycle information due to long run times. Numerical examples are presented for various flow rates (600, 700, 800, 900, 985 vehicle per hour per lane) and probe proportions (0-100%) to show the performance proposed models.

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434

Subcategory: Civil/Mechanical/Manufacturing Engineering

Application of FSW Technology to Join Aluminum and Copper Plates

T'Leya Walker, Virginia State University

Friction Stir Welding (FSW) is a solid-state process in which the base materials to be joined do not melt during the joining process. The rotating non-consumable pin shaped tool is forced to plunge into the material and create frictional heat which causes the material to be plasticized and stirred to make the joining process possible. Aluminum alloys, magnesium, copper, lead, and zinc are the most successful materials used with FSW. Investigations show that the FSW process of aluminum alloys yield high quality welds with low distortion and low cost. The first goal of this project is the application of FSW technology to weld aluminum and copper plates and produce a durable quality weld. For this purpose, several experiments were conducted to weld 102 copper and 6061 aluminum plates together in different setup conditions. In order to better understand the effect of different parameters on the microstructure of the material in welded zones, visual investigations were conducted using Scanning Electron Microscopy (SEM). Experiments are conducted on 0.25' and 0.125" thick plates using three different welding parameters of rotational speed, transverse, and normal force (in process) to identify the best setup conditions for further study of the mechanical properties of the welded regions (second goal). While working to identify the optimum conditions for quality friction stir weld of aluminum and copper alloys, it is also important to make progress in development of the FSW process for dissimilar materials using third material as intermediate (future topic).

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435

Subcategory: Computer Engineering

Performance and Power Efficient Multi-Core Computation

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To produce the most efficient hardware designs, it is crucial to have a good knowledge of application behavior. Without this knowledge it can be quite difficult to properly partition resources between communication and computation. Our research group focuses on understanding the behavior of applications in multi-core processors by running simulations on GEM5, which is a full system simulator platform designed for the use in computer architecture research, in order to be able to develop more power-efficient computers. To understand in more detail the behavior of applications, we ran simulations using different benchmarks, or applications, from two benchmark suites: Parsec and Plash-2. The Splash-2 benchmarks suite contains a variety of high performance computing (HPC) and graphic applications. The Splash-2 benchmarks that we are currently studying are FFT, LU, and RADIX. Parsec benchmarks offer a wider variety of appli-

cations rather than focusing on HPC. The Parsec benchmarks that we are currently studying are BODYTRACK and CANNEAL.

By running these simulations on GEM5, we are able to know the run-time of each benchmark, the total number of cycles each of the 64-Core CPU were on during each simulation, and the number of busy and idle cycles for each CPU. With this information we are able to find the busy percentage for each CPU for different configurations and run time penalty of each configuration, which is crucial to our research since this help us determine the most power-efficient configuration. We compare the default CPU configuration with VFI CPU configuration. In the default mode, all the 64-Core CPUs run at a frequency of 2.5GHz and a voltage of 1.0 Volt. In the VFI mode, we change the frequency and voltage of the CPUs in order to decrease power consumption of the CPUs without compromising their overall performance.

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436

Subcategory: Computer Engineering

Signal Processing with Universal Software Radio Peripheral

Brandon Harrington, Virginia State University

The Universal Software Radio Peripheral (USRP) is slowly becoming a very popular piece of hardware in different universities and research labs across the world. It is inexpensive, which attracts a lot of attention, along with its variety of applications and capabilities. The USRP connects to a host-computer through a high speed USB or Gigabit Ethernet interface. Another reason for the increasing popularity of the USRP is its ability to respond to multiple programming software such as GNU Radio, Matlab/Simulink, and LabView. There are a broad range of capabilities of the USRP one of which includes receiving GPS signals. Each GPS satellite transmits data on two frequencies, L1 (1575.42 Mhz) and L2 (1227.60 MHz). We focused on the L1 band that transmits at 1575.42 Mhz. The main objective was to engage in signal analysis with the carrier signal of the L1 band. This task proved to be challenging but not impossible. The carrier signal is essentially exactly what it sounds like. Its purpose is to carry information modulated on to it; in this case the navigation message from the GPS satellite along with other codes that are irrelevant to use at this point. After receiving the signal via USRP and with a simple extraction of the carrier signal, we were able to recorded the signal and reconstruct it using its In-phase/Quadrature(IQ) data.

This research is important because with just the carrier signal one is able to do multiple things. One can modulate his/her own information onto the signal and transmit it through the USRP. Further analysis on the characteristics of the signal can be done. For example, one can compare the strength of a direct to the strength of an indirect signal. In theory, one can determine the characteristics of the surrounding area when using both the direct and indirect carrier signal. The possibilities are endless.

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437

Subcategory: Computer Engineering

Constructing a Lego Mindstorm NXT Robot to Function in the Stratosphere

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Autonomy is a highly sought after and imagined subject in both science fiction and the science community. The idea of a robot being able to perform tasks that are either too dangerous or too difficult for us carbon-based life forms, inspires many new techniques and technological advantages in research. Using this premise, the High Altitude Research Project (HARP) was developed with the objective being to create a robot that would open and close a 3D printed drawer in near space conditions. PVCL fibers were located inside of the 3D printed drawer to document the reaction of being exposed to near space temperature and pressure. Problems that occurred while we were designing the robot include: pressure, stability, programming, extreme temperatures, landing, and battery life. At the conclusion of last year's HARP, the robotic arm of the NXT snapped off when it made impact with the ground and made the robot unusable in the future. Learning from this mistake, we decided on a robot with a smaller arm that was compact and less intricate than the previous year, thus it was less susceptible to damage on ground impact. We ran the robot, with the simplistic design, through pressure, stability, battery life and operation tests, all of which the prototype performed well. We used a cryogenic vacuum chamber that could replicate the pressure of near space to test how the robot would function in a high-pressure zone. To keep the robot stable we needed to create a base that would prevent the NXT brick and EV3 brick from moving around. The bricks are used to contain the data and program that the robot would collect. After making improvements to the core constructions, as well as moving the arm and the drawer, we found ourselves faced with the task of programming the robot. We used the NXT's own programming language that was included with the brick, and its user-friendly interface allowed us to easily program the motor.

A challenge we had was the task of correctly opening and closing the drawer only when it reached 80,000 ft. The barometer would record the altitude and pressure, but to insure that we had the correct readings a failsafe was created that would open

the drawer after 50 minutes when the program started. From previous launches we looked at the ascension rate of the balloon and concluded that 50 minutes was the time it took the balloon to reach 80,000 ft. To improve next year's robot, a stronger base is needed so that the robot is attached to the actual payload. In conclusion, we can say that we made advancement on the previous year's HARP robot design and coded a successful program for the robot.

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438

Subcategory: Computer Engineering

The Future of Dentistry Lies in Digital Impression Making

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CAD/CAM Dentistry presents a new measure of precision and accuracy that is patient-friendly. This new approach in dentistry aims to produce new benefits in patient care. Allowing the patient to have a prompt appointment with less chair side time. The methods include taking a chair side digital impression of the patient's tooth at the beginning of the appointment. The digital impression is placed in the CAD/CAM device and evaluated to form the final restoration/crown in the office. These methods do not involve having to send the digital impression to a laboratory technician, which limits the complication of the patient returning to the office multiple times to make sure the restoration fits properly. The CAD/CAM device is reliable in producing clinical restorations with a process that reduces complexity. Future applications of the device include utilizing the digital impression with Photoshop to show the patient how the final restoration will look before beginning the operation.

References: Beuer F, Schweiger J, Edelhoff D. Digital dentistry: an overview of recent developments for CAD/CAM generated restorations. Br Dent J. 2008;204(9):505-11. Giordano R. Materials for chairside CAD/CAM-produced restorations. J Am Dent Assoc. 2006;137(suppl):14S-21S. Calamia JR. Advances in computer-aided design and computer- aided manufacture technology. Curr Opin Cosmet Dent. 1994:67- 73. Lowe, R.A. Digital Master Impressions: A Clinical Reality!

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439

Subcategory: Computer Engineering

Magnetic Levitation Automation

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The purpose of this design is to enhance the functionality of the Magnetic Levitation trains (Maglev) systems by incorporating feedback from the trains. Maglev is a completely new way of transportation that will join the ship, the wheel, and the airplane as a mainstream in moving goods and people. The software that will be developed is for real time computer simulation of the Kelvin Electrons Magnetic Levitation (KEML) which is widely used in transportation education of middle and high school students. Virginia State University (VSU) has been utilizing this system for the past seventeen years to introduce the concept of magnetic trains to high school students in the VSU National Summer Transportation Institute (NSTI).

The Kelvin Electronics Magnetic Levitation system enhances the knowledge of magnetic levitation as demonstrated by a self-propelled magnetic vehicle utilizing a propulsion sub-system which directly ties to transportation. This incorporates knowledge of transportation by the development, design, modeling, and testing of a self-constructed vehicle. The objective of this project is to design and develop a sensor system which gathers data and automatically calculates displacement, velocity, acceleration, and friction of vehicles, all in real time. This ensures more accurate results as well as demonstrating the application of mathematics and physics in the form of the calculated measurements.

The objective is achieved by incorporating a sensor that records a train's movement while traveling along a single track, as well as developing software that simulates the vehicle's movement in real time. Integration of this design with Kelvin Track will allow for crucial data analysis such as comparing trains speeds, and calculating and graphing velocity, acceleration, and friction along the track. Although there is only one physical track, data analysis will allow for simulating a four train track simultaneously in order to compare different train displacements at the same time. This is just one statistic that can be examined. Having the entire process to now be computerized and reconstructed will help mold and better develop construction of the designs of the trains for future develop while moving along the track. Gathering this vital data will also make this project more interactive and exciting for users.

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440

Subcategory: Computer Engineering

Mobile Crowd Sourced Navigation For The Visually Impaired

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Mobile devices have become ubiquitous, including among the visually impaired. Our Crowd Navigation app is designed for the iPhone, which is by far the most commonly used mobile device among those with low vision. The app's primary objective is to assist a visually impaired or blind user in navigating from point A to point B through reliable directions given from an online community. The phone is able to stream live video to a crowd of sighted users through our website. The crowd is then able to give directions from the website. The aggregate of these directions will be relayed back to the user by audio.

The full implementation of the Crowd Navigation app involves many pieces. First, the visually impaired user needs some method by which their requests and current situation can be observed. This is done through the iPhone portion of the application. The visually impaired user is able to log into the app using a secure and unique Google Account. The user's iPhone is then able to stream video footage to our servers. Furthermore, the user's GPS location and directional requests may be sent to our servers. The feedback from the server will be retrieved by the user's phone and will be use audio cues to direct the user. On the server side, we are running a Google App Engine application. Sighted users are able to log into our server with their Google accounts and provide feedback based on the video being streamed to them from the visually impaired user. The user's will also have access to the GPS location and will have a map of the surrounding streets available to allow them to better guide the visually impaired user. This crowd of users is able to provide feedback to the visually impaired user using the arrow keys on their keyboard. The crowd's input is weighted and aggregated before being relayed to the user so that they receive only a single, concise majority opinion. Finally, Google's Endpoints API orchestrates the interaction between the iPhone and App Engine. It provides a simple means by which data can be sent between the two services. While the ability of an app to help guide visually impaired users is a valuable goal in its own right, there are various areas of research which this app will help advance. The app alone requires the study, experimentation, and evaluation of how to best aggregate large quantities of data from many users and how to most appropriately feed this information back to the visually impaired user.

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441

Subcategory: Computer Science & Information Systems

ScanDroid: Static Analysis Tool to promote Secure Design Methodology for the Android Environment

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Mobile devices are now storing a lot of sensitive data. With many users adapting to the new technical advancement of mobile devices, security of the user's sensitive data becomes imperative. Security vulnerabilities in the mobile apps will lead to leakage of user's sensitive data. There is a need to develop tools that can statically analyze developers' applications before they are publically available.

There have been tools that statically analyze the mobile applications to determine whether there are some kind of data leakage or access control vulnerability. For example, COPES detects permission gaps where applications are given more permission than they need to functionally perform. Brox detects whether an application requests location, deviceID, contact information and sends it via network or SMS. LeakMiner detects whether an application requested location, deviceID, contact information, calendar or SMS and send these information to log files. Flowdroid analyze applications statically using taint analysis to detect sensitive data leakage. TaintDroid detects when sensitive data is leaving the system with the assistance of third party applications.

We propose to develop a tool to help developers to develop secure Android applications. The tool will produce warnings to the developers regarding which classes or method include security vulnerabilities such as data leakage and access control. The tool analyzes Android source code using two steps: 1)Parse the source code and XML file to report design vulnerability based on CERT secure coding rules for Android application development. 2) Run FlowDroid on source code and parse the output of FlowDroid and look for device ID, GPS location data being leaked to a log file or through implicit intent.

The results from the two steps will be combined into a report to inform developers of security vulnerabilities. We are in the process of implementing the tool. The future plan is to finish imple-

menting the tool and test it on a large set of code sources and evaluate the effectiveness of the tool in detecting security vulnerabilities.

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442

Subcategory: Computer Science & Information Systems

Mission: Clip, Zip and Ship

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SERVIR is an organization that helps developing countries to manage their environment. They have international hubs in East Africa, Mesoamerica and the Himalayas named RCMRD, CATHALAC and ICIMOD, respectively. Each hub has clients that need specific information in their region. Some clients have slow internet connectivity, so it is harder for them to download large files. The Clip, Zip and Ship Challenge was presented to help SERVIR Hub's Clients download files faster. The goal of the Clip, Zip, and Ship challenge is to make a program that will take different layers of a Geospatial dataset, cut these datasets into a grid format, store each tile of that grid into a zip folder, and then send links of the zip folders to clients. This was programmed using python along with ArcPy, which is an ArcGIS library full of python methods. The end product will be a website where the client selects a geographic region on a virtual map. The program will ship, download, and geographically reconstruct specified tiles.

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443

Subcategory: Computer Science & Information Systems

Defining the Occlusal Plane for Three-Dimensional Laser-Scanned Palate Impressions

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Three-dimensional palate impressions contain rich spatial information about the palatepertinent to speech production. While it is trivial to define the occlusal plane for apalate impression set in plaster, image processing techniques are necessary to do so-for a cloud of data points produced from 3D laser scan of such an impression. Defining the occlusal plane is crucial for orienting the palate relative to the skull and allowing 3Dregistration of tongue data, e.g. from 3D ultrasound. In this study, we developed methods for 1) defining the occlusal plane of 3D laser-scanned palate impressions and2) regularizing the point cloud in order to enable integration of the scanned palate with3D tongue ultrasound images.

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444

Subcategory: Electrical Engineering

Zigbee Communication in Smart Grid: Challenges and Applications

Samuel Boateng, University of the District of Columbia

Smart Grid has emerged as the solution to the aging power grid with increased electricity demand, taking advantage of renewable energy, two-way communication and recent advancements in sensing computing and control. An important element of a smart grid is the ability of two way communication between the power company and consumers.

In this poster, we first give an overview of wireless technologies employed in Smart Grid Communications. ZigBee communication, Wireless Mesh Networks, Cellular network communication and power line communications are briefly introduced and discussed. We then focus on ZigBee communication, which is a low cost, low data rate communication scheme, and discuss the advantages of ZigBee communication in smart grid applications. A big challenge of ZigBee is its channel overlap, with that of Wireless Local Area Networks, impacting negatively on the performance of ZigBee due to interference. We review research that has been performed to identify the "Safe Distance" and "Safe Offset Frequency" between ZigBee and Wireless Local Area Network (WLANs). The results from both the empirical and analysis methods demonstrate that the design approaches are capable of efficiently resolving the effect of WiFi interference and improve the performance of ZigBee Network. The focus and the future is how to improve upon effectiveness of zigbee communication in smart grid.

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445

Subcategory: Electrical Engineering

Integrating a Dynamic Home Energy Management System (DHEMS) into a Nano-grid Infrastructure

Turner Cotterman, Clemson University

Increased energy consumption, coupled with a need to reduce greenhouse gas emissions, dictates the rethinking of energy management. Energy consumption begins with the single consumer; therefore it is practical to consider innovative methods of energy usage at the nano-grid (i.e. home) level. This research focuses on the development of a dynamic home energy management system (DHEMS). Efficient energy management techniques (e.g. demand response, "smart" home devices) joined with renewable energy sources and battery storage systems will reduce energy cost, energy usage, and emissions produced for residential homes.

Energy conservation measures carried out in real-time will allow the optimization of a household's load profile so that the generator (i.e. utility) and end-user (i.e. home consumer) will both benefit. It is expected that data on local household activity combined with simulation software capabilities will demonstrate both the possible reduction in energy, cost, and emissions as well as an illustration of an optimal household energy profile. A nano-grid infrastructure can clearly demonstrate the feasibility of increasing the efficiency of energy supply and consumption; then a collection of intelligent nano-grids would significantly reduce the demand on the electric power distribution system. A DHEMS is fundamental for developing the next environmentally-conscious, reliable, and efficient residential platform.

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446

Subcategory: Electrical Engineering

Fast Real-time Fitting of Wavelength Modulation Spectroscopy Signals for High Precision Greenhouse Gas Sensors

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We show development of compact, fast, robust and high-precision greenhouse gas sensor for ground-based mobile and aerial robotic platforms. The laser-based sensor will utilize non-intrusive optical sensing techniques to measure atmospheric trace gas concentrations with unprecedented vertical and horizontal resolution (~1 m) within the planetary boundary layer. The sensor utilizes versatility of low power, widely-tunable Distributed Feedback (DFB) diode lasers operating at 2 µm to probe atmospheric carbon dioxide molecular transitions. A key component of this project is to develop microcontroller based software interface for data acquisition, sensors control and data storage, while providing quantitative data on sensor performance in real-time. In addition, the software interface will also provide feedback based on instrument drifts (due to environmental conditions) and errors during field operation. A Voigt function based on Faddeeva algorithm (complex error functions) is used to model the molecular collision dynamics that represents absorption profile and wavelength modulation spectroscopy (WMS) signals in order to obtain gas concentration and emission rates. The goal is to perform real-time fitting of full WMS spectrum at 25 Hz using Matlab and Labview interface on the microcontroller. The sensor will provide fast response (>10 Hz) sampling of carbon dioxide in the atmospheric boundary layer for real-time monitoring and remote sensing. The project will answer key environmental protection and climate change questions by measuring greenhouse gas emissions e.g., from carbon dioxide and methane sources e.g. combustion of fossil fuels, landfills, natural gas, power plants, and agricultural sources in the local Kent county region.

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447

Subcategory: Electrical Engineering

Electrochromic Window: Reducing Costs Through an ASIC

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Annually, buildings throughout the United States take up 47.6% of the total energy consumed. This is nearly as much as transportation and industry combined (Architecture 2030, 2011). When considering how many "necessities" people require in commercial buildings, it is hard to imagine zero energy buildings ever being commonplace in American society. Through the use of high performing and highly efficient windows, this dream could become closer to reality. However, installing high performance windows into a building can be a costly endeavor.

This research project focused on improving the potential for zero-energy buildings through the use of energy harvesting electrochromic windows (ECW). The ECW that I was studying was a

non-energy harvesting window with a polymer (3,3-dimethyl-3, 4 dihydro-2H-thieno[3,4-b][1,4]dioxepine) (PProDOT-Me2) (Ha, 2014) that when given a voltage surge, changes to a darkened state, but still remains transparent. The voltage/tint of the window is controlled via an infrared controller. The projects goal was to minimize the circuit controller's area on the ECW, and reduce the power consumed by the controller of the ECW.

Using the program Cadence Virtuoso, I created and tested an application specific integrated circuit (ASIC) that combined several sub-circuits and discrete circuit components to reduce the size of the circuit. To create the ASIC on Cadence Virtuoso, each component that was integrated into the new circuit design needed a schematic and layout representation. After each component's schematic and layout was tested and performed adequately, all the components were combined into one final schematic and layout.

Results showed that creating the ASIC minimized the area the circuit occupies and cuts the future manufacturing costs of the window. The area the components occupied was reduced by 6,752mm2 and the cost was estimated to be reduced from $6.61 to $1.94. With the reduced cost it allows ECW's to be more accessible and efficient for users to reduce energy costs and consumption. Future research can analyze and reduce the power consumed by the circuit controller.

Funder Acknowledgement(s): Thank you to the National Science Foundation Research Experience and Mentoring program for providing this opportunity. I want to thank Professor Yasuo Kuga for allowing me to work in his lab and to take time out of his busy schedule to meet with us weekly.

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448

Subcategory: Electrical Engineering

Vibrotacile Feedback Evaluation for Visually Impaired People in Navigation

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Performing many important but seemingly simply daily tasks such as navigating an environment in the modern world can be a burdensome task for visually impaired people. Many assistive devices have been developed for aiding in blind navigation, such as the widely used white cane. Thanks to rapid technology and algorithm development, many assistive devices are equipped with advanced functions in detection and extraction of objects from the environment. However, conveying this information to visually impaired people is still very challenging. In this project, we used touch as a vibrotactile feedback mechanism for visually impaired people in navigation. Vibrotactile feedback was delivered on the skin using Eccentric Rotating Mass (ERM) actuators. The vibration of the actuators was accurately controlled and timed using a haptic driver chip that has a feature called "smart loop", which uses closed-loop feedback to apply the exact overdrive and brake signals to maximize the start and stop times of an actuator. In the first task, we studied the perception and sensitivity of vibrotactile feedback on three locations of the body (wrist, elbow and shoulder). We tested the absolute threshold of the vibration on those locations using a modified binary search method and tried to find the most sensitive position. In the second task, we tested the idea of "feeling" the environment without touching it using a low-cost IR range sensor. There are many haptic ways to convey the distance information of the environment, such as vibration intensity or frequency: for example, the closer an object is to the user, the higher the vibration intensity or frequency is. Both tasks were run on blindfolded sighted subjects.

Our preliminary data shows that vibrotactile feedback was reliably perceivable on wrist and elbow locations, but not on the shoulder area even with the highest intensity of the actuator. We also found that the wrist was more sensitive than the elbow. In the second task, subjects were able to discriminate two distances that were 0.1 meters apart using both vibration intensity and click frequency mapping methods. We plan to study this form of haptic feedback in a more systematic way and explore other ways to convey information about the environment to users. We also plan to test vibrotactile feedback in real-world navigation with visually impaired subjects.

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449

Subcategory: Electrical Engineering

Electrochromic Window Controller Application Specific Integrated Circuit Implementation

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Buildings in the U.S account for 40 percent of the total energy usage in the country (McLaren 2009). This research project is a step towards improving the energy-harvesting electrochromic window (EH-ECW) control circuit, EH-ECWs are windows that can transfer solar energy into electrical energy for building usage. This study focused on reducing the size of the EH-ECW's control circuit using an application specific integrated circuit

(ASIC), to make the window more energy efficient as well as more economical to produce.

The project tested how an ASIC could replace the current control circuit's operational amps, the analog switch, and the buffer. The ASIC design was tested using a computer program called Cadence Virtuoso. The program demonstrated the performance of the control circuit which included the effects of parasitic resistance and capacitance. In the design, each component had a symbol, schematic, layout, and a test bench. Designing the layout of the component was a crucial factor in the controller's performance because of inefficiencies, such as excess wire or poor placement, which would result in voltage drops or other negative aspects on performance.

This research found that, although Cadence Virtuoso had not successfully completed a simulation of the complete layout which incorporated all of the functional blocks of the ASIC, the redesigned control circuit should function because of successful simulations for each block of the ASIC individually. Cadence Virtuoso had not completed a simulation because of an unknown error and due to time constraints we were not able to resolve the issue. Thus, we can still draw conclusions about how the ASIC will improve the control circuit.

The components replaced by the ASIC will have a reduced surface area from 616mm2 to 54mm2. This was because the new design of the ECW controller by David Chamberlain had been designed so that the op-amps, the analog switch, and the buffer were all replaced. As a result of the components being replaced and the surface area being reduced the ECW control circuit would cost $4.97 less to be manufactured. The project concluded that a redesigned control circuit can reduce production costs, increase efficiency, and may provide an opportunity for the EH-ECW to be mass-produced and used commercially. Therefore, the closer that this research brings us to the EH-ECW being produced, the closer we are to decreasing the vast amount of energy used by buildings.

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450

Subcategory: Electrical Engineering

VHDL Integration of Digital Clock

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Traditionally, the digital projects are implemented using discrete integrated circuits. This approach may contribute to the learning of digital concepts from academic point of view. However, to make the system robust what is needed is a hardware description language that is robust and can be modified, programmed and tested. Very High Speed Integrated Circuit Hardware Description Language (VHDL) is used to for designing systems that allows the behavior of the system to be modelled and simulated before the Computer Aided Design (CAD) tools can download the code to the target CPLD (Complex programmable Logic Device). The principle goal of the summer research project was to design, test, simulate, and implement the Digital clock using the VHDL. The project was implemented on the Altera DE2 platform, which is based on Cyclone II EP2C35 (672-pin package) FPGA (Field Programmable Gate Array). Quartus II design software was used for design entry and scripting of the digital clock system blocks. This paper will discuss the implementation of the Digital Clock in VHDL.

Funder Acknowledgement(s): National Science Foundation

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451

Subcategory: Electrical Engineering

Solar Driven Liquid Desiccant System Dehumidifier

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In regions with high humidity levels, liquid desiccant systems could be extremely effective as renewable dehumidifiers in buildings. The resulting dehumidification of the desiccant system helps the conditioning unit to engender and improve thermal comfort climate in buildings. It also reduces the need to use a larger amount of electrical energy for air cooling, lowering the electricity load. The renewability of the desiccant solution comes from a solar hot water tank, which is used to regenerate the liquid desiccant solution to continue the cycle of dehumidification. Using a solution of Calcium Chloride (CaCl2) and water (H2O) as the liquid dehumidifier, this study, uses a prototype of a Solar Driven Liquid Desiccant (SDLD) system to study the absolute dehumidification of the air. To achieve this, it is necessary to understand the relationship between temperature, level of humidity in the air (water vapor pressure, water saturation vapor pressure), and level of saturation of desiccant solution. This system is currently tested experimentally with plans to install it in a community lab designed to be a net-zero building, and equipped with a solar powered thermal tank, which will be used for field experimentation. This research provides valuable data pertaining to the effectiveness and efficiency of solar driven liquid desiccant systems, leading to their introduction into the common household.

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452

Subcategory: Electrical Engineering

A Controllable and Portable Pressure Driven Pumping System for Microfluidic Applications

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Microfluidic systems have been widely utilized in various bio/ medical applications such as drug delivery, diagnostics, cancer research, and synthetic biology due to its capability of controlling small volume of samples accurately. This capability requires smooth and highly precise liquid dispensing in microfluidic systems, typically controlled by using commercial syringe pumps. However, the syringe pumps are expensive, and cannot provide smooth low-volume liquid displacement as flow speed decreases. Also, microfluidic systems often need multiple syringe pumps at the same time for handling various samples together, which increases the operating cost. Here, we present a simple, portable, inexpensive, and programmable pressure driven pumping system that has a capability of dispensing the small volume of liquid smoothly and stably. The pressure driven pumping system is a closed loop system, which consists of a fluid reservoir with an air inlet, a fluid outlet, and a pressure sensor. The operation of this system was controlled by Arduino Duo microcontroller, which regulated the pressure inside the fluid reservoirs by continuously comparing it with pre-selected target pressure. By selectively opening and closing a three-way solenoid valve, air flow into the fluid reservoir was controlled, and as a result, a certain level of pressure was continuously maintained inside the reservoir. This constant pressure pushed out the fluid from the reservoir to connected microfluidic chips, resulting in continuous liquid dispensing from the developed system. Flow speed of liquid was easily changed by adjusting the target pressure value. Also, multiple different flow speeds were generated simultaneously by integrating multiple fluid reservoirs into the system, where each reservoir was individually addressable. To achieve very stable pressure control with small hysteresis as well as smooth liquid dispensing, a fast response solenoid valves were used. The developed pressure driven pump was utilized in a microfluidic T-junction droplet generator, where two different flow speeds of oil and water from the single pump system successfully produced uniform- sized droplets (diameter: 100 µm) by regulating the pressure of two fluid reservoirs within ±0.1 psi of target point. The pressure driven pumping system will be further characterized to achieve lower flow speed, to implement user-friendly interface, and to compare the performance against commercially available syringe pumps.

Funder Acknowledgement(s): Arum Han, Texas A&M University

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453

Subcategory: Electrical Engineering

Regolith and Environment Science and Oxygen and Lunar Volatile Extraction (RESOLVE) Project

Ray Parker, Rensselaer Polytechnic Institute

NASA (National Aeronautics and Space Administration) exploration of extraterrestrial bodies is increasingly growing as well as what materials that can be gained from these lunar bodies. In future human exploration of space, NASA has an increasing interest in obtaining resources from outside of our own planetary system and using these resources as essential resources to help humans survive in the unforgiving climates of space, and lunar bodies such as Mars. The RESOLVE project is a lunar prospecting mission whose primary goal is to characterize water and other volatiles in lunar regolith. The Lunar Advanced Volatiles Analysis (LAVA) subsystem is comprised of a fluid subsystem that transports flow to the gas chromatograph – mass spectrometer (GC-MS) instruments that characterize volatiles and the Water Droplet Demonstration (WDD) that will capture and display water condensation in the gas stream. The LAVA Engineering Test Unit (ETU) is undergoing risk reduction testing this summer and fall within a vacuum chamber to understand and characterize component and integrated system performance. Testing of line heaters, printed circuit heaters, pressure transducers, temperature sensors, regulators, and valves in atmospheric and vacuum environments was done. Test procedures were developed to guide experimental tests and test reports to analyze and draw conclusions from the data. In addition, knowledge and experience was gained with preparing a vacuum chamber with fluid and electrical connections. Further testing will include integrated testing of the fluid subsystem with the gas supply system, near-infrared spectrometer, WDD, Sample Delivery System, and GC-MS in the vacuum chamber. This testing will provide hands-on exposure to a flight forward spaceflight subsystem, the processes associated with testing equipment in a vacuum chamber, and experience working in a laboratory setting. Examples of specific analysis conducted include: pneumatic analysis to calculate the WDD's efficiency at extracting water vapor from the gas stream to form condensation; thermal analysis of the conduction and radiation along a line connecting two thermal masses; and proportional-integral-derivative (PID) heater control analysis. Since LAVA is a scientific subsystem, the near-infrared spectrometer and GC-MS instruments will be tested during the ETU testing phase.

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454
Subcategory: Electrical Engineering

Evaluation of Range Sensors for Vibrotactile Navigation for the Visually Impaired

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Epidemic studies conducted by the World Health Organization have reported that the number of visually impaired individuals was 285 million in 2012; a number that has increased from the 161 million reported in 2002. Our wearable vibrotactile project is centered around designing and implementing various smart sensing platforms for evaluation of a multimodal assistive navigation device. These include multiple sensors, such as IR range sensors, sonars, and accelerometers. The ultimate goal of the project is to create a multimodal sensory navigation system for visually impaired users.

Two sensors that were evaluated for performance were an accelerometer and a sonar sensor. The 3-axis accelerometer can provide a trajectory of position and the sonar range detector can detect nearby obstacles. The sonar's accuracy was measured from both analog and digital interfaces. Analog readings were taken at 10ms and 100ms sampling rates. The sonars analog signal's noise rejection improved at a 100ms sampling rate as compared to a 10ms sampling rate. Digital readings taken at a fixed 20ms sampling period provided stable and consistent range detection. The accelerometer data obtained from the 3-axis accelerometer was analyzed and processed with two filters, a low pass filter and a one dimensional Kalman filter. Both filters improved acceleration readings, however the Kalman filter provided a better signal to noise ratio. Applying the one-dimensional Kalman filter helped reduce acceleration noise but the final position data still contained large drift errors. Overall, initial steps towards the project goal were taken this summer, in the form of testing the various sensors in order to determine the accuracy of each. For future work, the implementation of an Extended Kalman Filter will be considered to improve the trajectory estimates from the accelerometer as well as a real time data gathering and processing implementation. The sensor data will then be integrated to provide a visually impaired user feedback about their surroundings.

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455
Subcategory: Electrical Engineering

Nasa Simulation of an Autonomous Payload

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Have you ever wondered how NASA lands rovers on Mars? Understanding the complex engineering of landing delicate scientific payloads on a planet's surface is an essential process to space exploration. In order to support NASA's mission to advance technology and science through airborne remote sensing, this project simulates the landing of a payload on earth. The objective of this project is to design and build a payload able to perform telemetry, and equipped with a controlled descent system locking the descent rate to 10 m/s throughout the entire flight. In addition, the drag coefficient of the payload is calculated using dynamical analysis. Three subsystems have been identified when designing the engineering components of the payload: electrical, mechanical, and ground control system (GCS). The electrical subsystem handles the power distribution, the synchronization of all sensor data from the microcontroller, and their transmission to the GCS. The mechanical subsystem controls the descent rate, and the physical layout of the payload. Furthermore, it handles the deployment of the payload from its protective container at 200 feet above surface. The GCS is equipped with a Graphical User whose role is to displays in real time all telemetry data from the payload throughout the entire flight. The sensors utilized in this project are barometric, accelerometer, and camera. To control the descent rate, a parachute is used on both container and payload with a spill hole to minimize their diameter and increase their stability. Using altitude measurements calculated from the barometer readings, a nonlinear regression is performed on the experimental values to deduce the terminal velocity, and in turn, the drag coefficient of the payload. The regression function of velocity versus time is obtained by applying Newton's analysis on the payload, and by modeling the drag force as a function proportional to the square of the velocity. Our payload is now fully functional, and is scheduled to be launched on a rocket to an altitude of 400 feet. It is expected that the collected barometric data will be used to deduce the drag coefficient and reveal kinematics information of the payload. Further research will include two modifications: the use of an Inertial Measurement Unit to stabilize the payload, and obtain a more stable visual recording using the camera; and the replacement of the currently used passive control descent system (parachute) with an active system using propellers.

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456

Subcategory: Electrical Engineering

Health Concerns Regarding Smart Meters

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Smart grid refers to the "application of computer intelligence and networking abilities to an electricity distribution system." The "smart" in smart grid alludes to the "computerizing" of the electric utility grid. It's an innovative way of using information technology with our current electrical communications, allowing the system to "talk and listen." Generally, during a power outage, a customer calls their power company to inform them. With smart grid, the company will immediately know of the outage due to smart meters in the affected area that stop communication with them. The principal objective of this poster is to explore the effects of radiation produced by smart meters. Using recent data and knowledge about smart meters, this poster details what smart meters are, gives an analysis of the data surrounding the controversy concerning exposure levels of radio-frequency from smart meters, and the attempts to minimize such radiation.

Funder Acknowledgement(s): HBCU-UP HRD-1435947

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457

Subcategory: Electrical Engineering

Characterizing the Effects of Shading on the Performance of a Mobile Photovoltaic Array

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With advances in technology photovoltaics (PV) are becoming ever more feasible as a power source for electrified passenger vehicles. These mobile PV arrays however will experience operating conditions different than that of traditional PV arrays. For instance, shade caused by trees, buildings, dust, etc., may limit the performance of a mobile PV array. It is therefore, the goal of this research, to characterize the effects of shading on the performance of a mobile PV array designed for an electrified passenger vehicle. An electrified passenger vehicle with a roof-mounted PV array was placed under a series of characterization tests. These tests included shade tests to determine the effect of various levels of shading on the performance of the PV array. The shade testing was separated into two parts, which included fully covering and partially covering one of three adjacent PV panels in the roof-mounted array with materials of a known transparency. In doing so, the actual shade level on the PV array could be controlled. During the tests, current and voltage loggers were used to record data from each of the three PV panels. In these controlled tests, the findings indicated a 15% greater reduction in power than anticipated by the shade level alone. The additional loss in power is attributable to mismatch losses in the PV array. For a mobile PV array, non-uniform and varying shade levels are likely to occur; therefore, further testing will be required to understand such effects on a mobile PV array.

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458

Subcategory: Environmental Engineering

Investigating the Urban Hydrology of the Jamaica Bay Watershed

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During rainfall, runoff may readily pick up debris and dissolved pollutants from urban surfaces, and deposit these into nearby bodies of water. Runoff contamination is especially likely in regions which have a significant amount of impervious surfaces (≥10%). The amount and kinds of contaminants depend on the land use and land cover through which water flows. Some land use and land cover combinations put nearby water bodies and their ecosystems at different kinds of risks, depending on the specifics of the ecosystems and kinds of pollutants and their respective concentrations. Impacts include, but are not limited to, impaired drinking water, algal blooms, and negative impacts to recreation, fisheries, and wildlife. The area of interest that was evaluated in this study is the Jamaica Bay watershed. Jamaica Bay is an urban watershed, and therefore exhibits challenges in terms of maintaining acceptable water quality levels, especially in light of the ongoing rehabilitation efforts set by the NYC DEP. The DEP estimates that 15.5k MG of untreated water enters the bay per annum (2007). The DEP attributes 62% to storm water, 23% to direct runoff, 12% to combined sewer overflows and 3% due to partially treated CSO's, by volume. The purpose of this study is to assess the conditions and pathways for untreated water (specifically surface runoff) to enter the Jamaica Bay estuary. In order to assess the land use surrounding the study area, a Digital Elevation Model (DEM) was downloaded, from the USGS National Map Viewer, to display the elevation levels surrounding the estuary. The DEM was also used to display infrastructure, which may contribute to possible non-point sources of pollution, surrounding the estuary. In order to assess the land cover surrounding the study area, the National Land Cover Database (NLCD) and the Landsat8 satellite image was downloaded and used for land cover classification. It has been found that the land cover, surrounding the study area, contained approximately 50% of impervious cover from the Landsat8 satellite image and approximately 63% of impervious

cover from the NLCD image. The existing land use and land cover, therefore, puts the Jamaica Bay estuary at a high risk for water quality issues, and is likely to pose further challenges to the development of a healthy ecosystem there. Future research involves estimating the amount of surface runoff that will occur during a rainfall event, and eventually develop a model to assess the pollutants and its sources during heavy rainfall events.
References: Flinker, P (2010). "The Need to Reduce Impervious Cover to Prevent Flooding and Protect Water Quality", 3. "Jamaica Bay Watershed Protection Plan". Web. <http://www.nyc.gov/html/dep/pdf/jamaica_bay/vol-2-chapter-2.pdf>.

Funder Acknowledgement(s): This project was funded by The National Oceanic and Atmospheric Administration Cooperative Remote Sensing Science and Technology Center (NOAA-CREST). NOAA CREST - Cooperative Agreement No: NA11SEC4810004.

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459

Subcategory: Environmental Engineering

A Comparison of Energy and Greenhouse Gas Emissions of Conventional and Advanced Onsite Wastewater Treatment Systems

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In the United States, there are approximately 26M conventional onsite wastewater treatment systems (OWTS) designated to achieve primary treatment for the raw wastewater from a residence1. Unfortunately, OWTS constitute the third most common source of groundwater contamination contributing to eutrophication in water bodies2.The addition of a secondary treatment unit reduces the nutrient loading to the environment, but increases material and energy consumption. Limited research has been conducted to investigate the embodied energy and greenhouse gas (GHG) emissions associated with advanced treatment technologies.

The goal of this research is to evaluate the energy and GHG emissions of conventional and advanced OWTS using a life cycle assessment (LCA) framework. The LCA methodology consists of (a) defining the scope; (b) compiling an inventory; (c) evaluating the environmental impacts; and (d) interpreting the results. Two scenarios were considered: (1) a conventional OWTS with a concrete septic tank and a drain field, and (2) an advanced OWTS that includes passive nitrification and denitrification for secondary treatment; both to be replaced every 10 years. The advanced system uses a 5 years lifetime biofiltration media (e.g., clinoptilolite, sulfur, gravel, and oyster shell) for passive nitrogen reduction instead of aeration. A functional unit (FU) of 1 m3 was selected and a design for a four-people residence was modeled for an annual wastewater production of 381 m3 for both researched approaches. Lifecycle inventory data was collected through surveys, a literature review, and contacts with manufacturers. The Water Energy Sustainability Tool (WESTWeb)4 was used to estimate energy and GHG emissions. The dominant contributors to the embodied energy were the pumping requirement for the scenario (1) as 41 MJ/m3 and the biofiltration media for the scenario (2) as 79 MJ/m3. Relative to scenario (1), the biofiltration media increased the embodied energy by 50%, but effectively reduces effluent nitrogen concentration. The biogenic methane emissions released by the wastewater was the greatest contributor to GHG emissions for both scenarios; approximately 26 kg CH4 per year was emitted from the system. Future research will compare passive biofiltration and an OWTS with an aerobic treatment unit for advanced nitrogen removal. Additionally, the cost and environmental impact of septic tanks manufactured with different materials will be analyzed.

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460

Subcategory: Environmental Engineering

Estimation of Runoff and Peak Discharge to Facilitate Rural Development Using Statistical Analysis of Watershed in Ethiopia

Sierra Dennis, Howard University

The objective of this study is to conduct a hydrologic analysis of the waterways of a region, where bridge and drainage structure construction is proposed. The proposed roadway improvement and bridge construction will occur in the Mecha Woreda district. A literature review was conducted to establish the design frequencies necessary for various design structures. This study will help designers determine the peak discharge and infer which design frequency will achieve maximum productivity with minimum wasted effort or expense. For this region, the estimated flood magnitudes and peak discharges obtained from the analysis are fundamental characteristics for the expansion of rural development. Increased flood magnitudes and peak discharges are common ramifications that can affect peak runoff.

In order to conduct the hydrologic analysis the following methodology was used:
** Analysis and interpretation of satellite imagery maps on Google

** Interpretation of meteorological data from nearby stations
** Analysis of land use, land cover type, treatment class
** Analysis of field surveys and soil properties to determine soil grouping
** Interpolating unknown SCS data from graphical representations of known SCS data and characteristics
** Collection of data and analysis for un-gauged rivers, and estimation of flood magnitudes and peak discharge

The results of the proposed structural project, between Egdet Behbret and Amarit, will be a medium span bridge, about 15 to 50 meters long. The geometric design frequency standard intended for the medium span bridge is about 25 years. According to the study, the bridge, with a design frequency criterion of 25, will produce a peak discharge of approximately 357.47m3/s. The designer must produce bridge plans and designs based upon this integral discharge value.

In conclusion, understanding the flood magnitudes and frequency will assist in the planning and floodplain management investigations of the proposed structure. Flood magnitudes are a function of the watershed characteristics and physical environment. Drainage structures are expected to accommodate a discharge with a given return period, and must be designed in that manner. This study will help designers determine the peak discharge and infer which design frequency will achieve maximum productivity with minimum wasted effort or expense.

Funder Acknowledgement(s): Howard University GEAR UP

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461

Technology & Engineering
Subcategory: Environmental Engineering

Efficiency and Genetic Analysis of Methane Production in Varying Temperature and Substrates Through LAMP

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Methanogenesis is the biological production of methane by anaerobic Archaea known as methanogens. Methane's relevant abundance makes it an attractive fuel for as heating, power generation, and vehicle fuel, as the current infrastructure is already in place for its utilization. Different parameters affect the rate and efficiency of methane production. In this research, food waste digester sludge and digester sludge from the Columbia Metropolitan Wastewater Treatment Plant was maintained with a hydraulic residence time (HRT) of 10 days, a pH of 6, a C/N ratio of 20:1 (molar basis), and a BOD Loading rate of 7 g/L in all cultures. The cultures were monitored and tested for the pH, temperature, the optical density at 600 nanometers (OD600), the total nitrogen (TN), the total organic carbon (TOC), and for methane. Comparisons in growth conditions tested were: the glucose bottles at 35˚C and at 50˚C, and glucose versus sucrose at 35˚C.

In the food waste digester sludge, glucose-fed cultures produce more gas volumes at higher temperatures compared to at 35˚C, while sucrose fed cultures produced higher gas volumes when compared to glucose fed cultures at an equal temperature of 35˚C. Methane was produced at similar percentages (10-12%) at both temperatures and substrates, with a trace net of hydrogen production at 50˚C. The Metropolitan Wastewater Treatment Plant (WWTP) sludge produced less methane at 50˚C than the 35˚C glucose-fed cultures. However the 50˚C cultures produced approximately 17% Hydrogen gas. The glucose grown cultures produced more methane than the sucrose fed, producing 9% and 6% methane, respectively. For the WWTP culture, gas production volumes were typically greater for the sucrose-fed cultures than the glucose-fed cultures (both at 35˚C), and the 50˚C culture generally produced more gas than the 35˚C culture. Future and ongoing work includes the genetic analysis of methane production using Loop mediated amplification(LAMP) and the analysis of degredation of antibiotics such as tetracycline by use of methanogens and bacteria.

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462

Subcategory: Materials Science

A Comparative Analysis of Window Performance Using Measured and Simulated Data

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The energy required to power buildings accounts for 40-48% of energy usage in the United States (Yudelson and Meyer, 2013). If innovative techniques using daylight were to be applied towards window technologies, it could produce a more visually stimulating, healthful, and productive environment. Taking daylight into consideration during window construction for commercial buildings is crucial, given that employing certain techniques could potentially reduce electrical lighting usage while also improving upon the visual and thermal comfort of the space.

For this study, the performance of standard single-glazed windows was compared to different alternates, including electrochromic windows, double-glazed windows, and windows with

Venetian blinds. Real-time photograph, temperature, humidity, and light intensity data was collected at an office space at Rainier Tower in downtown Seattle. After the data was processed, the real-time single-glazed window data was compared to simulations of the window alternates modeled in COMFEN, a comparative facade analysis program.

The results of the data collection confirm that single-glazed windows are not as visually or thermally comfortable as other glazing systems. It gave rise to the importance of considering other window alternates, such as venetian blinds and electrochromic windows. Furthermore, the results showed that electrochromic windows would be the most suitable in terms of energy efficiency, while venetian blinds may be more appropriate in terms of providing maximum visual comfort. The use of these technologies ultimately depends on a building's criteria for comfort and energy, but it is something important that should be given a significant amount of consideration.

Future research should further explore the human perspective. It would be beneficial to survey people and see how their responses compare to visual comfort simulation data. In addition, when evaluating for visual and thermal comfort, studies or simulations can be performed over a long period of time to account for seasonal changes. To provide a closer comparison, longer term studies with measured data should be performed to test window alternates under various weather conditions. This will allow for an improved understanding of maximally efficient windows or combinations of window technologies. More studies and comparative analyses must be performed to discover more feasible window options in the technologically emerging world.

References: Yudelson, Jerry and Ulf Meyer. The World's Greenest Buildings: Promise Versus Performance in Sustainable Design. New York: Routledge, 2013.

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463

Subcategory: Materials Science

Strengthening of Aluminum with Multiwalled Carbon Nanotubes by Mechanical Alloying and Sintering

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Aluminum matrix composites are very attractive materials due to their excellent mechanical properties, low cost and light weight. They have a wide range of applications such as fabrication for strut assemblies, electronics and thermal control devices. This research focused on the feasibility of strengthening the Al matrix by adding multiwalled carbon nanotubes (MWCNT). These nanotubes are dispersed with isopropanol in an ultrasonic bath to favor dispersion, and then mixed with aluminum powder in a high-energy ball mill. Afterwards, the composite pellets were compacted and sintered at 500˚C. Mechanical and thermal properties of the specimens were compared to those of pure aluminum. The hardness of the nanocomposite improved with increasing MWCNT in the Al matrix. Future research involves functionalized multiwalled carbon nanotubes in the Al matrix.

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464

Subcategory: Materials Science

The Effect of Bagasse Filler on the Thermomechanical Properties of Bio-based Epoxy System

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Polymers have been used throughout industry to produce many materials that are needed for aerospace, aeronautics and automobiles and for thousands of other consumer products. For healthcare and medical applications, polymers are also used to create products such as lubricants, adhesives, artificial joints, orthopedic plates and heart valves. Although polymers are traditionally weak, they can be fortified with filler materials. Each year millions of tons of waste are disposed in landfills. According to the Environmental Protection Agency (EPA), the average person dumps about 4.5 pounds of waste into landfills each day, contributing to environmental problems. Problems created also includes pollution and the development of deadly greenhouse gases that have been found to be responsible for many catastrophes that include glacier melts and torrential flooding. Most landfill wastes are non-biodegradable. However, the disposal of materials that are biodegradable pose little or no threat to humanity or to the earth's atmosphere. Bagasse, the stalk that remains after sugarcane juices have been extracted, has been found to be a candidate for use as a biodegradable filler. Bagasse nanoparticles (NPS) were selected to be used as fillers for the epoxy 100/1000 system, which consists of epoxy resin (Part A) and the hardener (Part B). It is essential to determine the

appropriate amounts of bagasse NPS to be used to produce the greatest benefits of increasing the strength of the material without compromising other qualities. Experimental proportions of bagasse particles were used as reinforcement, beginning with 1,2,3, and 4% quantities. After samples were fabricated, thermal stability, storage moduli and dimensions stability were analyzed to determine the reinforcement effect of the bagasse filler on the polymer. The results showed significant delays in 5% decomposition temperature and increase in residual amount of char as the amount of bagasse increased from 1-4%, signifying some fire retardant ability of the bagasse filler. Storage modulus and dimension stability also significantly improved from those of the neat epoxy polymer. These results suggest that the bagasse filler is a promising polymer reinforcement material and should be explored further in this regard.

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465

Subcategory: Materials Science

Synthesizing Multifunctional Dyes for Energy-Harvesting Electrochromic Windows

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The world's petroleum supplies are depleting, which has led to the current energy crisis. A new alternative energy source must take its place. The development of solar energy has the ability to not only replace petroleum resources but also has the potential of changing the world's access to energy. Many solar cells in production are inorganic. Inorganic solar cells have high power conversion efficiencies; however, they are expensive to make. Organic solar cells are much more cost effective, yet their energy conversion efficiency is low. Thankfully, it is possible to combing the cell types and create a hybrid solar cell. These hybrid cells, which this research project focuses on, uses an organic dye and allows the harvesting of solar energy. The compound, poly(3-hexylthiophene), needed to be modified to attach to nanoparticles. Previous work in the group has focused on replacing the hydrogen at the end of the polymer with thiols to allow for nanoparticle functionalization (Okamoto and Luscombe 2014). In this work, work was performed to prepare the monomer that is required for poly(3-hexylthiophene) synthesis. The synthesis began with a commercially available reagent, 2-bromo-3-hexylthiophene, which was iodinated in the presence of (diacetoxyiodo)benzene in dichloromethane to yield the monomer, 2-bromo-3-hexyl-5-iodothiophene. The resultant monomer was purified via column chromatography and then tested for purity using Nuclear Magnetic Resonance (NMR) Spectroscopy. There is more to be done concerning this research. The polymer must be synthesized and inorganic nanoparticles need to be attached to the organic polymer to create a hybrid material. The resulting hybrid materials then need to be tested in photovoltaic devices. The future of energy depends on the research done to tap into the potential of solar power.

References: Okamoto, Ken, and Christine K. Luscombe. 'Simple procedure for mono- and bis-end-functionalization of regioregular poly(3-hexylthiophene)s using chalcogens.' Chemical Communications 50 (2014): 5310.

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466

Subcategory: Materials Science

Use of Bioadhesives and Dry Adhesives in the Engineering Field A Finite Element Analysis to Assess Their Mechanical Response

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In nature, specific organisms have the ability to create adhesives for the purposes of construction, obstruction, predation and attachment. Analyzing these substances has given scientist the information needed to artificially create them to be used in the medical field as bioadhesives. The purpose of this research, funded by the North Carolina Space Grant, is to apply a derived form of these naturally found adhesives, similar to bioadhesives, in the engineering field which are called dry adhesives. Currently the best method of joining two substances together, such as two sheet metal plates, is to weld them together, use some form of threaded fastener rivet, or to brazing and solder them together. Using dry adhesives for the purpose of joining two metallic substances together would currently fail due to the low tensile strength and high elasticity of the bioadhesives. For the purpose of engineering, these dry adhesives must be mostly rigid yet not brittle; they must also be able to withstand a high amount of force for an extended period of time as well as cyclic loading. To develop a substance with these characteristics, testing must be conducted on adhesives that are currently being used in the engineering field, such as dry microfibrillar adhesives. These adhesives, derived from natural adhesives found in insects and lizards, are effective because of their ability to change the area of contact which allows the adhesion to be controllable.

Using ABAQUS, a commercial finite element analysis package, polyurethane elastomer microfibrillar adhesives which are in

contact with a glass indenter was modeled to see the reaction of the polyurethane elastomer. In the model above the indenter is moving towards the elastomer at a rate of 10m/s. The polyurethane elastomer microfibers have a tensile strength of 6 MPa and a Young's Modulus of 2.9 MPa. To create a substance with a greater adhesion the next step will be to fill the gaps between the microfibrillar with another adhesive substance and conduct the same analysis test. Currently to facilitate the computation time, a part of the geometry is modeled and perfectly straight initial geometry of the microfibrils are considered. The modeling is refined to incorporate the excessive deformation of the soft microfibril surface during indentation. To model the indentation experiment in the finite element simulation a surface-to-surface contact is being used. Mesh has been refined sufficiently to capture the severity of localized deformation. In the future, various case studies will be performed by considering different initial geometry of the microfibrils and the effect of their mechanical properties on the indentation analysis.

Funder Acknowledgement(s): North Carolina Space Grant

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467

Subcategory: Materials Science

Extent of Dopant Activation after Microwave and Rapid Thermal Anneals Using Similar Heating Profiles

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Many sustainability issues arise with the current manufacturing processes used for semiconductor-based solar cells. Microwave (MW) heating could be adopted as sustainable; since, its capital costs are less and it more efficient than conventional furnace systems. This study compares the extent of dopant activation and damage repair for a MW anneal and a conventional rapid thermal anneal (RTA) with identical heating profiles. Sheet resistance measurements were used to assess the extent of dopant activation and ion channeling was used to monitor the extent of damage repair. Rutherford backscattering spectrometry was used to measure the extent of recrystallization of after each anneal. The MW saturation point for the dopant activation was 50 seconds as measured with a four-point probe. It is concluded that higher the dose and time of arsenic in the silicon, the smaller the difference in the sheet resistance between the RTA and microwave annealing. For the Hall measurements of the 1e15 ions cm-2 100s sample after MW processing, it has a higher carrier concentration than 2e15 ions cm-2 50s sample. For all three 50s doses for the RTA samples, the sheet resistance is observed to be inconclusive as a result of not reaching the saturation point. Rutherford backscattering spectrometry results show that the MW anneals give better dopant activation and damage repair for short times for identical heating profiles.

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468

Subcategory: Materials Science

Covert Printing of Near IR to Near IR Upconverting Nanoparticle Ink for Integrated Circuit Anti- Counterfeiting Techniques, and Development of an Effective Detection Method

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Counterfeiting of microelectronics has become an increasing problem in recent years. In 2008 alone, the U.S. Department of Commerce reported 9,356 counterfeit microelectronics incidents discovered by military suppliers [1]. Most of these incidents were for microcircuits priced between $1.01 and $100 [2]. The most common counterfeiting method used involves scratching off legitimate labels from outdated or low value integrated circuit packages and replacing them with labels of high value products. These are then sold back to a manufacturer for a profit. In order to combat this issue, it is hypothesized that near infrared (NIR) to NIR upconverting nanoparticle (UCNP) inks could be printed under the surface of the organic packaging, rendering this counterfeiting method ineffective.

This work is focused on the development of near infrared (NIR) to NIR upconverting nanoparticle inks, as well as the formulation of an effective and fast detection method for the purpose of anti-counterfeiting. A security ink containing lanthanide doped upconverting nanoparticles was synthesized and printed using an M3d Aerosol Jet printer on a paper substrate [2]. A tabletop apparatus was designed, incorporating a 980 nm laser, a digital camera using an 800 nm bandpass filter in place of an IR shortpass filter, and a computer to collect images from the ink. When the QR code was excited with 980 nm light, an image was captured with the digital camera, collecting the 800 nm emission while effectively filtering the 980 nm excitation wavelength. This detection apparatus was successful in collecting a readable QR code using only the 800 nm emission with a 980 nm excitation. This proves that the UCNP inks are a viable method for covert-to-covert security applications. A multispectral imaging system (Visual Spectral Comparator 6000) was used to collect optical transmission spectra for several mold compounds obtained

from various electronic packages. These results suggest that the security ink emissions could be transmitted by epoxy mold compounds used in electronics packaging, but future research is needed to evaluate the impact of the polymer composition and filler content on 900 and 800 nm light transmission. This is due to the significant variation in transmission behavior between different epoxies, which is likely associated with filler content and polymer composition.

References: 1. Toohey, B., Semiconductor Industry Association, "Testimony Before the Senate Committee on Armed Service on Counterfeit Electronic Parts in the U.S. Military Supply Chain", November 8th 2011.
2. Defense Industrial Base Assessment: Counterfeit Electronics. (2010). U.S. Department of Commerce.
3. Meruga, J. (2013). Security Printing using Multi-colored Upconverting Nanoparticle Inks (Unpublished Doctoral Dissertation). South Dakota School of Mines and Technology

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469

Subcategory: Materials Science

Synthesis and Characterization of Biocomposites Containing Ferroelectric Nanoparticles

Javier Martinez-Santos, University of Puerto Rico
Co-Author(s): Amarilis Declet, Nelson Sepulveda, Carolyn Ortiz, and O. M. Suarez, University of Puerto Rico, Mayaguez, PR

The search of high permittivity materials has intensified the interest in bioferroelectric composites in order to find sustainable alternatives for a number of devices. The present research involves the development of a biocomposite matrix made of chitosan and cellulose by varying the concentration of cellulose and acetic acid upon synthesis. A layered structure was used, i.e. chitosan-cellulose followed by ferroelectric nanoparticles, in order to fabricate the bioferroelectric composite. The material then underwent a series of tensile, thermogravimetrical and thermomechanical tests. Furthermore, ferroelectricity and dielectric properties were measured. Cellulose concentrations were varied to test the behavior of the mechanical properties of the composite. The data showed that higher levels of cellulose increased the composite formability. Additionally, our results suggest that the ferroelectric nanoparticles lowered the dielectric strength of the polymeric matrix. However, the addition of the nanoparticles raised the dielectric constant of the composites.

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470

Subcategory: Materials Science

Making Drops Move Faster: The Role of Topology on PEM Fuel Cells

Maritza Sanchez, California State University, Los Angeles
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Polymer Electrolyte Membrane (PEM) fuel cells can contribute to the production of clean energy for power and automotive applications. PEM fuel cells separately react hydrogen and oxygen gas on either side of the PEM. Hydrogen is oxidized to protons at the anode. Protons are conducted through the PEM to the cathode where they react with oxygen to form water. Water must be removed to avoid blocking the flow of oxygen to the cathode. The removal of liquid water from the gas flow channel is a major challenge for fuel cell engineers. We have observed how the topology of the surfaces in the flow channel affects water drop detachment and motion by examining water drop growth and movement over corrugated surfaces. Water flows from a 1/64" hole and forms a drop on the plate with a patterned surface. The pressures for drop detachment and drop sizes have been monitored with pressure transducers and photography as a function of the tilt angle for the plate. Stick-slip phenomenon was observed on hydrophilic surfaces affecting the drop volume and velocity. Elucidating the physics of drop detachment and motion will allow for a more efficient engineered PEM fuel cell, as well as future analyzation of other affecting factors, such as topological surfaces due to porosity.

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471

Subcategory: Materials Science

Catalytic Regeneration of Electroless Deposition of Nickel on Silicon Carbide Ceramic Foam Diesel Particulate Filters

Hunter Starring, Louisiana State University
Co-Author(s): Patrick F. Mensah, Stephen Akwaboa, and Lulit Affin, Southern University and A&M College, Baton Rouge, LA

Diesel Particulate DPFs (DPFs) are becoming a more effective solution to meet the stricter regulations being placed on diesel

vehicle emissions from the Environmental Protection Agency (EPA). These filters provide that solution because they collect the particulate matter, also referred to as Carbon soot, in the exhaust of diesel engines. However, DPFs are costly to replace and the current method of regeneration is extremely energy inefficient. Therefore, the focus of our research was to create an energy efficient, cost effective catalytic regeneration method using metal coatings on the surface of these filters. Thus, we developed a novel method of Electroless Nickel Deposition onto the surface of Silicon Carbide (SiC) Ceramic Foam DPFs to harness the catalyzing characteristics of Nickel and develop a continuously regenerating trap. The Nickel deposition on the SiC DPFs surface was confirmed using SEM/EDX characterization. Finally, these DPFs were tested in the exhaust of a 1-cylinder diesel engine using pure diesel fuel while chemical and differential pressure data was collected. In turn, we can confirm that SiC Ceramic Foam DPFs are sufficient in reducing particulate matter in diesel exhaust. However, only one of the two chemical products of catalytic regeneration (NO2 and CO2) increased for the Ni-plated SiC DPFs. Thus, we would like to test different metal catalysts such as Cobalt, Iron, and Copper in tandem with different percentages of Biodiesel Fuel.

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472

Subcategory: Materials Science

Comparison of Atomistic and Meso-scale C60 Fullerene Models in Simple Solvent

Raymond P. Ulibarri-Sanchez III, New Mexico State University

The excellent electron accepting properties of the C60 fullerene and its derivatives make them good candidates for building blocks of donor-acceptor complexes for artificial photosynthesis or photovoltaic devices. In particular, organic solar cells (OSC) consisting of polymer chains and fullerenes draw much attention, due to low cost and compatibility with well-developed thin-film deposition technology. One major challenge that exists in OSCs is understanding the long-term stability of the microstructure. Thus it is important to investigate the structural development of active layer mixtures on time and length scales that are relevant to device studies. Accurate computer simulation models play an important role in elucidating the diffusion-driven evolution of the microstructure. However, the computational limitations of atomistic simulations only allow for systems of the size of a few nanometers to be studied. The length scale of interest is on the order of 100 nm for analyzing the phase behavior of the active layer components. Coarse-grained (CG) models in which collections of atoms from an atomistic model are mapped onto a smaller number of super atoms, allow the investigation of structure-property functions at the required length scale.

The goal of this research is to build a coarse grained model of C60 fullerene/solvent mixture that can accurately capture the structure of atomistic models. To accomplish this goal, atoms from the atomistic C60 fullerenes/solvent model is systematically grouped into super-atoms. This reduces the number of interactions and degrees of freedom in the system allowing for simulations to be analyzed over longer length and time scales. In order to validate these coarse-grained models, molecular simulations were conducted using both atomistic and coarse-grained models, and their solubility parameters were calculated and compared. The solubility parameter is important in controlling phase behavior. The results showed that the coarse-grained model represents the atomistic model reasonably well. With the completion of the coarse-grained model validation, the model and simulations are to be extended to the real microstructure of fullerene and polymer organic solar cell heterojunction.

Funder Acknowledgement(s): The National Science Foundation; New Mexico Alliance for Minority Participation

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473

Subcategory: Nanoscience

Monolayers, Patterns, and Other Formations Produced Utilizing Wedge-Cell Microsphere Self-Assembly

Jennifer Jenks, University of Washington

At the Boechler Research Group, we study self-assembled surface acoustic wave metamaterials. In particular, we are conducting experiment-driven studies on the convective self-assembly process of silica microspheres. This includes self-assembly parameters governing monolayer formation over different particle sizes, pattern formations that occur during the self-assembly process, and free standing microsphere membrane formation. It is expected that by focusing on key parameters, the self-assembly process can be better understood, monitored, and adjusted. Understanding such processes can lead to better metamaterial assembly techniques. These materials have the potential to be used in items such as signal processing devices, protective coatings and armors, and biosensors. Our materials are produced utilizing the wedge-cell self-assembly technique. Water containing microspheres is left to dry between two angled glass slides. When the liquid solution between the slides evaporates, capillary forces pull the microspheres toward the water line where they will closely pack together. Depending on the conditions of the surrounding environment, tilt of the wedge-cell, and the surface of the substrate, different formations are observed. The concentration of the solution of micro-

spheres as well as the described wedge-cell formation are kept the same throughout the experiments conducted. Results vary for the microsphere formation that we want to achieve. In general, higher levels of humidity create monolayers of microspheres, with the level being increased the smaller the particle and decreased the larger the particle. Patterns such as ripples occur depending on several variables, including temperature, humidity, and microsphere concentration, usually forming on the edges of the wedge cell. Free-standing membranes can be observed when a TEM grid is placed on the substrate of a wedge-cell that would otherwise generate a microsphere monolayer. These results provide insight into the physics of the self-assembly process and the interactions between these micro and nano particles. Further research could explore how varying parameters change the periodicity of ripple and strip patterns, how spheres of different materials assemble in a wedge-cell, and whether these experiments can be conducted on a greater scale, creating larger areas of self-assembling materials.

Funder Acknowledgement(s): University of Washington LSAMP

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474

Subcategory: Nanoscience

Exploring the Nano-Machining Applications of the Helium Ion Microscope (HIM)

Jote Jinfessa, University of the District of Columbia
Co-Author(s): Eva Mutunga, University of Tennessee

The ability to machine materials at the nano-scale is becoming more significant for an increasing number of technological applications. The Orion® helium ion microscope (HIM) source consists of an atomically sharp tip with an emission area of just three atoms known as the trimer, cooled to liquid nitrogen temperature. The helium focused ion beam is then typically rastered across a sample surface in order to either image or machining nanostructures. The purpose of this research is to discover the optimal conditions[2] whereby each material can be milled or machined using the HIM and investigates nano-machining applications of the helium ion beam. Since helium has considerable mass unlike an electron[1], high doses the beam can be used at to modify or carve features into sample surface. This capability has numerous applications ranging from nano-electronics and integrated circuit editing to nanopore sensor devices.

In this research, materials that are relevant to the integrated circuit industry, such as gold and semiconductor-based materials, are examined under different beam conditions to optimize the material removal rate and feature resolution. In this presentation, the experimental methods and the results will be discussed as well as the applications and impact of this technology.

References: 1. Morgan, John, et al. 'An Introduction to the Helium Ion Microscope.' Microscopy Today July 2006: 24-30. Print. 2. Mutunga, E.M., Lockerman, S.L., Vladar, A.E., Klein, K.L. “Understanding Helium Ion Nanomachining in Membranes and Bulk Substrates.” Paper submitted to the Electron, Ion, and Photon Beam Conference 2014.

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475

Subcategory: Nanoscience

Synthesis and Characterization of Magnetic Nanoparticles for Eventual Use in Bacterial Extraction

Monica B. Setien-Grafals, Syracuse University
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Mycobacterium tuberculosis (Mtb) is the causative agent of tuberculosis (TB), a bacterial disease that mostly affects the lungs. TB has infected around 8.6 million people in the world in 2012. (WHO, 2012). Many were not correctly diagnosed due to the difficulty of its diagnosis. (CDC, 2011). There has been a lot of interest regarding the synthesis of nanostructured materials because of their many possible applications in science and engineering particularly in disease diagnosis. (Ramrakhiani, 2012). In this project, we are synthesizing apoferritin encapsulated magnetic nanoparticles and polyaniline (PANI) on ferric oxide (Fe3O4) magnetic particles which could be later used in the extraction of Mtb from a patient's sputum or other clinical sample. We will present the synthesis of the magnetic nanoparticles and their encapsulation in apoferritin and the synthesis of PANI on Fe3O4 coated particles. We will characterize the nanoparticles in terms of size, strength of attraction and electrochemical signals. Success of this project could improve the diagnostic efficiency of the conventional methods being used at the moment for Mtb.

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476

Subcategory: Physics (NOT Nanoscience)

Control of Lagrangian Mixing in Fuel Injector Flows into Supersonic Cross Stream

Josue Quinonez, San Diego State University
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The goal of this project is to verify distinct Lagrangian flow structures upstream of the fuel injectors in gas turbines, scram jets, and ram jets in order to develop a new theory that enables the quantitative analysis of the dynamic mass and fuel flows into the flame zones. The new theory will lead to better combustion efficiency in injector type engines.

Our controls were the heights in the reservoir and test section, the amount of water being pumped into the reservoir, the flow in the reservoir was static, and the flow into the test section is steady and laminar. Using foam filters and a metal screen filter to create a steady flow, we were able to rid the flow of turbulence caused from vortices from the pump. The reservoir gate has the capability to change heights by using premeasured acrylic tabs to hold it up in place. This allows for easy control of the flow rate into the reservoir by using the pump's different speed settings. Bernoulli's equation was used to find the Froude number of two in our test section.

The results of the experiment show that it is capable of producing oblique and detached shockwaves. The experiment was producing flow speeds in the test section around an average of a Froude number of 2.5. There is a hydraulic jump occurring in the test section of the table without an object having to create it, which is not desired. This hydraulic jump had a negative impact on how big our test section is. Overall, we still see it possible to create the ideal flow we need to study the control of Lagrangian mixing in fuel injector flows.

In conclusion, this experiment is showing that the shallow water table is capable of producing a flow that travels at supersonic speeds and is isentropic. Future work that is still in process is adding better camera equipment and devices to better measure the depth of water in the test section to further increase accuracy.

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477

Subcategory: Water

Evaluation of Point-of-Use Water Treatment Technologies in Limpopo Province, South Africa

Kimberly Cribbs, University of Arkansas

This study addresses the need for long term field research on point-of-use (POU) water treatment technologies and provides field research on a new design of the MadiDrop, a POU water treatment technology developed by researchers at the University of Virginia. The two POU water treatment technologies focused on in this study are a ceramic water filter (CWF) and the MadiDrop, both technologies use silver to provide metallic disinfection of water.

For the long term portion of the study, the focus was on determining how a year of use affected the efficacy of the two technologies at reducing total coliform bacteria in water. For 52 weeks, 73 participating households in Limpopo Province, South Africa used a CWF, MadiDrop, or a CWF and MadiDrop in conjunction to treat water. For the households with a CWF or CWF and MD, the control was the influent water. For the households with only a MD, they were given two MDs one with silver and one without silver, the control. Starting at week 52, every other week for six weeks control and effluent water samples were collected from the technologies and analyzed for total coliform bacteria. After 52 weeks of use, the CWF, MadiDrop, and CWF and MadiDrop achieved an average percent reduction in total coliform bacteria of 86%, 83%, and 95%, respectively.

After 52 weeks, the 2013 MadiDrops were replaced with 2014 MadiDrops that were designed to shorten the diffusion distance for silver; therefore, it was hypothesized that the 2014 MadiDrops would have a greater percent reduction in total coliform bacteria than the 2013 MadiDrops. However, our field study showed that the 2014 MadiDrop design achieved an average percent reduction in total coliform bacteria of 67% which is less than the 83% achieved by the 2013 MadiDrop design after 4 weeks of use.

The results show that after a year of use the CWFs and MadiDrops were still effective at reducing total coliform bacteria and the 2013 MadiDrop design is more effective at treating water than the 2014 MadiDrop design. Future research includes using an atomic absorption spectrometer to quantify the amount of ionic silver being released by the 2014 MadiDrops used in the field to determine why the 2014 MadiDrop performed worse than the 2013 MadiDrop.

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Washington DC Subway System Map

A

Abarca, Jonathan, A198
Abbott, Jacob, A22
Abdi, Mohammed, A275
Abdou Tchoussou, Boubacar, A123
Abebrese, Emmanuel, A181
Abel, Kristina, A73
Aberra, Dawit, A275
Abraham, Denin, A269
Abrokwah, Richard, A17
Abu-Laban, Mohammad, A36
Acevedo, Orlando, A11
Adams, Candice, A22
Adams, Staci, A79
Adams, Steven, A211
Addo, Phyllis, A181
Adelani, Lateef, A278
Adelman, Jim, A66
Aderogba, Ruka, A71
Adhikari, Arijit, A215
Adlaf, Elena, A196
Adrawy, Jermin, A66
Affin, Lulit, A337
Afghah, Fatemeh, A123
Aggarwal, Pallavi, A96
AghaKouchak, Amir, A245
Agrawal, Krishan, A280
Agu, Ucheena, A126, A316
Aguayo, Rafael, A80
Aguilar, R. Claudio, A63
Ahlstrom, Logan, A222
Ahmed, Abdi, A196
Ahmed, Anwar, A305
Ahmed, Sowda, A173
Ahmed, Talal, A47
Ai, Hong-Ha, A274
Ai, Lei, A327
Aizenman, Hannah, A272
Ajagbe, Joyce, A282
Akbar, Eslami, A23
Akbar, Muhammad, A49, A118, A119, A124
Akinleye, Ifedolapo, A85
Akinleye, Olasupo, A113
Akintewe, Olukemi, A111
Akwaboa, Stephen, A48, A126, A314, A337
Al-Ayied, Hassan, A10
Aldryhim, Y., A10
Alexander, Andrew, A181
Alexander, Barbara, A193
Alexander, Michael, A123
Alexis, Sherika, A173
Alfonso Garcia, Alba, A77
Alford, Terry, A336
Ali, Nadya, A43
Allan, Sandra, A75
Allen, Andrew, A127
Allen, Bengt, A169
Allen, Brandon, A124
Allen, Darnel, A284
Allen, Jared, A88
Alley, Jessica, A203
Almanza, Edith, A174
Almonte, Rafael, A313
Alocilja, Evangelyn, A339
Aloia, Alexandra, A12
Altizer, Sonia, A172
Alvarado, Rojelio, A181
Alvarez, Alvaro, A152
Alvarez, Juan, A254
Alvarez, Ronald, A142
Alverio, Orlando, A298
Amaral, Lorena, A194
Amaro, Elizabeth, A2
Amekah, Ebenezer, A304
Amin, Rajesh, A11
Amissah, Augustine, A273
Ammari, Kathy, A331
Amo-Frempong, Isaac, A23
An, Jiayi, A81
An, Peibo, A105
Anandan, Nishita, A315
Anderson, David, A251
Andrade, Nicolas, A285
Andrisani, Ourania, A151
Angelo, Jennifer, A228
Anmuah, Brandon, A132
Anoruo, Florence, A69, A203, A268
Ansari, Ali, A83, A300, A324
Ansari, Jahangir, A321
Antmann, Eric, A30
Aoki, Chiye, A71
Arah, Diliorah, A127
Archer, Jennifer, A77
Archibald, Wayne, A213, A225, A283, A284
Arechavala, Stacie, A135
Arguello, Irene, A193
Arnold, Karis, A182
Arocho, Yaileen, A61
Arrington, Brianna, A139, A158
Arurang, Madisen, A333
Asanbe, Olaniran, A48, A314
Askew, Shaquonia, A228
Assefa, Zerihun, A104
Astone, Pia, A106
Atena, Agegnehu, A277, A281
Ather, Syed Hussain, A198
Auden, Mark, A104
Auffan, Melanie, A93
Ausland, Jennifer, A2
Austin, Paul, A62
Au-Yeung, Courtney, A293
Averett, Todd, A106
Aviles, Amarillys, A38
Ayanwale, Lydia, A193
Ayracma, Berk, A118
Azimi, Mehdi, A57
Azize-Brewer, Jacqueline, A319
Azu, Nkem, A5

B

Baar, Keith, A149
Babu, Sainath, A208
Bacsa, John, A19
Bader, Rebecca, A36, A158
Badiga, Suguna, A142
Bae, Hassiem, A107
Bagayoko, Diola, A104
Bagga, Annie, A72
Baidoo, Jacqueline, A211
Bailey, Brandon, A100
Bailey, Cares, A229
Bailey, Joshua, A81
Bailey, Kristen, A206
Bailey, Mary Lou, A293
Bailon, Sonia, A100
Bakare, Oladapo, A7
Baker, Brenna, A98
Baker, Hannele-Ruohola, A134
Baker, Molly, A149
Balaguer-Barbosa, Maraida, A332
Balin, Samuel, A188
Balint-Kurti, P, A5
Ballerda, Dexter, A82
Bamshad, Michael, A174
Banerjee, Shiladitya, A42
Banks, Alexander, A175
Banks, LaQunia, A97
Bannister, Rahu, A119
Barley, Kamal, A96
Barnes, Bailey, A213
Barnes, Zachary, A231
Barnett, Cleon, A289, A292
Bassa, Lotfi, A2
Basu, Debarati, A26
Batcho, Krystine, A304
Bates, Andra, A67
Batra, Ashok, A42
Bauer, Phoebe, A300
Baugh, Loren, A136
Bausell, Casey, A278
Baxter, Keisha, A272
Bazemo, Ulrich, A33

Bean, Tim, A253
Beaty, Brandon, A74
Becker, Jordan, A67
Beckman, Liam, A174
Beecham, Rachel, A153, A189, A194, A229,
Beekman, Hailey, A189
Behera, Pradeep, A85, A113
Bell, John, A321
Bell, Malika, A162
Belmasrour, Rachid, A97, A279
Benes, Helen, A6
Benjamin, Mary, A213
Benson, Benjamin, A261
Benson, Kingsley, A292
Benson, Robert, A94
Benziger, Jay, A337
Berger, Sabrina, A102
Berkove, Ethan, A109
Bernardini, Simone, A101
Berry, Danielle, A212
Berthelote, Antony, A90
Bertoni, Mariana, A101
Bethel, Keturah, A212
Bethune, Brandi, A285
Bett, Dominic, A231
Bhambri, Megha, A245
Bhaskaran, Sunil, A273
Bias, Jacob, A237
Biedrzycki, M. L., A5, A10
Bierer, Barbara, A175
Bies, Dawn, A200
Biggane, Joseph, A153
Bililign, Solomon, A104, A290
Biris, Alexandru, A141, A213, A317
Bishop, Thomas, A230
Blackmon, Elise, A236
Blackwell, Ashley, A286
Blake, Andrew, A190
Blake, Reginald, A244, A245, A247, A259, A265, A267, A273
Blakely, Breahna, A62
Blanco, Carlos, A101
Blaylock, Waynesha, A139
Blue, Soijett, A11
Boateng, Samuel, A325
Boechler, Nicholas, A339
Bogler, David, A88
Bokel, Felicia, A53
Bolman, Jacquelyn, A88, A169, A250, A251, A261
Bonev, George, A247
Boni, Yannick, A78
Bonsu, Eric, A143, A201
Bonsu, Kingsley, A46
Boone, Nicole, A213
Boonthum-Denecke, Chutima, A25
Borgmann, Kathleen, A187
Borlam, Deborah, A299
Boroujerdi, A., A21, A232
Borunda, Aria, A242
Bost, Rana, A167
Boumedine, Marc, A233, A301
Bourdo, Shawn, A213, A317
Bower, Dorine, A27
Bowser, Samuel, A249
Boxell, Levi, A108
Boyd, Dominique, A182
Boyd, Janelle, A232
Boykin, Brittany, A11
Boysen, Alfred, A337
Brackins, Julian, A337
Bradford, Chastity, A192
Bradley, Joseph, A199
Bradshaw, Janet, A68
Bradshaw, Jessica, A136
Braithwaite, Eumala, A109
Brand, Danielle, A266
Brandao, Mark, A275
Brandy, Yakini, A207
Braun-Howland, Ellen, A249
Brede, Emily, A109
Bricker, Katherine, A194
Broad, Kenneth, A47
Broadway, Ruby, A254, A268
Brogan, Daniel, A26
Brooker, John, A270
Brooks, Alexandria, A283
Brooks, Charles, A222
Brooks, Jessica, A12
Browe, Daniel, A310
Brown, Autumn, A213
Brown, Elrica, A68
Brown, Shaniqua, A184, A245
Brown, Sherlene, A68
Brown-Clarke, Judi, A110
Brueseke, Matthew, A31
Brunson, Victoria, A86
Bryan, Ciera, A111
Bu, Xiu, A12, A14
Buahen, Jephter, A5
Buchanan, Katelyn, A69
Buchholz, Richard, A182
Buckingham, Kati, A174
Budischak, Sarah, A33
Budzevich, Mikalai, A41
Buenrostro, David, A58
Bufford, Alexandria, A190
Buford, Dreshun, A257
Buhr, Matthew, A95, A96
Bulled, Nicola, A302
Bullock, Jimmie, A216
Buncher, Brandon, A294
Burciaga Montoya, Marisol, A26
Burden, Frank, A232
Burke, Ian, A201
Burke, Mark, A73
Burkett, Zachary, A64
Burns, Colleen, A248
Burton, Lamar, A72
Burton, Liza, A146
Bush, Brittany, A149
Bushee, Brennen, A85
Bussmann, Rainer, A199
Butler, Kelley, A73
Buzzard, Gregery, A98
Byrd, Darrica, A181
Byrd, Ka'Ren, A23
Byrd, Vetria, A248

C

Cabeen, Matt, A71
Cabrera, Jessica, A324
Cabrera-Rios, Mauricio, A3
Cagle, Patrice, A2
Caine, Joseph, A277
Cainion, Ashley, A140
Calderon, Gloria, A128
Calle, Jasmine, A248
Calloway, Marcia, A161, A200
Cameron, Jeffrey, A165
Caminero, Jean, A288
Camp, L. Jean, A22, A240
Campbell, David, A49
Campbell, Daquille, A232
Camps, Manel, A183
Cao, Xinxiang, A215
Caplan, Jeffrey, A5, A10
Cardona, Nelson, A15
Carlson, Carl, A294
Carmichael, Bria, A140
Carnaval, Ana, A250
Carolina, Nancy, A255
Carpenter, Alex, A221
Carpenter, Joe, A53
Carrillo, Elisabeth, A150
Carrithers, Bria, A150, A153
Carruth, Laura, A132
Carter, Adrian, A30
Carter, Anthony, A193
Carter, Deidre, A88
Carter, Emmanuel, A233
Carter, Jevar, A262
Casey, Kasha, A184
Castillo II, Bernard, A209, A211, A263
Castillo-Chavez, Carlos, A96

Castillo-Hair, Sebastian, A306, A307, A308, A311
Castle, Toen, A294
Catanzaro, Chris, A91
Çek, Demet, A47
Celestine, Michael, A216
Ceron, Steven, A71
Cervantes, Layla, A183
Cesario, Joseph, A303
Cevallos, James, A204
Chai, Jenny, A108
Chai, Lauren, A137
Chakraborty, Indrinil, A208
Chamberlain, David, A326, A327
Chambers, Derric, A28
Chamklan, Nathida, A230
Chandrabose, Karthikeyan, A4, A145
Chaney, India, A282
Charbonnet, Joe, A259
Chaudhari, Atul, A39, A184, A288
Chaves, Destiny, A315
Chavez, Jasmine, A169
Chellu, Devi, A98
Chen, Chen, A128
Chen, Edward, A72
Chen, Jiun-Shyan, A319
Chen, Pei, A63, A199
Chen, Yanna, A245
Chen, Yi-Wen, A71
Cherayil, Nikitha, A306, A307, A308, A311
Chetty, Chellu, A98, A281
Chichoyan, Naira, A202
Chigbu, Paulinus, A254
Chileshe, Mulenga, A31
Chilukuri, Sowmya, A216
Chilvery, Ashwith, A42
Chin, Sajeeda, A113
Chintapenta, Lathadevi, A88
Chisholm, John, A215
Chitsonga, Shadreck, A275
Chlistunoff, Jerzy, A104
Cho, Yigil, A294
Chowdhury, Tara, A71
Christian, Ryan, A177
Christopher, Tsipporah, A183
Chu, Tiffany, A240
Chung, Katy, A270
Churchill, Christopher, A289
Cincotta, Steven, A166
Claiborne, Kendra, A82
Clark, Dominique, A68
Clark, Jessica, A141
Clark, Ryan, A306
Clark, Vernessa, A300
Clarke, Judi, A178
Claville, Michelle, A208
Clayton, Jessica, A295
Claytor, Frank, A123
Clemence, Dominic, A97
Clements, Cherith-Eden, A240
Clymer, E. William, A45
Coan, Mary, A330
Coats, Mamie, A284
Cobb, Melanie, A139
Cobbs, Alyssa, A150
Coggins, Ivy, A236
Cole, Jeff, A249
Coleman, Michelle, A3
Coleman, Trey, A151
Collier, Marta, A317
Collin, Herve, A330
Colon, Hector, A334
Colon-Bernal, Isabel, A290
Colwell, Christopher, A193
Comert, Gurcan, A318, A320, A321
Conklin, Dawn, A63
Cooksy, Andrew, A226
Cooley, Dezsjeun, A78
Cooper, Acacia, A151
Cooper, Shakim, A305
Copeland, Christopher, A13
Corbett, Keneisha, A147
Corcoran, Michael, A296
Cordero, Lina, A244
Cornejo, Pablo, A332
Cornelius, Nishja, A153
Corrigan, Kelsey, A191
Cosme, Latoya, A260
Coss, Nathan, A152
Cossio, Osvaldo, A141
Cotterman, Turner, A326
Coughlin, Alicia, A179
Cousin, Carolyn, A62, A67, A129, A168
Covarrubias, Ernesto, A172
Cowins, Janet, A40
Crawford, Carlos, A104
Crawford, Grant, A336
Creer, Marylyn, A334
Crehan, Helen, A73
Crews, Kristy, A78
Cribbs, Kimberly, A340
Crittenden, James, A106
Cromartie, Rosa, A58
Crosbie-Watson, Rachelle, A192
Crow, Rachel, A335
Crystal, Jonathon, A303
Cuevas, Elvira, A29
Cui, Suxia, A234
Culpepper, Martin, A137
Cunningham, Avery, A124
Cunningham, Thomas, A93
Curry, Michael, A54, A78
Cutler, Brett, A191
Cutler, Tamara, A192

D

Daboub, Micah, A30
Dade, William, A17
Dalbotten, Diana, A264
Dale, Louis, A36
Dallas, Tad, A251
Daloglu, Mustafa, A51
Dance-Barnes, Stephanie, A141
Dandurand, Julia, A98
Daniels, Davinelle, A298
Daniels, Emily, A262
Dantzler, Sharise, A95
Darthard, Loryn, A141
Darwish, Abdalla, A286
Davis, Donald, A204
Davis, Floyd, A70
Davis, Marcus, A286
Davis, Myles, A142
Day, Centennial, A152
Day, Nancy, A64
Dbouk, Hashem, A139
De Buren, Lucas, A114
De Jesus, Jorge, A38
De Jesus Vargas, Jose, A251
De La Cruz Torres, Elizabeth, A313
De La Puente, Sajay, A325
De La Torre, Adrianna, A204
De León Peralta, Esmarline, A283
De Maio, Antonio, A163
De Queiroz, Marcio, A115
Dean, Derrick, A285
Deb, Debzani, A84
DeCaro, James, A45
Declet, Amarilis, A337
Deeyaa, Blessing, A224
DeFranco, Don, A143
DeFreece, Cecily, A142
Dekaney, Chris, A159
Deksissa, Tolessa, A32, A33
Del Aguila, Gustavo, A102
Del Rosario, Nathalie, A226
DeLorenzo, Marie, A270
DeMarco, Rebecca, A205
Demmings, Brittany, A142
Denisin, Aleksandra, A312
Dennis, Sierra, A332
Dennis, Vida, A39, A286
DePass, Anthony, A3
DeRamus, Lafayette, A286
Deshmane, Vishwanath, A17

Desroches, Luc, A313
Devreaux, Phillip, A83
DeWalt, Saara, A248
Dewitt, Jamie, A155
Dhar, Ratan, A269
Dhingra, Amit, A171, A177, A198
Dhinojwala, Ali, A180
Dhir, Sarwan, A74, A75, A170, A171, A200
Dhital, Brittiny, A245
Di Stilio, Veronica, A203
Diaz, Kenia, A136
Diaz-Elsayed, Nancy, A332
Dick, Justin, A319
Dickey, Michael, A227
Dickey III, Abraham, A299
Dickinson, William, A99
Dickson, Nicholas, A143
Didari, Shohreh, A259
Dierolf, Volkmar, A293
Dietrich, Carl, A123
Diggs-Yang, Gregory, A309
Dillard, Rebecca, A261
Dilling, Thomas, A41
Dimson, Jared, A249
Ding, Laura, A102
Dinning, Anne, A136, A203, A309
Diong, Bill, A120
Dixit, Saurabh, A286
Dixon, Freddie, A67
Dixon, Ricky, A86
Doan, Kieu, A69
Dobbs, Jamel, A175
Doiron, Amber, A282
Dollete, Amber, A321
Domenech, Maribella, A288, A312
Donnerfeld, Daniel, A238
D'Orgeix, Christian, A87
Dosunmu, Ejovwoke, A39
Dosunmu, Omotolla, A10
Dotson, Treasure, A189
Doty, Patrick, A19
Dougan, Jodi, A146
Downing, Jonathan, A54
Doze, Van, A153
Drake, John, A251, A277
Dréau, Didier, A3
Dreyer, Samuel, A59
Drozdowski, Chris, A131
D'Silva, Joseph, A172
Du, Toby, A108
Dubey, J.P., A181
Dubose, Desiree, A270
Duboue, Eric, A165
Dudley, Aaron, A223
Duffing Romero, Mareike, A267
Dulin, Jennifer, A162
Dumbuya, Mohamed, A129
Duncan, R. Scot, A257
Dunleavy, Robert, A281
Dunn, Gabriel, A293
Dupiche, Gabrielle, A184
Dura, Lucia, A46
Dyson, Delarian, A28

E

Easley, Christopher, A12
Eaton, Cyntrica, A242
Edet, Rosemary, A199
Edison, Arthur, A179
Edmonds, Kyle, A115
Edwards, Brian, A125
Edwards, Marcellus, A191
Egan, Terrance, A168
Ehrlich, Jake, A235
Ekness, Felix, A306, A307, A308, A311
Ekwunife-Orakwue, Oluwakayode, A45
Elhelu, Oumsalama, A67
El-Khaldy, Adnan, A78, A214
Elkhechen, Justin, A307
Elliot, Lisa, A45
Ellis, Katherine, A80
Ellis, Rhonda, A233
Ellsworth, Desmond, A242
Eltouny, Samia, A306, A307, A308, A311
Emerson, Ishara, A89
Emmett, Thomas, A313
Enemuo, Amara, A269
Enlglehardt, James, A31
Epps, Jeremy, A335
Ergas, Sarina, A332
Ericson, Barbara, A237
Esbaugh, Andrew, A191
Eshun, John, A52
Eslick, John, A257
Esquivel, Deisy, A216
Esther, Suswam, A145
Ethridge, Aiesha, A54
Etienne, Christian, A214
Etienne, Nichole, A233
Evans, Abby, A262
Evans, Ashana, A97
Evans, Emani, A86
Evans, Melissa, A179
Everly, Ryan, A328
Evoen, Vanessa, A54
Ezelle, B., A49
Ezenwa, Vanessa, A33
Ezeude, Kristen, A153

F

Falconer, April, A38
Fall, Mame, A118
Fan, Huitao, A152
Fang, Yayin, A7
Farje-Van Vlack, Kai, A250
Faulkner, Aaron, A115
Fei, Zhangjun, A198
Feinberg, Eliza, A12
Feizpour, Amin, A164
Felix, Gilbert, A280
Feltz, Eric, A199
Fendorf, Scott, A226
Feng, Jiawen, A51
Fernandez-Alarcon, Claudia, A173
Ferreccio, Amy, A134
Ferrel, Abel, A192
Fetene, Hohite, A275
Fewins, Patrick, A339
Fiddler, Marc, A104
Fields, Anthony, A252
Fields, Kristen, A143
Figueroa, Joshua, A221
Fincher, Malia, A250
Finnie, James, A94
Finton, Drew, A180
Firestein, Bonnie, A162
Fite, Kevin, A116
Fitzgerald, Andrew, A272
Fixico, Loga, A90
Flanigan, Daniel, A117
Fleming, Lorraine, A118
Fleming, Sherry, A147
Fletcher, Hansel, A185
Fletcher, Sha'La, A38
Flores, Ivan, A9
Florian, David, A334
Flot, Michael, A124
Flowers, Marlon, A153
Floy, Martha, A153
Floyd-Smith, Tamara, A57
Fofana, Rahil, A31
Folarin, Ibukun, A326
Foley, Mary, A261
Fomin, Sergei, A275, A278
Forbrich, Inke, A254
Ford, Amanda, A289
Ford, Gary, A319
Ford, Katarena, A12
Ford, Willie, A214
Fordjour, Emmanuel, A69
Forrest, Mason, A203
Foster, Amber, A143
Fox, Geoffrey, A238
Franco-Watkins, Ana, A300

Franks, Marion, A79, A208
Frazier, Johnnieshia, A267
Freedman, Jonathan, A224
Freeman, Joseph, A310
Frick, David, A130
Friley, Jessica, A188
Frizell, Tayla, A279, A297
Frunza, Victor, A234
Fuad, Muztaba, A84, A234
Fuentes, Tahiri, A298
Fuller, Jessica, A21, A34
Furey, Terry, A243
Furrer Chau, Jessica, A184, A245
Fustero, Santos, A12

G

Gaddes, Christopher, A314
Gadson, Sharla, A79
Gaitor, Danielle, A144
Galindo, Ruben, A129
Gallagher, Kimberley, A77
Gallant, Nathan, A111
Galloway, Malcolm, A91
Gao, Feng, A207
Gao, Yu, A299
Garcia, Edwin, A107
Garcia, Isaac, A326
Garcia, Nitza, A313
Garcia, Oscar, A96
Gardner, Leigh, A267
Garige, Mamatha, A6
Garner, Bianca, A68, A304
Garner, Latonya, A86, A93
Garner, Jr., Dewayne, A116
Gaskins, Danielle, A243
Gassie, Lucien, A30
Gates, Ann, A26, A46, A243
Gauli, Ashish, A276
Gauthier, Marilyn, A327
Gayle, Jordan, A319
Gbemafu, Abravi Akpedze Rose, A175
Gearhart-Serna, Larisa, A112
Gebrehiwot, Eled, A79
Gebrelul, Sebhatu, A72, A90
Geddis, Demetris, A124
Gelpi, Svetlana, A214
Gengci, Kawashita, A312
Genzer, Jan, A227
Gergen, J. Peter, A8
Gerhard, Nicole, A300
Gerhold, Richard, A181
Gerrodette, Peter, A275
Getzel, Elizabeth, A44
Ghariban, Nasser, A256, A316, A318, A321
Ghorpade, Anuja, A187
Ghosh, Anindya, A141
Ghosh, Antara, A166
Giblin, Anne, A254
Gibson, Tracie, A181
Gifford, Nathanael, A153
Gil, Carmen, A291
Gil, Yeimy, A269
Gilbert, Milan, A287
Gilbert, Reesheda, A215
Gilchrist, Jeffrey, A119
Giles, Qualateai, A74
Gillis, Peter, A173
Giner, José-Luis, A212
Girgis, Shady, A130
Gitcho, Michael, A164
Gittleman, John, A252
Givens, Melvin, A314
Gladkova, Irina, A247
Glenn, Christina, A35
Glover, Aliyah, A109
Goihberg, Polina, A155
Golbek, Megan, A275
Gold, Kimberly, A50
Goli, Mudlagiri, A229
Gomez, Ana, A136
Gong, ChongFeng, A28
Gong, Xingting, A294
Gonzales Parham, Ilia, A280
Gonzalez, Jesica, A206
Gonzalez, Jorge, A246
Gonzalez, Juan, A75
Gonzalez, Luis, A154
Gonzalez, Osvaldo, A280
Gonzalez-Hernandez, Jose, A261
Gonzalez-Karlsson, Adrea, A171
Goodwin, LyAvia, A201
Goornavar, Virupaxi, A180
Gorden, Anne, A16
Gordon, Janica, A276
Gordon, Jasmine, A80
Gordon, Mikhail, A48
Gorfu, Lydia, A154
Gousse, Hannah, A250
Granger, Paulnisha, A144
Grant, Andwele, A315
Grant, Kathryn, A77
Grant, La'Shant'e, A294
Grant, Nyjah, A279, A297
Grauer, Christine, A44
Graves, Mary, A130
Gray, Dominic, A297
Gray, Kathy, A278
Gray, Patrick, A234
Gray, Shakeidra, A277
Greenberg, Andrew, A160, A166
Greene, Oliver, A110
Greulich, Heidi, A60
Grier, Janice, A14
Griffard, Jessica, A199
Griffin, Gerald, A132
Griffith, Adam, A138
Griffith, Paul, A170
Grinstaff, Mark, A224
Grisewood, Matthew, A153
Groffman, Peter, A254
Gross, Barry, A244
Grossberg, Michael, A247, A272
Grosse, Hannah, A257
Grotjahn, Douglas, A226
Guan, Tong, A82
Guerrero-Medina, Jennifer, A17
Guerrero-Medina, Karen, A19
Guinea, Jilma Rachel, A251
Gumbs, Sheresia, A173
Gunawansa, Taliya, A336
Guner, F. Seniha, A225
Gupta, Ashwani, A117
Gupta, Sarika, A203
Guragain, Yadhu, A206
Gurung, Indrajit, A247
Guth, Alan, A102
Guthrie, Nicholas, A206
Gutierrez, Adrian, A32
Gutter, Kelli, A155

H

Ha, Trinh, A315
Haake, Danelle, A253
Haataja, Mikko, A337
Habtom, Ermias, A184, A245
Hagberg, James, A191
Haghani, Sasan, A325, A331
Hagrman, Doug, A262
Hahm, Eun-Ryeong, A146
Hahn, Daniel, A179
Hahn, Insu Frank, A211
Hahn, Thomas, A6
Haile, Sossina, A54
Halawani, Amanda, A137
Haley, Kathleen, A157
Hall, Paulana, A98
Hall, Richard, A172
Hallman, Tara, A192
Halpern, Marnie, A165
Hammond, Vanessa, A242
Hampton, Brittany, A278
Hampton, Cari, A193
Han, Arum, A329
Hanai, Aaron, A318
Handy, Eunice, A34

Hankinson, Madison, A278
Hanley, Brittnie, A228
Hanna, Maureen, A324
Hannaford, Blake, A309
Hansell, Otto, A271
Hanson, Jim, A53
Haque, Mohammed, A185
Harber, James, A187
Hardiman, Howard, A121
Hardy, W. Reef, A152
Hargrove, April, A131
Harms, Katherine, A229
Harp, Julius, A11
Harper, Marcus, A116
Harper, Martika, A284
Harrington, Brandon, A322
Harris, Jolisa, A316
Harris, Randall, A21, A34, A187, A268
Harrison, Scott, A66
Hart, Robbie, A199
Hartland, Tucker, A275
Hartman, Ethan, A76
Harutyunyan, Araks, A77
Haslam, Gareth, A71
Hassan, Oyindayo, A176
Hataway, Robert, A249
Hawley, Dana, A65
Hayden, Linda, A93, A236, A238, A246, A274, A278, A297
Hayes, Daniel, A36
Head, Monique, A86, A115
Heath, Julie, A170
Heinbockel, Thomas, A62
Heiniger, Erin, A309
Helms, Brian, A171
Helms, Rachel, A3
Henderson, James, A307
Henderson, Keheira, A324
Henderson, Michael, A170
Hendrickson, Ashlea, A182
Henley, Sheryce, A70
Hennington, Bettye Sue, A193
Henry, Karl, A94
Henry, Ralph, A207
Henry, Sean, A119
Henry, Sydney, A155
Heo, Tae Wook, A54
Her Many Horses, Shawn, A235
Hermanowicz, Slav, A49
Hernadez, Nestor, A153
Hernandez, Eduardo Ismael, A116
Hernandez, Laura, A88
Hernandez, Liliana, A38
Hernandez-Maldonado, Arturo, A17, A19
Herrejon Chavez, Florisela, A176
Herrera, Cynthia, A187
Herrick, Nathan, A10
Herring, Shanita, A4, A145
Heslop, Kareem, A147
Hester, Barry, A189, A193
Heyes, Colin, A207
Hicks, Jyla, A193
Hileman, Ryan, A131
Hilkat, Selin, A225
Hill, Edward, A324
Hill, Joanne, A313
Hill, Kimberly, A264
Hilliard, Lawrence, A305
Hinds, Samantha, A158
Hines-Adkins, Amber, A281
Hiniker, Anne, A161
Ho, Kelly, A263
Hobbs, Jasper, A31
Hobgood, Marthony, A316
Hodge, Jonathan, A99
Hoffmann, Federico, A236
Hofmann, Gretchen, A255
Holder, Alvin, A217
Holland, Destin, A177
Holloway, Lynn, A86
Holmes, Khalid, A232
Holmes, Tiffani, A218, A220, A223
Holness, Gary, A232
Holston, Timothy, A82, A85
Hopkins, Aleeyah, A305
Hoque, Ridwan, A269
Hossny, Amr, A156
Hosur, Mahesh, A18, A55, A56
Hota, Sanjukta, A276
Hou, Harvey, A228
Hou-Broutin, Yanxia, A37
Howard, Whitney, A276
Hoy, Donyeil, A91
Hsu, William, A235
Hu, Feng, A120
Hua, Binh, A235
Huang, Lei, A238
Huang, Wei, A71
Huang, Yu, A40
Hubbard, Dereca, A18
Huffmeyer, Audra, A8
Huie, Nicole, A257
Huitema, Ricky, A215
Hulbert, Scot, A171
Hull, Morgan, A75, A76
Humphrey, Trianna, A251
Hunnicutt, Kellie, A199
Hunt, Elizabeth, A169
Huntley, Chemar, A78
Hurdle, Julian, A70
Hurley, Steven, A63
Hurns, Alexzondra, A244
Huskey, Brionna, A240
Hussain, Imran, A145
Hussain, Nida, A269
Hussaini, Hamid, A156
Hutchinson, Mark, A224
Hwang, Hyun-Min, A92

I

Ibarra, Imelda, A185
Ijieh, Ebholo, A124
Ikegwu, Kelechi, A121
Ikonomou, Laertis, A166
Ilgu, Muslum, A131
Inan, Tugce, A225
Ingram, Conrad, A18, A19
Insain, Pimporn, A230
Intapad, Suttira, A193
Iozzo, Dante, A106
Iragena, Jacques, A211
Isaza, Clara, A3
Ishahak, Matthew, A135
Islam, Syed K., A37
Isokpehi, Raphael, A186, A188, A243
Ivey, Frank, A200
Izquierdo, Alicia, A204

J

Jackson, Duane, A90, A301
Jackson, JaNise, A14
Jackson, Latia, A252
Jacob, Devin, A146
Jacobs, Gustaaf, A340
Jacobson, Dave, A179
Jagessar, Daniel, A287
Jain, Sapna, A288
Jakmunee, Jaroon, A230
Jalinas, Johari, A10
Jamann, T., A5
James, Joilah, A94
James, Morgan, A252
James-Burke, Julian, A301
Jang, Ben, A215, A216
Janik, Michael, A153
Jarett, Leigha, A287
Jauregui, Luis, A291
Javidi, Tara, A126
Jeelani, Shaik, A18, A55, A56
Jeffers, Gejae, A210, A263
Jefferson, Jacquella, A59
Jefferson, Michael, A246
Jenkins, Andrea, A185
Jenkins, Kyle, A134
Jenkins, Sherrall, A157

Jenks, Jennifer, A338
Jensen, Kat, A265
Jensen, Timothy, A129
Jerman, Callista, A312
Jerripothula, Shanmukha, A24
Jiang, Iris, A309
Jimenez, Ivan, A87
Jinfessa, Jote, A339
Jo, Jinmyun, A315
Joell, Tiarra, A157
Johnson, Ashley, A131
Johnson, Chenel, A148
Johnson, Darnell, A279, A297
Johnson, David, A83, A303
Johnson, Jennifer, A289
Johnson, Kevin, A269
Johnson, Nina, A58
Johnson, Vanda, A98
Johnson, Warren, A9
Jones, Andrew, A304
Jones, Ayanna, A226
Jones, Chris, A149
Jones, Correy, A3
Jones, DeAndra, A177
Jones, Derrick, A88
Jones, Jabari, A265
Jones, Jasmine, A146
Jones, Jeffrey, A213, A317
Jones, Justin, A236
Jones, Leandra, A282
Jones, Miranda, A132
Jones, Nathan, A255
Jones, Paquilla, A116
Jordan, Maria, A192
Jordan, Matthew, A216
Joseph, Carleta, A3
Joseph, Janay, A94
Joseph, Lorne, A216
Joung, Sunhwa, A77
Juarez, Bryan, A29
Jung, Euiyeon, A294
Junior II, Cary, A110

K

Kaeo, William, A317
Kaewwonglom, Natcha, A230
Kagey, Henry, A49
Kahan, Tara, A217
Kahsai, Bereket, A318
Kalaisam Mani, Saravana Kumar, A152
Kaiser, David, A102
Kamaha, Roussel, A307
Kamboj, Herman, A73
Kamien, Randall, A294
Kamps, Terry, A66
Kang, Lauren, A335
Kanjanda, Simbarashe, A49
Kankawala, Gyanadeep, A230
Kaplan, Bethany, A60
Karimi, Maryam, A266
Kassa, Tsegaye, A295
Katam, Ramesh, A75
Kaul, Reni, A280
Kawashita, Masakazu, A312
Kearse, Jesse, A319
Keiluweit, Marco, A226
Keliipuleole, Melanie, A177
Kellar, Jon, A336
Keller, Charles, A156
Keller, Lance, A188
Kelley, Nicholas, A58
Kelley, T., A22
Kellogg, Elizabeth, A76
Kelly, Edward, A178
Kelly, Sean, A169
Kenche, Harshavardhan, A256
Keskinov, Anton, A140
Kettenbach, Arminja, A133
Key, Kelin, A210
Khademi, Ehson, A57
Khan, Ishrat, A15, A20, A39, A40
Khan, Mohammad, A326
Khan, Nabil, A217
Khan, Shafiq, A12
Khanbilvardi, Reza, A331
Khatiwada, Raju, A34
Khodkar, Abdollah, A276, A277
Khoo, Wai, A238
Kibet, Daniel, A229
Kilian, Benjamin, A177
Kim, Hyun Soo, A329
Kim, Joonyul, A12
Kimble, Tyree, A322
Kimmich, Sara, A108
Kinunda, Stephen, A178
Kiptoo, Paul, A150
Kirk, Brenna, A226
Kirk, Matthew, A272
Kirkpatrick, Laila, A66
Kishore, Vimal, A60
Klee, Harry, A74, A200
Klein, Kate, A339
Kleinert, Michaela, A295
Klimkowski, Victoria, A86
Klingensmith, Lauren, A71
Knicely, Joshua, A36
Knight, Gary, A318
Knight, Matty, A62, A67, A168
Koehler, Stephan, A71
Koepfli, Klaus-Peter, A8
Koepp, Deanna, A166
Koepping, Gregory, A305
Kolb, Delaney, A264
Kologunda, A., A10
Komarnytsky, Slavko, A203
Kopp, Kevin, A53
Korosh, Travis, A160
Kraatz, Simon, A331
Krakauer, Nir, A272
Kramer, Wolfgang, A205
Krishnamoorthy, Raghu, A167
Kromah, Lusenii, A97
Kruger, Lauren, A170
Kucera, Dion, A24
Kuga, Yasuo, A326, A327
Kuhlman, Alyse, A199
Kuila, Debasish, A17
Kurkalova, Lyubov, A46
Kusimo, Abisola, A117
Kuykendall, Caroline, A41
Kwapong, Peter, A181

L

Lacey, Dominique, A170
Lacko, Lauretta, A158
LaFont, Anderson, A213
LaMarca, Babbette, A195
Lambert, Marcus, A158
Lambert, Tamara, A113
Lamm, Monica, A132
Lanckriet, Gert, A80
Land, Julian, A126
Landers, Rian, A191
Landry, Brian, A306, A307, A308, A311
Landry, Corey, A36
Landry, Latrice, A43
Langer, Stephen, A163
Langerman, David, A336
Lanz, Aprillya, A99, A297, A336
Lanza, Janet, A173, A179, A213
Laracuente, Luis, A38
Lassiter, Jonathan, A58
Laurencin, Cato, A139
Lavin, Ryan, A262
Lawal, Hakeem, A190
Lawrence, Jerome, A73
Lay, Laura, A91
Lea, Krissean, A132
Lee, Ann, A149
Lee, Crystal, A4, A145
Lee, Gyeonghee, A101
Lee, Joshua, A134
Lee, Kameron, A210
Lee, Luke, A49
Lee, Matthew, A327

Lei, Cao, A64
Leinwand, Leslie, A163
LeMelle, Elise, A140
Lemere, Cynthia, A73
Lemma, Mulatu, A279
Leon, Victor, A66
Lesen, Amy, A254
Leszczynski, Jerzy, A13, A21
Letcher, Susan, A267
Leveillee, Raymond, A135
Levet, Yentyl, A301
Levette, Burley, A203
Lewis, Breanna, A126
Lewis, Darryl, A217
Lewis, Sharon, A252
Li, Bao-An, A102, A106
Li, Qing, A34
Li, Sean, A291
Li, Wei, A120
Li, Weiyi, A287
Liang, Jennifer, A179
Liang, Yanna, A258
Liburd, Jamar, A296
Lieberman, Diana, A172
Liebner, Jeff, A108
Lin, Ye, A306, A307, A308, A311
Lindley, Sarah, A79
Lin-Lo, Min, A280
Lintner, Benjamin, A241
Liou, Geoffrey, A134
Liou-Mark, Janet, A244, A247, A260, A265, A267, A273
Lipps, Stephen, A98
Lipsey, Kiara, A218
Liu, Jie, A101
Liu, Liping, A95
Liu, Teresa, A143
Liu, Ying, A227
Livermore, Carol, A137
Livingston, Krystal, A147
Lockhart, Catherine, A178
Lohani, Vinod, A26, A35
Lohn-Wiley, Blake, A36
Lokey, Scott, A214
Lombardi, John, A37
Loncar, Marko, A285
Long, Tiffany, A111
Lopez, Benjamin, A168
Lopez, Karlo, A206
Lopez, Leticia, A186
Lopez, Marlena, A65
Lopez, Nicole, A292
Lopez-Llorca, L.V., A10
Lorente-Rodriguez, Andres, A139
Lorenzo, Enery, A3
Losick, Richard, A71
Low, Karin, A162
Lu, Jun, A157
Lu, Paul, A162
Lu, Qin, A109
Lujo, Sylvia, A76
Luke, Elizabeth, A158
Lulich, Steven, A325
Lund, Brianna, A203
Lund, P. Kay, A159
Lundgren, Ben, A158
Luo, Wei, A51
Luscombe, Christine, A335
Lutz, Barry, A309
Ly, Bao Chau, A132
Lyles, Carl, A331

M

Ma, Bo, A147
Ma, Huilin, A310
Ma, Yang, A140
MacDonald, Jonathan, A45
Mack, Angelica, A206
Mackey, Stephon, A122
Madabushi, Amrita, A160, A175
Madawala, Rathnayaka, A14
Madsen, Nels, A314
Magee, Jesslyn, A60
Mahmood, Meena, A141
Mahoney, Matthew, A168
Majumbdar, Devashis, A13
Malagon, Hector, A254
Malakar, Nabin, A244
Maldonado, Mercedes, A289
Mallard, Deanna, A279, A297
Mallin, Zach, A330
Mankin, Richard, A10, A75, A76
Manning, Mackenzie, A178
Mansoor, Alexis, A194
Manzo, William, A196
Mao, Wendy, A266
Maranas, Costas, A153
Marasteanu, Mihai, A313
Marcano, Aristides, A43
Marcel, Shelsa, A243
Marcette, Jana, A152
Marinov, Tchavdar, A100
Markley, Andrew, A160
Marquart, Kyle, A272
Marshall, Renita, A72, A90
Martin, Joseph, A134
Martin, Melanie, A240
Martin, Patrick, A2
Martinetti, Luis Bernardo, A264
Martinez, Joseph, A103, A291
Martinez, Juita, A270
Martinez, Julio, A318
Martinez, Marcia, A70
Martinez, Milton, A100
Martinez-Santos, Javier, A337
Martus, Kevin, A196
Masaoe, Estomihi, A117
Mascharak, Pradip, A208
Mascorro, Xiomara, A79
Mashhadi, Soheila, A42
Mass-Gonzalez, Genesis, A17
Mathew, Thomas, A12
Mathis, Andrea, A170
Mathis, Stephan, A18
Matute, Codie, A330
Matute, Luis, A194
May, Stanley, A336
Mayett, David, A42
McAmis, Bill, A184
McArthur, Magdalene, A236
McClendon, Chakia, A63
McClure, Christopher, A251
McConnell, Allison, A278
McCoy, Armeshia, A158
McDaniel, Darvin, A58
McDaniel, Larry, A189
McDonald, Kalyx, A236
McDonald, Kyle, A265
McDonald, Walter, A35
McEachern, Michael, A170
McElwee, Derrick, A236
McFerrin, Harris, A140
McGinn, Christine, A125
McGowan, Dyfrreyon, A204
McHugh, Michael, A328
McIntosh, Steven, A41, A229, A282
McKenzie, Jessica, A194
McKenzie, Raveen, A93, A273
McMahon, Katherine, A160
McMillin, Margaret, A174
McNeil, Paul, A50
McReynolds, Roy, A227
McRoberts, Christian, A107
Meadows, Shatori, A55
Medellin, Ivan, A306, A307, A308, A311
Medina, Amber, A289
Medina, Ariel, A295
Meek, Christopher, A260, A333
Meeker, Matthew, A84
Meekins, Darlette, A269
Mejia, Jeury, A120
Melnyczuk, John, A14
Meloni, Michael, A228
Mena, Crystal, A258
Mendenhall, Juana, A227
Mendez Perez, Daniel, A153

Mendoza, Joshu, A195
Mendoza, Karla, A159
Meng, Yizhi, A287
Menon, Jaishri, A196
Mensah, Patrick, A48, A126, A314, A316, A337
Merchant, Shakila, A265
Mérida Figueroa, Fernando, A283
Meruga, Jeevan, A337
Meza-Lopez, Maria, A28
Mikael, Paiyz, A138
Miles, Shakira, A299
Miletti-Gonzalez, Karl, A164
Miller, Andrew, A106
Miller, Dan, A219
Miller, Justine, A133
Miller, Michael, A39
Miller, Paige, A277
Miller, Sonni Ali, A70
Miller, Stephen, A160, A176
Miller-Jensen, Kathryn, A112
Minker, Katharine, A5, A10
Minten, Elizabeth, A218
Mireles, Lillian, A309
Mitchel, Ruel, A296
Mitchell, Bryan, A298
Mitchell, Le'Andrea, A159
Mitchell, Shannon, A218
Mittal, Neha, A9
Mittal, Roopali, A145
Moan, Emili, A252
Modlin, Robert, A188
Moeller, Jens, A312
Moffett, Steve, A134
Mohammed Nur, Sara, A195
Mohandesi, Ehsan, A321
Molina, Abner, A321
Molina, Edgardo, A330
Moline, Olivia, A108
Molitor, Hannah, A160
Moncur, Briana, A182, A185
Mondal, Ananda, A231
Mondello, S., A59
Monroy, Marco, A77
Moore, Alexander, A12
Moore, Ashli, A182, A185
Moore, Jan, A270
Moore, Ronnie, A280
Moorefield, Emily, A159
Mora, Carlos, A219
Morales-Silva, Miguel, A214
MoRamal, Madhusoodanan, A140
Moreno, Violeta, A22
Moreno-Rodriguez, Itzel, A147
Morgan, Harith, A330
Morin, Benjamin, A96
Moritz, Chet, A59
Moros, Eduardo, A41
Morris, David, A296, A305, A313
Morris Wang, Y., A54
Morrow, Jairus, A93
Morton, Benjamin, A117
Moseley, Janae, A194
Moseley, Malik, A186
Moses Chambers, Michelle, A142
Mosley, Gregory, A321
Motschman, Courtney, A111
Moyers, Sahnzi, A66
Mubayi, Anuj, A96
Muche, Solomon, A309
Mudie, Shii-Anna, A118
Muhsen, Amira, A219
Mukjeree, Sourav, A130
Muldrow, Lycurgus, A110, A111, A323
Mulero, Javier, A200
Mullenbach, Jared, A265
Munday, Mihaela, A281
Munoz, Socrates, A12
Murchison, Marissa, A207
Murillo, Esdras, A328
Mutunga, Eva, A339
Myers, Kimberly, A147

N

Nabers, Ashleigh, A90
Nagalingam, Aru, A61
Naghedolfeizi, Masoud, A98
Nagy, Martina, A65
Naheed, Naima, A276
Naidu, Malini, A178
Nangia, Shikha, A310
Nato, Nazarine, A333
Navasca, Carmeliza, A35
Nazario, Gerardo, A38
Neace, Meghan, A171
Neal, Shane, A117
Neamati, Nouri, A209
Neblett, Tamra, A148
Neckameyer, Wendi, A299
Nefalar, Jason, A186
Neils, Christopher, A309
Nelson, R., A5
Nemtserova, Antoniya, A137
Nepal, Madhav, A261
Newell, Sara, A230
Newton, William, A102
Ngu-Schwemlein, Maria, A131
Nguyen, Alice, A255
Nguyen, Khoa, A77
Nguyen, Tan, A91
Nguyen, Tina, A253
Nguyen, Vincent, A329, A330
Nhliziyo, Manelisi, A70
Nielsen, Nikole, A289
Nieto, Fernando, A147
Nietzold, Tara, A101
Nilsen-Hamilton, M., A131
Ning, Zhu, A28
Nisbett, Khalin, A207
Nkinsi, Naomi, A60
Noble-Haeusslein, Linda, A197
Nocon, Honorine, A5
Nogues, Gilles, A37
Nomura, Christopher, A158
Nonet, Michael, A152
Norouzi, Hamidreza, A245, A259
Northcutt, Tiffany, A278
Ntembe, Bruno, A63
Nukavarapu, Syam, A139
Nuruddin, Md., A18
Nyairo, Elijah, A285

O

Oakes, Scott, A161
Ochiobi, Amarachi, A220
Odedina, Folakemi, A108
Odero-Marah, Valerie, A146
Odom, Winston, A319
Oehmke, Theresa, A264
Officer, Joi, A309
Often, Nicholas, A160
O'Gara, Bruce, A202
Ogindo, Charles, A7
Ogston, Andrea, A89
Ogwuazor, Linda, A161
Ojeda, Norma, A193
Ojo, Babatunde, A220
Okani, Obinna, A206
Okegbu, Daniel, A319
Okeh, Onome, A267
Olah, George, A12
Oliver, Brian, A62
Oliver, Danielle, A208
Oliver, Jasmine, A41
Olmschenk, Greg, A324
Olubi, Omotunde, A20
O'Malley, Katherine, A143
O'Malley, Kathleen, A179
Omojola, Joe, A97, A276, A279
Omoru, Matilda, A179
Ong, Mitchell, A54
Ong, N. Phuan, A337
Onyenweaku, Ifeanyi, A84
Onyilo, Vincent, A196
Orenstein, Eric, A231
Orimadegun, Famuyide, A268

Orogbangba, Kehinde, A25
Orogbangba, Taiwo, A25
Ortega, Omayra, A96
Ortega, Robert, A30
Ortiz, Ashley, A201
Ortiz, Carolyn, A337
Ortiz, Jastine, A340
Ortiz, Michael, A3
Ortiz-Martinez, Krisiam, A19
Osano, Anne, A63, A143, A199, A201
Oseguera, Berenice, A265
Osei, Janeen, A201
Osunsade, Adewola, A80
Overstreet-Wadiche, Linda, A196
Owens, Omar, A246
Oyeamalu, Agozie, A14
Oyesanya, Regina, A59
Oyola, Oscar, A15
Ozbay, Gulnihal, A34, A88
Ozcan, Aydogan, A52

P

Pacheco Olivas, Andres, A272
Paden, John, A236
Padilla, Hugo, A161
Padovani, Agnes, A44
Page, Catherine, A227
Page, Michael, A222, A224
Palmer, Colin, A175
Pan, Miao, A120
Pande, Manju, A229
Pande, Partha, A321
Pandya, Anjani, A187
Pang, Yawei, A120
Papac, Meagan, A127
Par, Sindhu, A120
Parada Bustelo, Samuel, A119
Paris, Thomson, A75
Park, Rudolph, A160, A175
Park, Young Ho, A338
Parker, Keith, A261
Parker, Ray, A329
Parker-Lemieux, KiTani, A60
Partridge, Edward, A142
Parvatiyar, Michelle, A192
Pascal, Dana, A210
Passe, Ulrike, A328
Patel, Hiren, A79
Patel, Monal, A98
Patel, Parth, A180
Patterson, Wayne, A80, A116, A184, A225, A236, A241, A333
Pati, Gour, A43
Patterson, Chelsea, A119
Patterson, Jennifer, A223
Paukpol, Autchara, A230
Paulino, Stivaly, A265
Paulius, David, A284
Payton, Khalia, A220
Paz Gutierrez, Maria, A49
PB, Mishal, A227
Pearson II, McKeith, A63
Pease, Karli, A135
Peault, Bruno, A152
Pedigo, Nancy, A151
Pellman, Ashley, A268
Peña, Alexis, A310
Peng, Hanjing, A220
Peoples, Veolanda, A284
Perales-Perez, Oscar, A100
Perez, Dianne, A153
Perez, Felipe, A114
Perez, Isabel, A272
Perez, Melina, A100
Perina, F. J., A5
Perkins, Andy, A8
Person, Vernecia, A15
Peters, A., A232
Peterson, Alex, A276, A277
Peterson, Lisa, A309
Peterson, Nicole, A260, A333
Pettiford, Sherrell, A63
Petty, Bathsheba, A237
Pfleger, Brian, A153, A160, A165, A306
Pham, Anh, A291
Phambu, Nsoki, A211, A218, A219
Phanstiel, IV, Otto, A77
Philip, Neal, A273
Phillips, Charles, A61
Phipps, Jennifer-Lynn, A237
Pierre, Webs, A221
Pike, Maxwell, A241
Pilapil, Levi Glenn, A221
Pilaz, Louis-Jan, A156
Pillai, Shreekumar, A39, A184, A288
Pinckney, James, A263
Pintus, Drew, A85
Pipkins, Haley, A189
Piyathilake, Chandrika, A142
Plowes, Robert, A255
Podrabsky, Jason, A176
Pondugula, Satyanarayana, A4, A145
Pope, C. Earl, A138
Pope, Mike, A147
Poppe, Kara, A302
Porter, Madeline, A162
Posada, Adrian, A330
Postle, Brad, A300
Potma, Eric, A77
Povijua, Deseree, A171
Powell, Anthony, A120
Powell, Geralle, A76
Powell-Rose, Vertonica, A56
Pozos, Hilda, A204
Pradhan, Aswini, A38
Prager, William, A319
Prakash, G. K. Surya, A12, A13
President, Bonnie, A258
Presley, DeAnn, A263
Pressey, Shannon, A108
Pressley, Mariyah, A66
Prestegard, James, A58
Pretz, Chelsea, A253
Pride, Carol, A281
Primeau, Marc, A121
Prothro, Calvin, A262
Pruitt, Beth, A14, A313
Prusinski, Melissa, A249
Pryor, James, A237
Pu, Ying-Chih, A79
Puri, Ashok, A124
Purviance, John, A26
Putnam, David, A113

Q

Qiao, Chunming, A83
Qiao, Fengxiang, A34, A57
Qin, Hong, A177
Quach, Bryan, A243
Quinonez, Josue, A340

R

Racoma, Bryson, A330
Rafie, Reza, A91
Ragle, Matt, A150
Rahman, Esha, A246
Rajaram, Harihar, A274
Ramachandran, Sowmya, A171
Ramadhin, Jessica, A33
Ramatsitsi, Khuliso, A302
Ramesh, Govindarajan, A180
Ramji, Ramesh, A112
Rammelkamp, Derek, A287
Ramos, Karla, A312
Ramsundar, Ariane, A258
Ranabhat, Rohit, A63
Rangari, Vijaya, A55, A334
Rankins, Claudia, A24, A122
Rao, Anuj, A71
Rao, Vivek, A49
Rapala, Joe, A98
Rasic, Daniel, A100
Rasic, Goran, A100
Rasulev, Bakhtiyor, A21

Raychoudhury, Samir, A276
Reagan, Mary, A266
Reale-Munroe, Kynoch, A263
Recha, Reid, A295
Reddi, Prabhakara, A176
Reddie, Royan, A148
Reece, Taylor, A323
Reed, James, A16
Reed, Raven, A92
Reed, Sara, A108
Reeder, Amanda, A99
Rees, Bernard, A194
Reid, Dana, A138
Reid, Hadyn, A223
Reinhard, Bjorn, A164
Reinhardt, Nora, A37
Relman, David, A70
Ren, Dacheng, A58, A69
Ren, Gary, A51
Renteria, Boris, A334
Rento, Chloe, A128
Reutter, John, A94, A232
Reuven, Darkeyah, A107
Reyes, Gil, A298
Reyes, Po'okela, A330
Reyes, Tiffany, A96
Rhein, S., A10
Rhoden, Stephanie, A320
Ribeiro, Alexandre, A312
Rice, Antonie, A185, A210
Rickman, Doug, A36
Ridgeway, Jefferson, A84
Riggs, Nancy, A263
Riley, Mitchell, A197
Rinaldi, Chiara, A9
Riordan, John, A129
Rios, Jose, A113
Rivas, Jesus, A30
Rivera, Carlos, A334
Rivera, Christian, A101
Rivera De Jesus, Wilmer, A29
Rivera, Roberto, A298
Rivera Gonzalez, Ivonnemary, A100
Rivera Rodriguez, Angelie, A288
Rivera-Reyes, Nilda, A302
Rivie, Adonis, A196
Rizzo, Anael, A162
Rizzuti, Anthony, A260
Roach, Lara, A163
Roberts, Paul, A231
Roberts, Samori, A107
Robinson, DaChiron, A193
Robinson, Derrick, A237
Robinson, Felisha, A134
Robinson, Laren, A252
Roby, Jamaal, A120
Rockward, Tommy, A104
Rodriguez, Ana, A162
Rodriguez, Jason, A133
Rodriguez, Jeanette, A201
Rodriguez, Marita, A136
Rodriguez-Gonzalez, Laura, A258
Rogers, Tamara, A121
Rohde, Barukh, A10, A75, A76
Rokita, Steven, A224
Rolf, Julianne, A259
Roman, Felix, A19
Romero, Alicia, A70, A186
Ronquillo, Nancy, A126
Roos, Kenneth, A192
Rorie, Checo, A139, A145, A158
Rosas, Juan, A3
Rosenzweig, Bernice, A245
Ross, Elise, A317
Ross, Erica, A303
Ross, Sederra, A266
Rosypal, Alexa, A181
Rowe-Gaddy, Yuliana, A169
Roye, Brittini, A331
Royer, Lesa, A207
Rubalcava, Kasondra, A254
Rubenstein, Shmuel, A71
Ruffin Jr., Jeff, A85
Ruffley, Megan, A87
Ruiz, Freddy, A221
Ruiz-Deliz, Frances, A306
Rush, Arielle, A182
Rusin, Scott, A133
Russell, Chelsea, A44

S

Sabalowsky, Andrew, A333
Sabree, Shakoora, A163
Saddler, Maria, A4, A145
Saetang, Songpon, A230
Sagers, Cinthia, A268
Sain, Trisha, A119, A336
Saiz, Justin, A30
Sajwan, Kenneth, A281
Sakulich, Aaron, A320
Salas, Nelson, A135
Salcedo Perez, Jose Luis, A101
Salinas, Steven, A30
Sallan, Lauren, A29
Sam, Pingdewinde, A197
Samaha, Jason, A300
Samuels, Quentin, A331
Sanabria, Natalia, A27
Sanchez, Bryan, A266
Sanchez, Jessica, A77
Sanchez, Maritza, A337
Sanders, Carrie, A283
Sanni, Damola, A319
Sannigrahi, Biswajit, A20
Sannoh, Fatim, A134
Sansiñena, Jose-Maria, A104
Santiago, Claudia, A46
Santiago, Nayda, A298
Santos, Cornelia, A4
Santos, Guaciara, A77
Santos, Jeannette, A44
Sapateh, Genefine, A20
Sapp, Ryan, A191
Satchell, Khaliq, A238
Satin, Leslie, A229
Satterfield, Dara, A172
Saucedo, Antonio, A280
Sayegh, Ayman, A135
Saylor, Rick, A244
Saynonh, Jay, A91
Sayre, Eleanor, A235
Scales, Raven, A208
Scally, William, A35
Schamschula, Marius, A42, A223
Schewendeman, Anna, A79
Schimmel, Keith, A17
Schleiss, Mark, A173
Schlicker, Steven, A97
Schmidt, Sarah, A290
Schneider, Emily, A320
Schneider, Sallie, A2
Schroeder, Analyne, A192
Schwarz, Jennifer, A43
Schwendeman, Anna, A79
Schwochert, Josh, A214
Scott, Anthony, A246
Scott, Maureen, A270
Seals, Cheryl, A22
Sedlak, David, A259
Segall, Richard, A6
Semien, Joy, A254
Semple, Bridgette, A197
Sen, Arpita, A63
Sene, Modou, A273
Sengupta, Bidisha, A204
Seo, Hye-Won, A286
Sepulveda, Nelson, A337
Sequera, Pedro, A246
Serna-Grey, Donald, A103
Setien-Grafals, Monica, A339
Settineri, John, A238
Setyono, Beatrix, A164
Severson, Sheri, A160, A166
Seymore, Jade, A243
Sezer, Volkan, A320
Shackleford, Louis, A223
Shaeffer, Faith, A71

Shahbazi, Abolghasem, A47, A52
Shankar, Ravi, A275
Sharbat, Ali, A114
Sharma, Abhijeet, A158
Sharma, Dipali, A61
Sharma, Sharad, A23, A24, A51, A82, A83, A85, A122, A127
Shaw, Tiana, A16
Shea-Brown, Eric, A195
Sheard, Andrea, A67
Shearin, Shenna, A20
Sheikh, Zaid, A221
Shelton, Alexis, A164
Sheng, Kevin, A275
Sherani, Aiman, A222
Sherer, Nathan, A67
Sheth, Ravi, A306, A307, A308
Shetty, Sachin, A50, A121, A124
Sheybani, Eshan, A305, A322
Shi, Ainong, A267
Shi, Crystal, A266
Shi, Zhaozhong, A106
Shikh, Simran, A303
Shirazi, Behrooz, A321
Shishodia, Shishir, A5
Shively, Kathryn, A174
Shry, Samuel, A179
Shuler, Pamela, A158
Shumiya, Nana, A295
Shurin, Galina, A140
Shurin, Michael, A140
Siahaan, Teruna, A150
Sidwell, Tiffany, A186
Siemann, Evan, A28
Sikora, John, A106
Silver, Debra, A156
Silveti-Falls, Tony, A278
Simmonds, Caresse, A310
Simmons, Dwayne, A129
Simmons II, David, A118
Simonis, Ursula, A77
Simpson, Edwin, A179
Simpson, Scott, A219
Sinanyan, Araik, A202
Singh, Shivendra, A146
Singh, Shree, A39, A184, A189, A193, A282, A284, A286, A288
Singleton, Cynthia, A97
Singleton, Rana, A283
Sinn, Ekkehard, A14
Sitsula, Londolani, A302
Sivapatham, Paramasivam, A256
Skoko, Selma, A259
Sloan, Steven, A252
Small, Sharon, A85
Smith, Aaron, A242
Smith, Abigail, A280
Smith, Adrian, A96
Smith, Brandi, A8
Smith, Damon, A105
Smith, Herbert, A270
Smith, James, A128, A302, A340
Smith, Jocelyn, A182
Smith, Julie, A108
Smith, Korey, A197
Smith, Marguerite, A164
Smith, Micheal, A67
Smith, Patrick, A85
Smith, Phil, A284
Smith, Shawn, A170
Smith, Stacy, A34
Smith, TaShonda, A64
Sneed, Rosie, A72
Sniadecki, Nathan, A136
Snyder, John, A225
Sobahi, Nebras, A329
Sofjan, Katri, A306, A307, A308, A311
Sofjan, Katrii, A306, A307, A308, A311
Sohn, Rachel, A134
Solano, Maria Gabriela, A26
Solis, Adriana, A311
Solis, Alexis, A199
Solis, Jose, A274
Somers, Bernard, A209
Sommer, Koby, A263
Sondh, Inderbir, A230
Song, Bao-Hua, A9
Song, Baojun, A96
Song, Jianxun, A185
Song, Xueqing, A80, A221
Sossa, Awolou, A226
Soto, Bethsymarie, A165
Soto, Hildelix, A313
Soto-Medina, Sujeily, A44, A101, A334
Souilmi, Yassine, A43
Sours, Dan, A278
Sousa e Silva, Amabile, A63
Sowells, Evelyn, A121
Spann, Kiozsa, A222
Spears, Andre', A104
Spellman, Zenora, A271
Squires, Caleb, A201
Sreenivasan, Aparna, A256
Sridara, Tharinee, A230
Sriharan, Shobha, A247, A252, A257, A270
St. Pierre, Andrew, A98
Stahr, Madison, A165
Standley, Melissa, A183
Stanford, Alice, A174
Stanley, Yasmine, A229
Stanskwoska, Dorota, A167
Starring, Hunter, A337
Steans, Marisa, A242
Stearns, Tim, A154
Stegall, Jabari, A122
Steiner, Nicholas, A265
Stephens, Chelsea, A138
Stephens, Patrick, A252
Stephenson, Steven, A28
Stevenson, Jamal, A93, A273
Stewart, Anthony, A104
Stewart, Rodell, A247
Stigall, James, A51, A85
Stinson, Andrea, A228
Stoler, Aaron, A249, A257
Stolz, Ariel, A283
Strangas, Maria, A250
Strauss, Eli, A109
Stubbs, Ian, A39
Stuhlmann, Heidi, A158
Suarez, O. Marcelo, A38, A44, A101, A313, A334, A337
Subedi, Abhi, A166
Sumdani, Hasan, A96
Sun, Quan, A239
Sunda-Meya, Anderson, A62, A176, A211, A218, A219, A323
Sunshine, Michael, A59
Sussman, Daniel, A294
Swaid, Samar, A237
Swartzentruber, Ryan, A96
Sweder, Kevin, A218
Szick, Kathleen, A185

T

Taase, Setu, A239
Tabor, Jeffrey, A306, A307, A308, A311
Tai, Wai Yan Elsa, A25
Taisali, Elenoa, A271
Tang, Bin, A235, A239
Tang, Fusheng, A6
Tang, Guoqing, A123, A209
Tang, Hao, A81, A120, A241
Tang, Juliet, A8
Tang, Yongan, A100, A101
Tanner, Sacile, A172
Taplin, Martha, A68
Taqqee, Mandisa, A64
Tarekgn, Eyob, A275
Tarver, Siobhan, A92
Tavernese, Annette, A45
Taya, Minoru, A315
Taylor, Colleen, A223
Taylor, Darlene, A213, A217
Taylor, Deborah, A239
Taylor, Fontaine, A211

Taylor, Jeffrey, A182, A185
Taylor, Keylantra, A286
Taylor, Mark, A200
Taylor, Tatyanna, A320
Taylor, Tracey, A187
Tcherbi-Narteh, Alfred, A18, A55, A56
Tchounwou, Martha, A325
Teets, Nicholas, A179
Tekle, Yoel, A260
Tekle, Yonas, A155, A167
Tekola, Sarra, A89
Teles, Matheus, A196
Temple, Brandi, A61
Tena, Jennyfer, A208
Teng, Tian-Lih, A45
Tesfagiorgis, Kibrewossen, A258
Teymur, Berrack, A118
Thanaiah, Yugaananthy, A21, A34
Thanthirige, Viraj, A14
Theodorakis, Emmanuel, A145
Thich, Tracy, A134
Thieler, E. Robert, A24
Thomas, Alicia, A323
Thomas, Millie, A270
Thomas, Mychal, A42
Thomas, Naija, A279
Thomas, Wendy, A309
Thomas, Xien, A325
Thomas Jr., Jerry, A223
Thompson, Brittany, A187
Thompson, Brittany S., A166
Thompson, Michael, A223
Thompson, Paris, A256
Thomson, Bruce, A57
Thoner, Melissa, A91
Thornton, Trevor, A336
Tidball, James, A9
Tieman, Denise, A74, A200
Tiffany, Stephen, A111
Tigner, Julaunica, A56
Tiimob, Boniface, A55, A334
Timpano, Kiara, A47
Ting, Kang, A129
Tipgunlakant, Pooncharas, A77
Tison, Krislen, A173
Titinchi, Salam, A207
Tiwari, Amit, A4, A145
Tokuta, Alade, A233
Tolbert, Michelle, A325
Tomany, Armand, A317
Tomat-Kelly, Giovanna, A254
Tomescu, Alexandru, A201
Tonellato, Peter, A43
Torres, Daniel, A283
Torres, Martin, A240
Torres Cabán, Cristina, A166
Torres Lugo, Madeline, A283
Torres-Rodriguez, Jahannie, A298
Toure, Sibongile, A240
Townesmith, Andrew, A199
Tripathi, Renu, A43
Trivedi, Piyush, A4, A145
Trottier, Nathalie, A190
Trotz, Maya, A332
Trouard, Theodore, A137
Tuiolosega, Chastity, A271
Tuitt, Omani, A209, A210
Turk, Erin, A154
Turner, Helen, A269
Turner, Sydnie, A140
Turner, Timothy, A142, A143, A144, A199, A254, A299
Turochy, Rod, A49
Turos, Mugurel, A313
Tuszynski, Mark, A162
Tutson, Charmaine, A16

U

Ubanyionwu, Victoria, A167
Uche, Ifeanyi, A202
Ulibarri-Sanchez, Raymond, A338
Urbano, Nancy, A255
Urbina, Rebecca, A242
Usher, Tim, A104, A292
Uta, Fili, A271

V

Vadapally, Praveen, A147, A273
Vaeoso, Motusaga, A268
Valdez, Andrea, A255
Valdez, Michael, A137
Valentin, Vanessa, A27
Valentine, Megan, A168
Valles-Rosales, Delia, A27
Van Eck, Joyce, A203
Van Nocker, Steve, A200
Van Rompey, Koen, A73
Van Vlack, Kai, A250
Vandewege, Michael, A236
Vanterpool, Elaine, A182, A186
Vant-Hull, Brian, A266
Vargas, Benni, A188
Vargas, F. Hernan, A251
Vasquez, Sheena, A134
Vasquez Jr., David, A65
Vaughan, Sharniece, A280
Vazquez, Alicia, A172
Velasco, Aaron, A32
Velazquez, David, A223
Velbel, Michael, A264
Venayagamoorthy, G. Kumar, A326
Venkateswarlu, Divi, A21
Verghese, Martha, A223
Vetter, Douglas, A159
Vidal, Daniel, A244
Vig, Komal, A184, A189, A193, A282, A284, A289, A292
Vinodgopal, Kizhanipuram, A100
Virrueta, Cristian, A274
Vladar, A.E., A339
Vlahovic, Branislav, A100
von Laszewski, Gregor, A84
Vorosmarty, Charles, A245
Vu, Thomas, A140
Vuckovic, Djordje, A92

W

Waffo, A. B., A283
Wagnac, Jared, A121
Wahl, Christina, A276, A277
Walker, Brandon, A38
Walker, Carsten, A190
Walker, Lloyd, A223
Walker, Scharri, A61
Walker, T'Leya, A321
Walsh, Zach, A276, A277
Walters, Eric, A6
Walton, Staci, A38
Walz, Katherina, A64
Wang, Binghe, A220
Wang, Cheng, A285
Wang, Fugang, A84
Wang, Guangdi, A140
Wang, Haixin, A275
Wang, Jing, A307
Wang, Jingyu, A273
Wang, Ke, A220
Wang, Lijun, A47, A52
Wang, Zhou, A143
Warbutron, Marilyn, A8
Ward, Ayzha, A241
Wardwell, Patricia, A158
Warren, Lamara, A238
Washington, Aurora, A304
Washington, Jamilha, A256
Washington, Jasmine, A210
Washington, Kehinde, A323
Washington, Parris, A167
Waterman, Jenora, A63
Waters, Andrew, A109
Watkins, Marquita, A21
Wazeerud-Din, Idris, A12, A14

Webber, Gabrielle, A288
Webb-Nelson, Jeannise, A167
Webster, Destiny, A280
Weeraratne, Dayanthie, A266
Wei, Kuang, A168
Weiblen, George, A175
Weinstein, Spencer, A261
Weiss, Nathan, A40
Welch, Roy, A165
Wellman, Christopher, A67
Wells, Alan, A142, A147, A148
Weng, Jing-Ke, A135
West, Maya, A16
Wester, Julia, A47
Wheeler, Charles, A137
Wheeler, Sarah, A142
White, Corin, A177
White, Kaaba, A323
White, Stephanie, A64
Whitehurst, Travon, A180
Whittington, Richard, A148
Wiggin Esselstrom, Dawn, A328
Wiles, Benjamin, A98
Will, Robert, A93
Williams, Alfred, A217
Williams, Amelle, A209, A210
Williams, Frances, A38, A42
Williams, Janelle, A94
Williams, Kurtis, A103, A281
Williams, Mary-Kate, A172
Williams, Michael, A16, A20, A43
Williams, Mina, A256
Williams, Sierra, A224
Williams, Terrel, A333
Williams, Tiffany, A188
Williams-DeVane, ClarLynda, A194
Willis, William, A135
Willson, Kevin, A257
Wilson, Adriann, A117, A119
Wilson, Bobby, A92
Wilson, Christopher, A290
Wilson, David, A301
Wilson, Kasey, A260
Wilson, Simeon, A286
Wilson Jr., Chapman, A289
Wiltshire, Jessica, A203
Winegar, Geoffery, A302
Winfield, Leyte, A210
Wint, Jinelle, A8
Wirtu, Gemechu, A138
Wisser, Randall, A5, A10
Wohl, Christopher, A83
Wolf, Michael, A136, A203, A309
Wolfe, Vincent, A323
Wolfe, Vinton, A319
Wong-Ala, Jennifer, A257
Woo, Myungwu, A317
Wood, Brandon, A54
Wood, Imani, A94, A223
Wood, Jeff, A274
Woodford, Quaneisha, A222
Woods, Adam, A224
Wooten, Terqueasha, A225
Wright, Thaiesha, A210
Wu, Juanjuan, A163
Wu, M., A105
Wu, Xiaoqian, A69
Wu, Zhenhua, A316
Wubah, Daniel, A133, A181
Wubah, J., A181

X

Xie, Zhifu, A94, A95
Xu, Xiang-Xi, A141

Y

Yabba, Elangeni, A209, A210
Yaffe, Eitan, A70
Yang, Christopher, A324
Yang, Q., A5, A10
Yang, Shu, A294
Yang, Suhui, A209
Yang, Zhou, A41
Yapuwa, Harold, A31
Yarber, Aara'L, A295
Yarelis Rivera-Reyes, Nilda, A302
Yates, Clayton, A148
Yearby, Letitia, A60
Yeboah, Cecilia, A12
Yee, Jonathan, A203
Yee, Kathleen, A159
Yerokun, Tokunbo, A144, A148, A150, A153
Yitna, Michael, A325
Yorio, Thomas, A167, A187
Young, Carlos, A305, A323
Young, Jared, A131
Youngblood, Claresa, A188
Yousuf, Asad, A328
Yu, Lei, A34, A57
Yuan, Xiaohong, A325
Yuen-Lau, Laura, A244, A247, A260, A265, A267, A273

Z

Zagar, Dane, A265
Zagvazdina, Nina, A76
Zahler, Alan, A150
Zamora, Azucena, A32
Zamore, Ykeshia, A225
Zarringhalam, Alireza, A129
Zein-Sabatto, Saleh, A118
Zemlick, Katie, A57
Zettl, Alex, A293
Zhang, Amy, A134
Zhang, Fan, A127
Zhang, Geoffrey, A41
Zhang, Hao, A152
Zhang, Jin, A79
Zhang, Li, A58
Zhang, Lijie Grace, A144
Zhang, Nian, A307
Zhang, Qiang, A140
Zhang, Qiong, A332
Zhang, T.X., A290
Zhao, Zhao, A266, A336
Zheng, Shilong, A140
Zheng, Yi, A198
Zheng, Zhong, A129
Zhong, Hang "Becky", A203
Zhong, Qiu, A140
Zhong, Sheng, A82
Zhou, G., A15
Zhou, Hailong, A40
Zhu, Wei, A144
Zhu, Zhigang, A81, A120, A239, A324, A327, A330
Zhuo, You, A58
Zofka, Adam, A313
Zou, Huang, A241
Zurek, Eva, A219