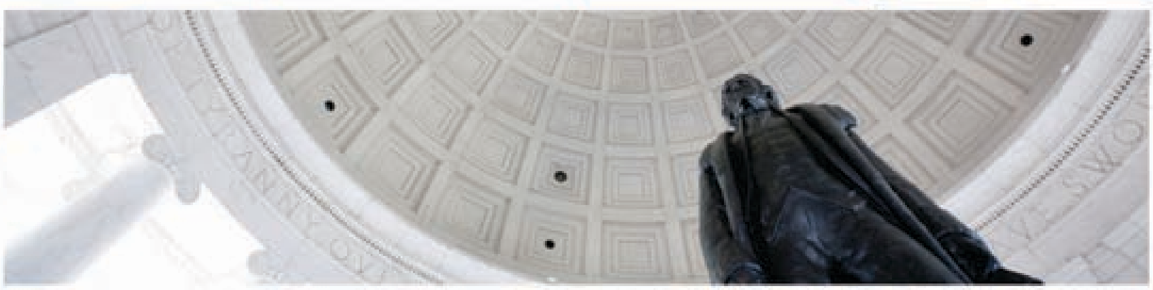
2014 Emerging Researchers National (ERN) Conference in STEM

February 20-22, 2014
Washington, D.C.

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

I HAD A MONUMENTAL EXPERIENCE. YOU CAN TOO.



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)

National Society of Black Physicists (NSBP)

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

This material is based upon work supported by the National Science Foundation Grant Nos. HRD-1036084 and HRD-1242666.

ISBN 978-0-87168-757-9

Conference Program Editors: Donna Behar, AAAS, EHR
Betty Calinger, AAAS, EHR
Nicole Davies, AAAS, EHR
Yolanda George, AAAS, EHR

Conference Program Cover Design: Ann Williams, AAAS, EHR

Conference Program Design: Donna Behar, AAAS, EHR

Contents

Overview of the Conference

Emerging Researchers National (ERN) Conference in STEM

The 2013 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 o f 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;
- National Society of Black Physicists (NSBP) Scholars[1];
- 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/*.

[1]The National Society of Black Physicists (NSBP) is working with AAAS to increase the number of African American and other underrepresented minority physics students who participate in the ERN conference.

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 under the Directorate for Engineering provides funding opportunities for interdisciplinary teams of researchers to embark on rapidly advancing frontiers of fundamental engineering research. EFRI identifies emerging topics and solicits proposals with potentially transformative ideas that represent an opportunity for a significant shift in fundamental engineering knowledge with a strong potential for long term impact on national needs or grand challenges.

In keeping with ENG's priority to broaden the participation of underrepresented groups in Engineering, EFRI addresses the need to enhance diversity in all fields of Engineering by requiring all EFRI projects to include a "Broadening Participation Plan" when submitting proposals in response to EFRI solicitations. Additionally, EFRI is currently supporting a pilot program, *Research Experience and Mentoring (REM),* that encourages active EFRI awardees to request supplemental funding to support costs associated with bringing Research Participants (RPs) into the laboratory over the summer to participate in research aligned with the goals of EFRI-supported research, and to extend the duration of structured mentoring into the academic year.

GOAL:

The REM program was designed to increase the participation of underrepresented groups in the field of engineering and in engineering research. The requirements of the REM program not only promotes diversity in the human resources engaged in these EFRI projects but also expands diversity of thought, ideas, and approaches brought together by EFRI in defining and solving important research questions.

REM PROGRAM DESCRIPTION:

REM was created to encourage EFRI-supported researchers to create mentored research opportunities for underrepresented minorities, females, and veterans enrolled in post-secondary education, persons with disabilities, and others who are underrepresented in engineering. The program supports the active involvement of high-school students and STEM teachers, undergraduate STEM students and faculty (including community-college students and faculty), professors, and veterans in hands-on research in order to bring this rich research experience and contact with suitable STEM mentors into their lives.

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 Ferrini-Mundy

Sylvia M. James

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

January 15, 2014

Dear Conference Participants:

On behalf of the National Science Foundation (NSF), the Directorate for Education and Human Resources, and the Division of Human Resource Development, we welcome you to the 2014 *Emerging Researchers National Conference in Science, Technology, Engineering and Mathematics (STEM)*. This research conference for undergraduate and graduate students 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

Sylvia M. James
Division Director
Human Resource Development

Shirley M. Malcom

Yolanda S. George

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

Dear ERN Conference Participants:

Welcome to the 2014 *Emerging Researchers National (ERN) Conference in Science, Technology, Engineering, and Mathematics (STEM)*. The American Association for the Advancement of Science (AAAS), publisher of the journal *Science,* is pleased to join the National Science Foundation (NSF) in co-sponsoring the fourth ERN conference. We applaud the NSF's commitment to building a well-prepared and competitive U.S. STEM workforce, including broadening participation by underrepresented minorities, persons with disabilities and the institutions that serve them.

The previous ERN conferences have primarily included undergraduate and graduate students and faculty and administrators from the NSF HRD and REU Programs. This year, we also welcome attendees from the Directorate for Engineering (ENG), Office of Emerging Frontiers in Research and Innovation (EFRI) Research Experience and Mentoring (REM) Program and undergraduate Scholars from the National Society of Black Physicists (NSBP). Because of these collaborative efforts, this year we have nearly 1,000 attendees from over 200 colleges and universities and organizations, including about 650 undergraduate and graduate students.

For the first time, we also have workshops on MD/PhD programs organized by the Association of American Medical Colleges (AAMC). Three of the faculty grantees of the NSF-funded AAAS Women's International Research Collaborations (WIRC) at Minority Serving institutions (MSIs) and their graduate students will share their experiences during the Saturday luncheon. We wish to acknowledge these efforts and the work of all faculty and administrators who develop and nurture the future STEM workforce. All of your efforts are important in implementing the *5-Year Federal STEM Education Strategic Plan* that is designed to keep the U.S. at the forefront of technological innovation, "such as those that improve health care, inspire new industries, protect the environment, and safeguard us from harm."

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*.

Five-hundred-and-seventy-seven (577) students are scheduled to make presentations at the conference, so we are most appreciative to the PhD alumni and current graduate students of the David and Lucile Packard HBCU Graduate Scholars Program, the AAAS Policy Fellows, and 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.

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

Sylvia James, *Division Director*
Jermelina Tupas, *Deputy Division Director*

HRD Program Directors and Staff

Tamara Battle, *Science Assistant*
Lura (Jody) Chase, *TCUP*
Earnestine Easter, *HBCU-UP*
A. James Hicks, *LSAMP*
Mary Anne Holmes, *ADVANCE*
Tasha Inniss, *LSAMP*
Martha L. James, *EASE and HBCU-UP*
Mark H. Leddy, *RDE and AGEP*
Beth Mitchneck, *ADVANCE*
John Rand, *TCUP and CREST*
Claudia Rankins, *HBCU-UP and REU*
Victor Santiago, *CREST*
Marilyn J. Suiter, *EASE*
Alonso Thelem, *Science Assistant*

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

Sohi Rastegar, *Director*

EFRI Program Manager and Staff

Garie Fordyce, *Program Manager*
Johnetta Lee, *Program Assistant*
Shannon Dunphy, *Science Assistant*
Ophelia Barizo, *Einstein Fellow*

AAAS Education and Human Resources (EHR)

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

Conference Team

Donna Behar
Tarrick Clayton
Yolanda Comedy
Nicole Davies
Colleen Hayes
Sabira Mohamed
Dione Rossiter
Laureen Summers
Jennifer Williams

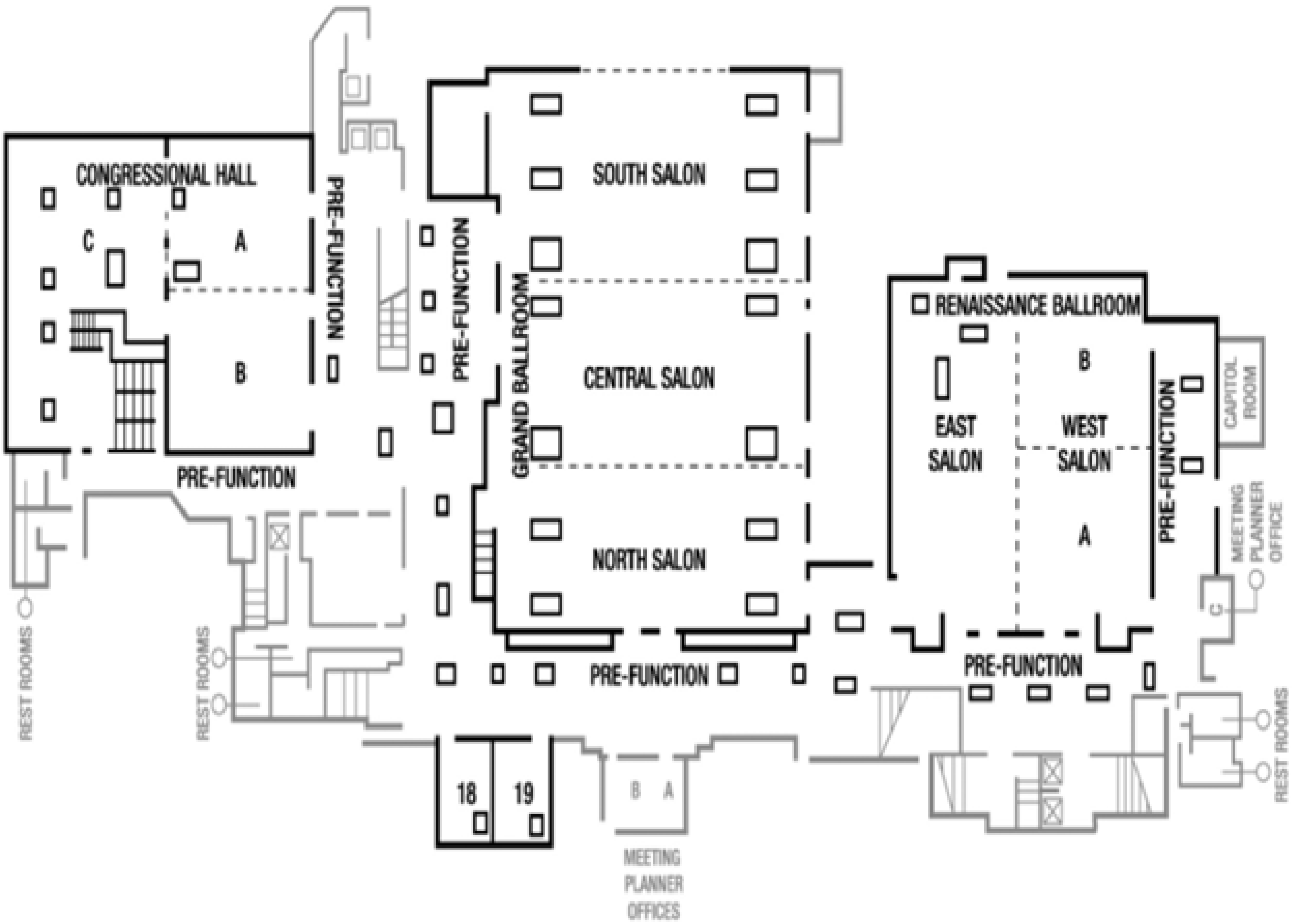
ERN Advisory Board

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

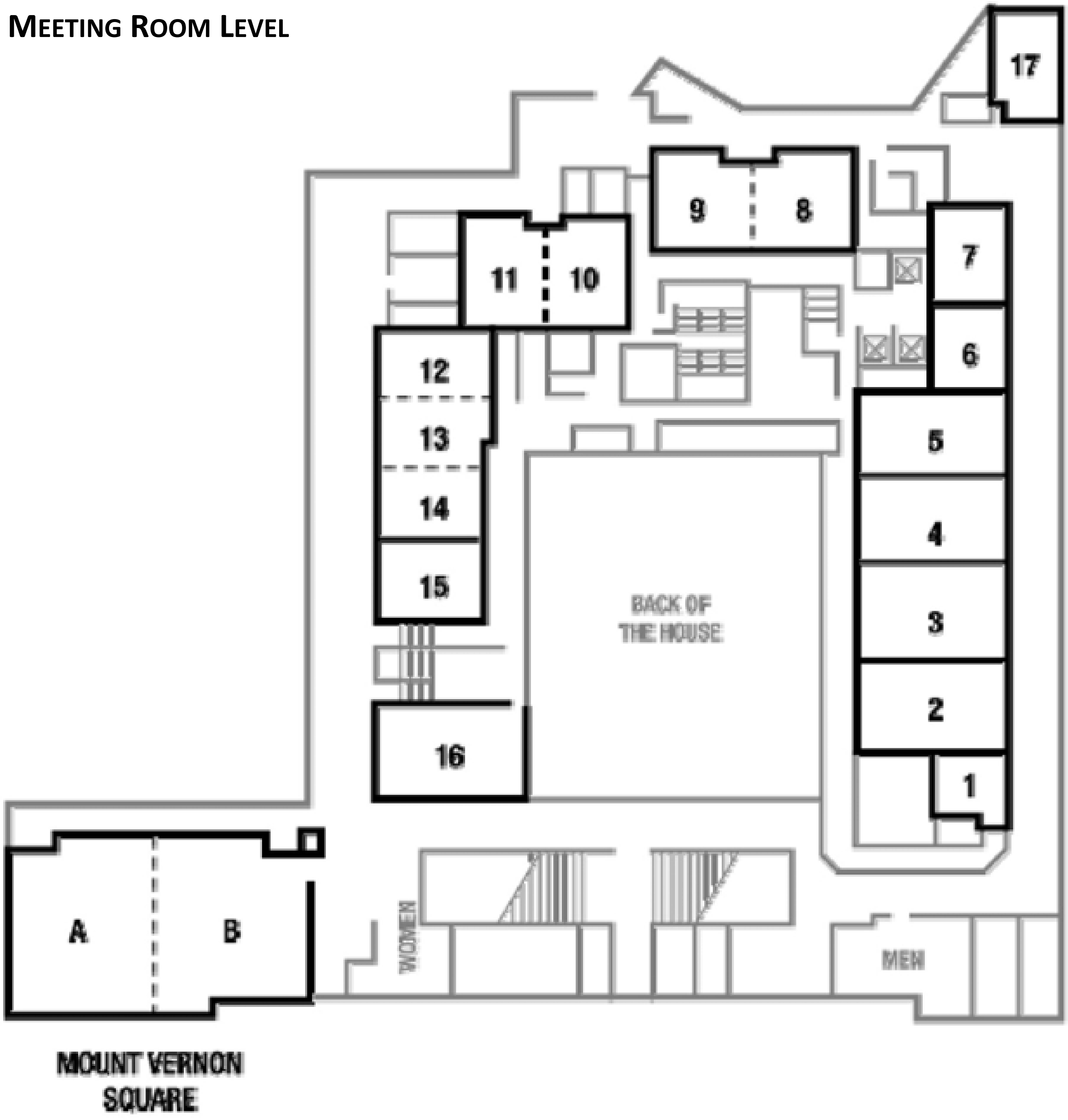
Jonathan Lambright, *Savannah State*
Arlene Maclin, *AAAS Consultant*

BALLROOM LEVEL



Hotel Floor Plans

Meeting Room Level



Thursday, February 20, 2014

3:00pm - 9:00pm **Registration**
Grand Ballroom Foyer

1:00pm - 7:00pm **Exhibitor Setup**
Congressional A&B

3:00pm **ADA Resource Room Opens**
Meeting Room 18

4:00pm - 5:00pm **Exhibitor Orientation**
Congressional A&B

5:00pm - 6:00pm **Judges Orientation**
Congressional C

6:00pm - 8:00pm **Opening Plenary Session 1**
Grand Ballroom

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

Welcome Remarks:
Sylvia M. James, *Division Director, NSF, HRD*

Speaker:
Paula T. Hammond, *David H. Koch Professor in Engineering, Department of Chemical Engineering, Massachusetts Institute of Technology*

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

"How to Get the Most out of the Conference"

8:00pm - 10:00pm **Exhibit Hall Opens/Judges Room Opens**
Congressional A&B/Congressional C

Friday, February 21, 2014

7:00am - 7:00pm **Registration**
Grand Ballroom Foyer

7:00am - 7:45am **Oral and Poster Presentations Session 1 (Set-Up)**
Renaissance Ballroom/Renaissance Foyer
Meeting Rooms - Meeting Room Level

7:00am - 6:30pm **Judges Room Opens**
Congressional C

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

Moderator:
Sylvia M. James*, Division Director, NSF, HRD*

Joan Ferrini-Mundy, *Division Director, NSF, Directorate for Education and Human Resources (EHR)*

Speaker:
Rory Cooper, *Distinguished Professor and FISA-Paralyzed Veterans of America Chair, School of Health and Rehabilitation Science and Technology, University of Pittsburgh*

Closing Announcements:
Yolanda S. George, *Deputy Director, AAAS*

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

10:00am - 12:15pm **Poster Presentations Session 1**
Renaissance Ballroom and Renaissance Foyer

Oral Presentations Session 1
Meeting Rooms - Meeting Room Level

These include:
Cancer and Physiology
Meeting Room 6

Cell and Molecular Biology and Genetics
Meeting Room 7

Chemistry and Chemical Sciences
Meeting Room 8

Computer Sciences and Information Management
Meeting Room 9

Mathematics and Statistics
Meeting Room 10

Nanoscience and Physics
Meeting Room 11

Plant Research/Ecology
Meeting Room 12

Concurrent Workshops Session 1

A. NSF Graduate Research Fellowship Program
Meeting Room 3

Earnestine Psalmonds Easter, *Program Director, NSF EHR*

B. Funding your STEM Education for Undergraduates and Graduates
Meeting Room 4

Liv Detrick, *Institute for Broadening Participation, Inc. (IBP)*

Yolanda Treviño, *Assistant Dean, Indiana University Graduate*

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

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

C. The Exciting World of Physics
Meeting Room 5

Paul Gueye, *President, National Society of Black Physicists*

12:15pm - 1:30pm **Plenary Session 3**
Grand Ballroom

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

Speaker:
Lydia Villa-Komaroff, *Chief Scientific Officer, Cytonome/ST, LLC*

1:30pm - 4:00pm **Exhibit Hall Opens**
Congressional A&B

1:45pm - 4:00pm **Oral and Poster Presentations Session 2 (Set-Up)**
Renaissance Ballroom/Renaissance Foyer
Meeting Rooms - Meeting Room Level

4:00pm - 6:30pm **Poster Presentations Session 2**
Renaissance Ballroom/Renaissance Foyer

Oral Presentations Session 2
Meeting Rooms - Meeting Room Level

These include:
Cancer and Physiology
Meeting Room 6

Cell and Molecular Biology and Genetics
Meeting Room 7

Chemistry and Chemical Sciences
Meeting Room 8

Mathematics and Statistics (Undergraduate and Graduate Students)
Meeting Room 9

Nanoscience and Physics
Meeting Room 10

Plant Research and Ecology
Meeting Room 11

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

A. NSF Graduate Research Fellowship Program
Meeting Room 3

Earnestine Psalmonds Easter, *Program Director, NSF, EHR*

B. Funding your STEM Education for Undergraduates and Graduates
Meeting Room 4

Liv Detrick, *Institute for Broadening Participation, Inc. (IBP)*

Yolanda Treviño, *Assistant Dean, Indiana University Graduate*

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

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

C. Scientific Computation and Visualization: Solutions for World Changing Science
Meeting Room 5

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

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

Paul Delgada, *Research Associate, University of Texas, El Paso*

Bhanu Rekepalli, *Computational Scientist, National Institute for Computational Science*

D. Biomedical Science PhDs and MD-PhDs: Careers and Training
Meeting Room 16

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

Nancy B. Schwartz, *Associate Dean for Postdoctoral Affairs Co-Director, Office of Graduate Affairs, Director of the Kennedy Center, University of Chicago Division of Biological Sciences, The Pritzker School of Medicine*

6:30pm - 8:30pm **Dinner on Your Own**

Saturday, February 22, 2014

7:00 am **Breakfast on Your Own**

7:00am - 2:00pm **Registration**
Grand Ballroom Foyer

7:30am - 5:30pm **Judges Room Opens**
Congressional C

7:30am - 8:00am **Oral and Poster Presentations Session 3 and 4 (Set-Up)**
Renaissance Ballroom/Renaissance Foyer
Meeting Rooms - Meeting Room Level

8:00am - 10:30am **Poster Presentation 3**
Renaisssance Ballroom/Renaissance Foyer

Oral Presentation 3
Meeting Rooms - Meeting Room Level

These include:
Biological Sciences (Graduate Students)
Meeting Room 3

Chemistry and Chemical Sciences (Graduate Students)
Meeting Room 4

Civil/Mechanical/Manufacturing Engineering/Materials Science (Undergraduate Students)
Meeting Room 5

Computer Engineering and Electrical Engineering (Undergraduate Students)
Meeting Room 6

Computer Sciences and Information Management (Graduate Students)
Meeting Room 7

Ecology, Environmental and Earth Sciences (Undergraduate and Graduate Students)
Meeting Room 9

Microbiology/Immunology/Virology (Undergraduates)
Meeting Room 10

Plant Research and Ecology (Undergraduates)
Meeting Room 11

Science and Mathematics Education (Undergraduate and Graduate Students)
Meeting Room 12

Social and Behavior Sciences (Undergraduate Students)
Meeting Room 13

Technology and Engineering (Graduate Students)
Meeting Room 14

9:00am - 1:00pm **Exhibit Hall Opens**
Congressional A&B

11:00am - 12:30pm **Poster Presentations Session 4**
Renaissance Ballroom / Renaissance Ballroom Foyer

Oral Presentations Session 4
Meeting Rooms - Meeting Room Level

These include:
Physics and Nanoscience (Graduate Students)
Meeting Room 7

Social and Behavior Sciences (Undergraduate and Graduate Students)
Meeting Room 9

Concurrent Workshop Session 3

A. Writing Powerful Winning Poster and Presentation Abstracts
Meeting Room 3

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

Beronda Montgomery, *Associate Professor, Biochemistry and Molecular Biology, Michigan State University*

B. Scientific Computation and Visualization: Solutions for World Changing Science
Meeting Room 4

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

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

Paul Delgada, *Research Associate, University of Texas, El Paso*

Bhanu Rekepalli, *Computational Scientist, National Institute for Computational Science*

C. Biomedical Science PhDs and MD-PhDs: Preparing and Applying to PhD, MD-PhD, and Medical School Programs
Meeting Room 5

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

Naomi Rosenberg, *PhD, Dean, Sackler School of Graduate Biomed Sciences Vice Dean for Research, Professor of Molecular Biology and Microbiology Tufts University School of Medicine*

Lauren Siegel, *MCAT^{2015} Outreach Specialist, Association of American Medical Colleges (AAMC)*

Katie Post, *Communications and Program Support Specialist, American Medical College Application Service, AAMC*

D. Career Options with Physics Degrees
Meeting Room 6

Toni Sauncy, *Director, Society of Physics Students and Sigma Pi Sigma*

Kendra Redmond, *Programs Manager, Society of Physics Students and Sigma Pi Sigma*

12:30pm **Exhibit Hall Closes**
Congressional A & B

12:30pm - 2:00pm **Plenary Session 4 (Lunch)**
Grand Ballroom

Panel Discussion:
Faculty and Student International Collaborations in STEM

Moderator:
Yolanda Comedy, *Program Director, AAAS Center for Advancing Science and Engineering Capacity*

Panelists:
Delaram Kahrobaei, *Doctoral Faculty, PhD Program in Computer Science (CUNY Graduate Center) Associate*

	Professor of Mathematics (NYCCT, City University of New York) Director, C-LAC (Center for Logic, Algebra, Computation) Founder of NY Women in Math and CS Network
	Ha T. Lam, *Doctoral Student, CUNY*
	Maria Ngu-Schwemlein, *Professor of Chemistry, Winston-Salem University*
	Kshawna Askew, *University of North Carolina at Greensboro, Graduate Student*
	Cimona V. Hinton, *Assistant Professor, Department of Biological Sciences, Center for Cancer Research and Therapeutic Development, Clark Atlanta University*
	Ayesha Don-Salu-Hewage, *2013 PhD Recipient, Clark Atlanta University*
12:30pm - 3:30pm	**Judges Meeting and Lunch (Determining Awardees)** *Congressional C*
2:00pm - 6:00pm	**Free time for Tours or Special Meetings**
6:00pm - 9:00pm	**Plenary Session 5 and Awards Banquet** *Grand Ballroom*
	Moderator: **Shirley M. Malcom,** *Director, AAAS, EHR*
	Introduction of Speaker: **Mary Harris**, *President and CEO, BioTechnical Communications, Inc.*
	Speaker: **Sidney E. Harris**, *Former Dean and Professor of Information Systems, Management and International Business at the J. Mack Robinson College of Business at Georgia State University*
	Recognition of David and Lucile Packard HBCU Scholars:
	James Stith, *Vice President Emeritus, American Institute of Physics (AIP)*
	Recognition of the AAAS Policy Fellows and SACNAS Leadership Institute Alumni
	Presentation of Oral and Poster Awards:
	Shirley M. Malcom, *AAAS* **Claudia Rankins**, *NSF*
	Presentation of Conference Incentives: ***AAAS ERN Conference Team***
	Closing Remarks: **Shirley M. Malcom**, *AAAS*
10:00pm - Midnight	**Karaoke, Open Mic, and Networking**

Biographies

Rory A. Cooper, *Distinguished Professor and FISA-Paralyzed Veterans of America Chair, School of Health and Rehabilitation Science and Technology, University of Pittsburgh*

Rory A. Cooper received the BS and M.Eng degrees in electrical engineering from California Polytechnic State University, San Luis Obispo in 1985 and 1986, respectively. He received the PhD degree in electrical and computer engineering with a concentration in bioengineering from University of California at Santa Barbara in 1989.

He is the FISA and Paralyzed Veterans of America (PVA) Chair and Distinguished Professor of the Department of Rehabilitation Science and Technology, and professor of Bioengineering, Mechanical Engineering, Physical Medicine and Rehab, and Orthopedic Surgery at the University of Pittsburgh. Cooper is the Founding Director and VA Senior Research Career Scientist of the Human Engineering Research Laboratories, a VA Rehabilitation Research and Development Center of Excellence in partnership with the University of Pittsburgh. He is also the Co-Director of the NSF Quality of Life Technology Engineering Research Center, a joint effort between the University of Pittsburgh and Carnegie Mellon University.

Cooper is the Editor of the AT Research book series of IOS Press and past editor of the journal *Assistive Technology,* and he has authored or co-authored 285 peer-reviewed journal publications. He has over ten patents awarded or pending. Cooper is the author of two books: *Rehabilitation Engineering Applied to Mobility and Manipulation* and *Wheelchair Selection and Configuratio*n, and co-editor of *An Introduction to Rehabilitation Engineering*, *Warrior Transition Leader: Medical Rehabilitation Han*dbook, and the award winning book *Care of the Combat Amputee*.

Cooper is an elected Fellow of the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA), the Institute of Electrical and Electronics Engineers (IEEE), the American Institute of Medical and Biological Engineering (AIMBE), and the Biomedical Engineering Society (BMES). He has been an invited lecturer at many institutions around the world, for example the National Academies of Sciences Distinctive Voices Lecture, and was awarded Honorary Professor at The Hong Kong Polytechnic University and Xi'an Jiatong University. He has also been elected to Eta Kappa Nu, Tau Beta Pi, and Sigma Xi honorary societies. He is a former President of RESNA, and a member of the RESNA/ANSI and ISO Wheelchair Standards Committees, and IEEE-EMBS Medical Device Standards Committee.

In 1988, Cooper was a bronze medalist in the Paralympic Games, Seoul Republic of Korea. He was on the steering committee for the 1996 Paralympic Scientific Congress held in Atlanta, GA, and the Sports Scientist for the 2008 U.S. Paralympic Team in Beijing, China. In 2013, Cooper was awarded the Paralympic Scientific Achievement Award. He has been a member of the U.S. Centers for Medicare and Medicaid Services – Medicare Advisory Committee, U.S. Secretary of Veterans Affairs Prosthetics and Special Disability Programs Advisory Committee, Chair of the National Advisory Board on Medical Rehabilitation Research, National Institute of Child Health and Human Development, U.S. Department of Defense Health Board Subcommittee on Amputation and Orthopedics, and National Academy of Sciences Keck Foundation Initiative on Human Health Span Steering Committee.

Cooper has actively collaborated with the Indian Spinal Injuries Centre on increasing access to quality services and devices for people with disabilities in India and throughout developing countries. He is a U.S. Army veteran with a spinal cord injury and a Director of the Paralyzed Veterans of America Research Foundation. He currently serves as a member of the Board of Directors of Easter Seals, Command Council, Staff Sergeant Donnie D. Dixon Center for Military and Veterans Community Services, Chair of the USAID/WHO Evidence Practice in Wheelchair Service Delivery Committee, and other national committees/boards.

Cooper's highest awards include the American Association for the Advancement of Science Mentor Award, U.S. Army Distinguished Civilian Service Medal, U.S. Department of Veterans Affairs Diversity and Inclusion Excellence Award, Olin E. Teague Award, Paul Magnuson Award, Cliff Crase Award, Pennsylvania Military and Veteran Hall of Fame, Order of Military Medical Merit, Pennsylvania Meritorious Service Medal (1OLC), Chancellor's Award for Public Service, Chapel of Four Chaplains Legion of Honor, Boy Scouts of America Community Cornerstone Award, U.S. Army Outstanding Civilian Service Medal (1OLC), James Peters Award, Maxwell J. Schleifer Award, DaVinci Lifetime Achievement Award, Veteran's Leadership Program Veteran of the Year, RESNA Distinguished Service Award (x2) and a member of the inaugural class of the Spinal Cord Injury Hall of Fame. Cooper was recognized in the Congressional Record of the United States Congress on Monday, July 27, 2009 for his contributions to people with disabilities and personal example.

In 2009, Cooper was featured on a Cheerios® cereal box for his many achievements, and in August 2010, he with one of his robots was the centerfold in Popular Science for his work in robotics to aid people with disabilities and older adults. He also shared his story and provided insights to best-selling author, Mary Ann McFadden, during the writing of her novel The Book Lover. He was selected by the Gen. James Amos, Commandant of the United States Marine Corps as the Guest of Honor for the "Evening Parade" hosted on 3 August 2012 by Michael P. Barrett, the 17th Sergeant Major of the Marine Corp. Further, his students have been the recipients of over 50 national and international awards.

Earnestine Psalmonds Easter, *Program Director in the 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.

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 Under-graduate 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*

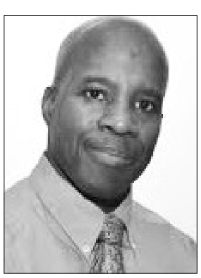
Yolanda Scott George is Deputy Director and Program Director, Education and Human Resources Programs, American Association for the Advancement of

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 B.S. and M.S. from Xavier University of Louisiana and Atlanta University in Georgia, respectively.



Paul Gueye, *President, National Society of Black Physicists*

Paul Gueye is a Physics Professor at Hampton University, Hampton, VA. He obtained his PhD in nuclear physics from the University of Clermont-Ferrand (France) in 1994. He joined the Physics Department at Hampton University in 1995 and participated in the first sets of experiments of the Department of Energy funded Jefferson laboratory (Newport News, VA). Gueye's research group encompasses multi-disciplinary areas such as accelerator physics, nuclear/high energy physics and medical physics. His group is presently building a low energy linear electron accelerator on the campus of Hampton University (the first ever at a Historically Black College).

Gueye is the current President of the National Society of Black Physicists that is co-organizing two sessions during the 2014 ERN Conference on opportunities at national laboratories (with Jefferson Lab and Brookhaven National Lab) and career workshops (with the Society of Physics Students). He is also a member and committee chair in various professional organizations such as the American Institute of Physics, the American Association of Physicists in Medicine, the American Association of Physics Teachers, the American Physical Society, and the International Organization of Medical Physicists, to name a few. He is strongly engaged in minority issues pertaining to science and heavily involved in K-12 STEM education.

Paula T. Hammond, *David H. Koch Professor in Engineering, Department of Chemical Engineering, Massachusetts Institute of Technology*

Paula T. Hammond is the David H. Koch Professor in Engineering at MIT. She received her SB in Chemical Engineering from MIT in 1984 and worked for Motorola in Fort Lauderdale, Florida for two years before pursuing her doctorate. She received her MS from Georgia Tech in 1988 and earned her PhD from MIT in 1993. In 1994, she was awarded the NSF Postdoctoral Fellowship in Chemistry while performing research in the Harvard University Chemistry Department as a member of the Whitesides research group.

In 2000, she was awarded the Junior Bose Faculty Award and the GenCorp Signature University Award. She has also received the NSF Career Award, the EPA Early Career Award, the DuPont Young Faculty Award, and the 3M Innovation Fund Award. Recently, The Harvard Foundation presented Hammond the 2010 Scientist of the Year Award as part of its annual Albert Einstein Science Conference: Advancing Minorities and Women in Science, Engineering, and Mathematics.

In 2013, Hammond received the Charles M.A. Stine Award from the American Institute of Chemical Engineers (AIChE), which is bestowed annually to a leading researcher in recognition of outstanding contributions to the field of materials science and engineering. She also received the 2013 Department of Defense Ovarian Cancer Research Program Teal Innovator Award for visionary research and was inducted into the American Academy of Arts and Sciences.

Her research focuses on nano-based drugs, cancer immunology and creating novel devices for monitoring and detecting cancer. She was one of a group of key faculty members involved in starting the Institute for Soldier Nanotechnologies. In 2010, Hammond made a research agreement with Ferrosan A/S, a Denmark based pharmaceutical company, to develop a nano-bio bandage to stop bleeding on the battlefield.

Hammond has served as a mentor to many graduate and undergraduate students and postdoctoral fellows. She has published nearly 150 scholarly articles pertaining to her research in chemical engineering. She has also encouraged an increase in the presence of minority scientists and engineers at MIT by chairing the Initiative on Faculty, Race and Diversity.

Hammond is married to Carmon Cunningham, and they have one son, James.

The Honorable LaDoris G. Harris, *Director of the Office of Economic Impact and Diversity, U.S. Department of Energy*

LaDoris "Dot" Harris was nominated by President Obama to be the Director of the Office of Economic Impact and Diversity at the United States Department of Energy. She was confirmed by the U.S. Senate on March 29, 2012. Harris brings nearly 30 years of management and leadership experience to this position, having served at some of the world's largest companies and created a successful energy, IT, and healthcare consulting firm.

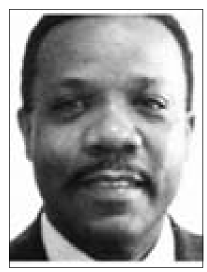
Serving at an Assistant Secretary level position at the Office of Economic Impact and Diversity, Harris leads the Department's efforts to ensure underrepresented communities are afforded an opportunity to fully participate in the agency's programs. Harris oversees partnerships with diverse stakeholders and communities, develops the current and future Departmental workforce, advances small business contracting opportunities and capabilities of minority business enterprises, and protects the civil rights of Departmental employees and recipients of funding from the Department.

Harris brings a wealth of knowledge to this work, having been deeply engaged in the energy sector, small business innovation, and strategic partnerships. Previously, Harris was the President and CEO of Jabo Industries, LLC, a minority woman-owned management consulting firm concentrated in the energy, IT, and healthcare industries.

Harris has also served as an executive at General Electric Company (GE) and held a number of leadership positions in GE's Energy and Industrial Systems businesses. After joining GE in 2000, as the E-Business Leader for Engineering Services, Harris was critical in expanding GE's business operations and energy sector growth. GE tasked her with key operations roles, including responsibility for the North Region power services businesses, responsibility for the Central U.S./Canada's integrated power generation, and, beginning in 2009, oversight over all marketing for GE's industrial businesses as GE's Global Marketing Leader.

Before joining GE, Harris was an officer and Vice President of Operations and Production for ABB Service, Inc. She also spent twelve years as Field Services Engineer and Services Manager with Westinghouse Electric Company.

Harris holds a BS in Electrical Engineering from the University of South Carolina in Columbia, South Carolina and a MS in Technology Management from Southern Polytechnic State University in Marietta, Georgia.



Sidney E. Harris, *Former Dean and Professor of Information Systems, Management and International Business at the J. Mack Robinson College of Business at Georgia State University*

Sidney E. Harris is the former Dean and Professor of Information Systems, Management and International Business at the J. Mack Robinson College of Business at Georgia State University. He is a graduate of Morehouse College and earned his Masters and PhD degrees in Operations Research in the School of Operations Research and Information Engineering at Cornell University.

Harris was named dean of the College of Business at Georgia State University in July 1997. During his tenure (1997-2004) as dean, he reformulated the strategic direction of the College, provided leadership for a fundraising campaign that raised over $27 million (including the college's naming gift) and launched three new research centers. When he stepped down as dean the College was ranked in sixteen different areas by eight different national and international publications, including the *Financial Times*, *BusinessWeek*, *U.S. News & World Report*, and *Forbes.*

His professional career began in the Operations Research Center with AT&T Bell Telephone Laboratories in Holmdel, New Jersey and he moved to Georgia State University in Atlanta, where he became a (tenured) member of the College of Business faculty. In 1987, he joined the faculty of the Peter F. Drucker Graduate School of Management at the Claremont Graduate University as professor of management. He served as dean of the Drucker School (currently the Peter F. Drucker and Masotoshi Ito Graduate School of Management) from 1991-1996. At Drucker, he provided the leadership for a fundraising campaign that resulted in a new home for the school and increased faculty hiring.

Harris' research and teaching focuses on the dilemmas that leaders face during times of uncertainty in confronting reality, adapting to strategic change and leading their firms through "fork in the road" decisions, in which the stakes are high and so are the risks for the leader and the top management team. His research has been published in *Organization Science, Organization Dynamics, ACM Transactions on Information Systems, MIS Quarterly,* and *IEEE Transactions on Knowledge and Data Engineering.*

Harris has lectured internationally at several universities, including Nanyang Technological University in Singapore, Sorbonne University (Paris), Erasmus University (Holland), United Arab Emirates University (U.A.E.), University of British Columbia (Canada), University of Waterloo (Canada), University of West Indies (Trinidad), and the National University of Singapore.

He currently serves as the nonexecutive Chairman of the Board of Directors of the Ridgeworth Funds ($24B mutual fund complex). He also serves on the board of Total System Services (TSYS), an electronic payments processor where he is Chairman of the Technology Committee and member of the Audit Committee and Executive Committee. He has served on the boards of Family Savings Bank, Transamerica Investors, AMERSCO, Lanier Worldwide, Airgate PCS and ServiceMaster, where he was Chairman of the Executive Committee and the lead director. Harris also served on the board of the Multi-Manager TEI Portfolio Fund (hedge fund), where he served as Chair of the Governance and Nominating and on the Audit Committee. Among nonprofits, he is currently the Chairman of the Board of the International University of the Grand-Bassam (Ivory Coast) Foundation and on the board of the St. Jude Recovery Center. He previously served on the boards of the Society of International Business Fellows, Beta Gamma Sigma – The International Honor Society, AACSB International, Georgia Council for Substance and Drug Abuse, Camp Coca-Cola, and the Peter F. Drucker NonProfit Foundation.

Harris is a Fellow of the International Academy of Management (IAM). He enjoys visiting art museums, listening to jazz, traveling, boating, fishing, and college football. He is married to Mary S. Harris, founder and CEO of BioTechnical Communications.

Sylvia M. James, *Director, Division of Human Resource Development, Directorate for Education and Human Resources, NSF*

Sylvia M. James is the Director of the Division of Human Resource Develop-ment (HRD) in the National Science Foundation's (NSF) Directorate for Education and Human Resources (EHR). As Division Director, she oversees a $129 million budget and a talented team of 25 scientific and administrative staff. The mission of HRD, as exemplified by its seven longstanding programs, is to contribute to the creation of "…a well-prepared and competitive workforce of scientists, technicians, engineers, mathematicians, and educators that reflects the diversity of the U.S. population."

During her 13-year tenure at NSF, she served as the Acting Division Director of the Division of Human Resource Develop-ment, Acting Deputy Division Director of the Division of Research on Learning in Formal and Informal Settings (DRL), and Lifelong Learning Cluster Coordinator. As Cluster Coordinator, she managed the Informal Science Education Program (ISE) which has a budget of $64 million dollars, while also providing direction for the Innovative Technology Experiences for Students and Teachers (ITEST) program.

She has served as a program officer for the ISE, ITEST, Faculty Early Career (CAREER), and the Advanced Technological Education (ATE) programs. She has also worked with the Innovation through Institutional Integration (I^3) and Academies for Young Scientists (AYS) programs. James previously served as the Lead Program Officer for ITEST, and its predecessor, the After School Centers for Exploration and New Discovery (ASCEND).

Prior to coming to NSF, she was the Director of Education at the National Aquarium in Baltimore where she was employed for 14 years. While at the National Aquarium, she directed teacher training and youth enrichment projects supported by national funders such as the Howard Hughes Medical Institute, DeWitt Wallace Readers Digest Fund, and the National Science Foundation, as well as an assortment of local foundations. She has served as an education consultant for science education radio, youth publications, and museums. James is the author of seven children's books on marine animals, in addition to science education publications and reports. She is an adjunct science faculty member at Sojourner-Douglass College in Baltimore. She holds a Bachelor of Science degree in Biology from Loyola University, a Master of Science degree from the Johns Hopkins University, and a Doctorate in Science Education from Morgan State University, all located in Baltimore, Maryland.

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.

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. She manages the Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) which provides awards to enhance the quality of undergraduate science, technology, engineering and mathematics (STEM) education and research at HBCUs as a means to broaden participation in the nation's STEM workforce. She also manages the Centers of Research Excellence in Science and Technology program which makes resources available to enhance the research capabilities of minority-serving institutions through the establishment of centers that effectively integrate education and research.

Prior to this post, Rankins served at Hampton University for 22 years in a number of capacities, including endowed university professor, chair of the department of physics, assistant dean for research, and dean of the School of Science. She also directed STEM enrichment and research programs for students ranging from middle school through post baccalaureate studies.

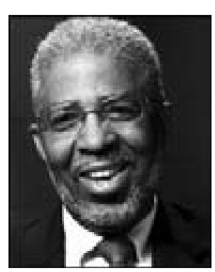
Her formal education includes military training, certification as translator and interpreter for German, French and English, a BS in Mathematics, an MS in Statistics, an MS in Physics, and a PhD in Physics.

Since 1998, Rankins secured over $10 million in external grants that supported pre-college activities as well as undergraduate education and research in STEM. Her current research interests focus on the underrepresentation of women faculty of color in STEM disciplines.

Sohi Rastegar, *Senior Advisor, Director, Office of Emerging Frontiers in Research and Innovation at the US National Science Foundation*

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 *Journal 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.

Lydia Villa-Komaroff, *Chief Scientific Officer, Cytonome/ST, LLC*

Lydia Villa-Komaroff is Chief Scientific Officer and Board member of Cytonome/ST LLC, a company developing and manufacturing cell processing systems. She received her BA from Goucher College and her PhD from MIT. As a postdoctoral fellow in Walter Gilbert's laboratory, she was lead author of a landmark paper reporting the first synthesis of mammalian insulin in bacterial cells.

Villa-Komaroff held research positions at Harvard University, the University of Massachusetts Medical Center, Cold Spring Harbor Laboratories, and Children's Hospital in Boston and published over 75 research articles and reviews. As an administrator she served as Vice President for Research at Northwestern University in Illinois and Vice President for Research and Chief Operating Officer of the Whitehead Institute in Cambridge, MA. She was non-management Chair of the Board of Transkaryotic Therapies, Inc., and CEO of Cytonome, Inc.

Villa-Komaroff has served on committees for the National Science Foundation, the National Institutes of Health, and the National Academies of Science and Engineering. She is a member of the National Academies of Science standing Committee on Women in Science, Engineering and Medicine. She serves on the Boards of the American Tissue Culture Collection and Massachusetts Life Science Center (a Gubernatorial appointment).

Daniel Akins
City College of New York

Linda Akli
Southeastern Universities Research Association

Florence Anoruo
Claflin University

Krishna Athreya
University of Iowa

Gregory Bogin
Colorado School of Mines

Kenneth Boutte
Xavier University of Louisiana

Travis Brown
Pomona College

Anissa Buckner
University of Arkansas at Pine Bluff
C. Marcel BufordNaval Research Laboratory

Reeshemah Burrell
Former AAAS Science and Technology Policy Fellow

Chukwudi Chidume
Auburn University

Carla Cotwright
Delta Decisions of DC

Silvia Crivelli
Lawrence Berkeley National Laboratory

Carol Davis
Tribal Nations Research Group

Agnes Day
Howard University

Anthony DePass
Long Island University

Aleisha Dobbins
BioMarin Pharmaceuticals

Ayesha Don-Salu-Hewage
Clark Atlanta University

Cyntrica Eaton
Norfolk State University

Melanie Eddins-Spencer
Prairie State College

Lisa Elliot
Rochester Institute of Technology

Yayin Fang
Howard University

James Ford
Department of Energy

Knatokie Ford
AAAS Science and Technology Policy Fellow

Yaihara Fortis
AAAS Science and Technology Policy Fellow

Alison Gammie
Princeton University

Mary Garica
AAAS Science and Technology Policy Fellow

Matthew George Jr.
Howard University

Juan Gilbert
Clemson University

Christine Grant
North Carolina State University

Patrice Gregory
Sandia National Laboratories

Paul Gueye
Hampton University

Ahmasi Harris
BAE Systems

Kelley Harris Johnson
University of Wisconsin-Madison

Sanjukta Hota
Fisk University

Duane Jackson
Morehouse College

Marian Johnson-Thompson
University of the District of Columbia

Bob King
Education Consultants

Tina King
Education Consultants

Charla Lambert
Cold Spring Harbor Laboratory

Jonathan Lambright
Savannah State University

Aprillya Lanz
Norfolk State University

Janet Lanza
University of Arkansas at Little Rock

Mulatu Lemma
Savannah State University

Mary Ann Leung
Sustainable Horizons

Kim Lewis
Rensselaer Polytechnic Institute

Kelly Mack
Association of American Colleges and Universities

Arlene Maclin
Morgan State University

Elisa Maldonado
Harvard University

Wayne Martin
Pacific Northwest National Laboratory

Lee Anne Martinez
Colorado State University-Pueblo

Larry Mattix
Norfolk State University

Aliecia McClain
Norfolk State University

Judges

James McGee
Elgin College

Tanisha McGlothen
Emory University

Camille McKayle
University of the Virgin Islands

Sydika McKissic
Vanderbilt University

Bob Megginson
University of Michigan

Juana Mendenhall
Morehouse College

Patrick Mensah
Southern University and A&M College

Lucas Miller
Haskell Indian Nations University

Edgar Moctezuma
University of Maryland, College Park

Loretta Moore
Spelman College

Knashawn Morales
University of Pennsylvania

Alycia Mosley Austin
University of Rhode Island

Patrice Moss
Trinity College

Lycurgus Muldrow
Morehouse College

Syed Muniruzzaman
Xavier University of Louisiana

Debra Murray
Baylor University

Grace Ndip
Virginia State University

Chinonye Nnakwe
University of Chicago

Shantisa Norman
Sandia National Laboratories

Joseph Nunez
Schoolcraft College

Joe Omojola
Southern University at New Orleans

Chiatogu Onyewu
G.O. Global

Robert Osgood
Rochester Institute of Technology

Michael Page
California State Polytechnic University, Pomona

Natarajan Ravi
Spelman University

Karen Redden
University of the District of Columbia

Darkeyah Reuven
Morehouse College

Antoine Rice
University of Arkansas at Pine Bluff

Darshini Roopnarine
Le Moyne College

Sharad Sharma
Bowie State University

Jean Shin
American Sociological Association

Carmen Sidbury
Spelman College

Bernard Singleton
Dillard University

Dan Smith
South Carolina State University

Sonya Snedecor
Pharmerit International

Rosie Sneed
University of the District of Columbia

Xueqing Song
University of the District of Columbia

Hattie Spencer
Mississippi Valley State University

James Stith
American Institute of Physics

Robert Stolz
University of the Virgin Islands

Roy Sutliff
Emory University

LaTonia Taliaferro-Smith
Emory University

Guoqing Tang
North Carolina Agricultural and Technical State University

Hao Tang
City University of New York (BMCC)

Alicia Thomas
Morehouse College

Steven Thomas
Michigan State University

Gregory Triplett
University of Missouri

Delia Valles-Rosales
New Mexico State University

Jessica Venable
Virginia Commonwealth University

Anissa Vines
University of North Carolina at Chapel Hill

Jacquline Vinson
University of Mississippi

Kedra Wallace
University of Mississippi

Edward Walton
California State Polytechnic University, Pomona

Alicia Washington
Howard University

Richard Whittington
Tuskegee University

Damon Williams
Xavier University of Louisiana

Bryan Williams
United States Navy

Joycelyn Wilson
Spelman College

Danyelle Winchester
Howard University

Jim Winter
University of Arkansas at Little Rock

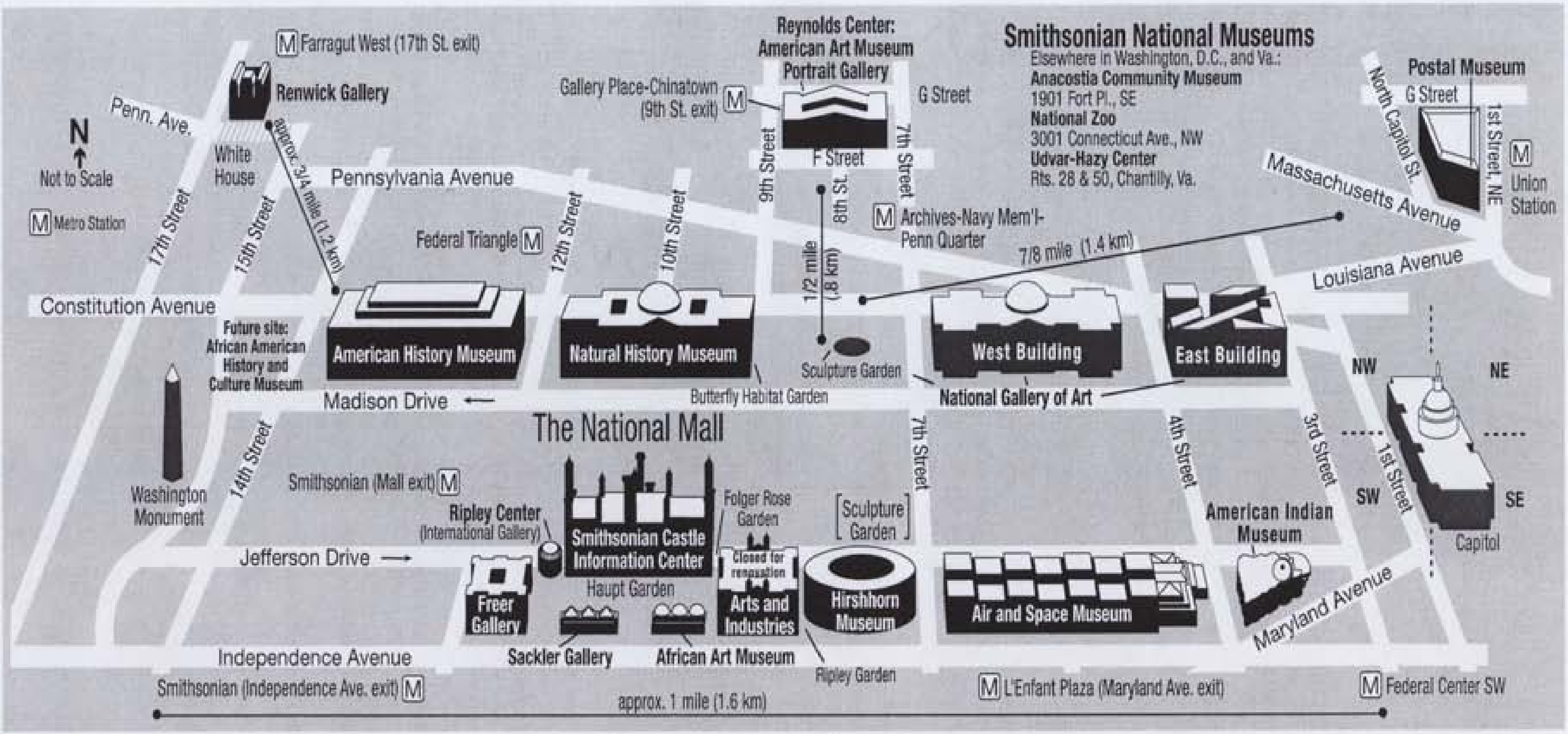
Ronald Woodard
University of Michigan

Victor Wyatt
USDA Agricultural Research Service

Milin Zhang
University of Pennsylvania

Zhigang Zhu
City College of New York

Smithsonian



Produced by: Office of Visitor Services
Smithsonian Information Center (located in the Castle)
1000 Jefferson Drive, SW, Washington, DC
202-633-1000 (voice/tape)
Open daily 8:30 a.m.-5:30 p.m.; closed December 25

Note: Information subject to change without notice.

Rev. 4/2012

Exhibitor Listing

Table	Institution
53	AAAS Center for Careers in Science and Technology
23	Albert Einstein College of Medicine, Biomedical Sciences PhD, MD-PhD, PREP
12	American Society for Microbiology and ABRCMS
44	Auburn University, Office of Diversity and Multicultural Affairs
14	Boston University School of Medicine, Division of Graduate Medical Sciences
47	Brown University Graduate School/The Leadership Alliance
30	Claflin University Biotechnology Graduate Studies
45	Columbia University School of Engineering and Applied Science
19	Cornell University, College of Engineering
3	Delaware State University, School of Graduate Studies and Research
16	Emory University School of Medicine MD/PhD Program
13	Emory University, Laney Graduate School
2	Florida International University Graduate School
32	Institute for Broadening Participation (IBP)
15	Massachusetts Institute of Technology
34	MassNanoTech Institute, University of Massachusetts Amherst
11	Michigan State University
51	Michigan Technological University, Graduate School
10	Mississippi Valley State University
38	National Science Foundation, EAPSI Program
52	National Science Foundation
4	Norfolk State University, Center for Materials Research
6	North Carolina State University
46	Northwestern University, McCormick School of Engineering and Applied Science
25	Ohio State University Graduate School
9	Penn State University, Office of Graduate Educational Equity Programs

Table	Institution
37	Princeton University
24	Rensselaer Polytechnic Institute
7	Rice University
39	Rochester Institute of Technology
18	St. John's University
35	Stanford University
42	Stony Brook University/ Center for Inclusive Education
40	Tufts University Sackler School of Graduate Biomedical Sciences
43	University of California at San Diego, Office of Graduate Studies
22	University of California, Riverside – Bourns College of Engineering
28	University of Chicago
33	University of Delaware
36	University of Illinois Graduate College
50	University of Iowa Graduate College
20	University of Michigan College of Pharmacy Graduate/Professional Programs
31	University of Michigan – College of Literature, Science and the Arts
27	University of Missouri, Graduate Life Sciences Programs
17	University of Nebraska - Lincoln
8	University of Pittsburgh
26	University of South Florida
48	University of the Virgin Islands – Master of Marine & Environmental Science Program
49	University of Wisconsin Madison, College of Engineering
5	University of Wisconsin Medical Physics
21	UT Southwestern Medical Center-Graduate School of Biomedical Sciences
29	Vanderbilt Graduate School, Fisk/Vanderbilt Bridge Program
1	Worcester Polytechnic Institute
41	XSEDE: eXtreme Science and Engineering Discovery Environment

Table 53
AAAS
Center for Careers in Science and Technology
1200 New York Avenue, NW
Washington, DC 20005

Contact: Richard Weibl, *Rweibl@aaas.org*

AAAS offers many resources in support of aspiring and early career scientist and engineers including internships, fellowships, webinars, profiles of professionals in action, blogs and forums, and much more. Learn about Entry Point Internships for Students with Disabilities, Mass Media Science and Engineering Fellowship, the Science and Technology Policy Fellowship, Science Careers, and more!

Table 23
Albert Einstein College of Medicine
Biomedical Sciences PhD, MD-PhD, PREP
1300 Morris Park Avenue
Belfer 203
Bronx, NY 10461

Contact: Victoria Freedman, *victoria.freedman@einstein.yu.edu*

"Research knows no Boundaries" at Einstein. Established in 1957, Einstein has long provided an exciting intellectual environment in which students acquire the knowledge and skills necessary to explore science and attain the PhD and MD/PhD degrees in the biomedical sciences.

Graduate students work with faculty on 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.

Come make great discoveries and meet life-long friends and colleagues within a collegiate community of scientists in the tradition of Einstein! *www.einstein.yu.edu/phd*

Table 12
American Society for Microbiology and ABRCMS
Education Department
1752 N Street, NW
Washington, DC 20036

Contact: Irene Hulede, *ihulede@asmusa.org*
Beronda Montgomery, *montg133@msu.edu*

ABRCMS is a national STEM conference for minority students. Conference draws from 12 scientific discipline, www.abrcms.org. ASM offeres several programs for students and postdoc, *www.asm.org.*

Table 44
Auburn University
Office of Diversity and Multicultural Affairs
103 M White Smith Hall
381 Mell Street
Auburn, AL 36849

Contact: 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 at creating 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 14
Boston University School of Medicine
Division of Graduate Medical Sciences
72 E. Concord Street
L-317
Boston, MA 02118

Contact: Kayleigh Klegraefe, *kay416@bu.edu*
William Cruikshank, *bcruiksh@bu.edu*
Linda Hyman, *lhyman@bu.edu*

The Division of Graduate Medical Sciences at BUSM 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. Our PhD Programs provide 4 options for PhD study. The Program in Biomedical Sciences, also known as 'PiBS', is an interdisciplinary PhD program which integrates the foundations of biomedical research with focused investigation and preparation for career advancement. The department-based PhD programs are Anatomy, Pharmacology and Behavioral Neuroscience in which students focus on a particular scientific disciplines. The third option is a university-wide PhD program in Neuroscience that unites graduate training faculty members from Boston University's 2 campuses. Finally, the MD-PhD program balances both clinical and scientific training to develop exceptional physician scientists.

STaRS@BU: Summer Training as Research Scholars is designed to promote access to graduate education for talented undergraduates from minority groups traditionally underrepresented in the biomedical sciences. During the ten week onsite summer internship, scholars will be mentored in the laboratory by faculty and group of lab members from Graduate Medical Sciences. STaRS offers motivated and academically talented students a valuable opportunity to confirm a strong interest in doctoral studies particularly in the areas of heart, lung and blood research.

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

Contact: Jabbar Bennett, *jabbar_bennett@brown.edu*

Since 1850, graduate education has been an integral part of Brown University and has helped to 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, and by educating and preparing students to discharge the offices of life with usefulness and reputation. With nearly 80 graduate programs we aim to educate and train a very distinguished and diverse cohort of master's and doctoral degree students in preparation for exemplary careers in practice, research and teaching.

The Leadership Alliance is a national consortium of 34 leading teaching and research colleges, universities, and private industry united by a shared vision – to train, to mentor, to inspire, a diverse group of students from a wide range of backgrounds into competitive graduate programs and professional research careers. 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 225 PhDs who as undergraduates participated in its Summer Research-Early-Identification Program.

Table 30
Claflin University Biotechnology Graduate Studies
400 Magnolia Street
Orangeburg, SC 29115

Contact: 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.

Table 45
Columbia University
School of Engineering and Applied Science
500 West 120 Street
Room 254 ET, MC 4708
New York, NY 10027

Contact: 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. For more information, please visit: *www.engineering.columbia.edu.*

Table 19
Cornell University
College of Engineering
146 Olin Hall
Ithaca, NY 14853

Contact: Sara Hernandez, *sh267@cornell.edu*

Founded in 1870, the College of Engineering at Cornell University is the preeminent engineering school in the Ivy League. The college has a long history of excellence in undergraduate and graduate education within the context of a uniquely broad and renowned research-intensive university. Its strengths have developed from cutting edge discovery, a genuine commitment to students, and a sincere desire to contribute to society. Cornell Engineering faculty members are global leaders in the discovery of new knowledge and creation of transforming inventions, the development of innovative interdisciplinary research and programs, and the education of students who will better the future.

Table 3
Delaware State University
School of Graduate Studies and Research
1200 N. Dupont Highway
Dover, DE 19901

Contact: Saundra DeLauder, *sfdelauder@desu.edu*

Delaware State University (DSU) is a public, comprehensive HBCU and 1890 land-grant institution located in Dover, DE. Integral to its mission, DSU provides for its students and the people of Delaware meaningful and relevant educational experiences that emphasize both the liberal and professional aspects of higher education.

Two honors received this year illustrate DSU's focus on academic excellence and community outreach: The Association of Public and Land-Grant Universities named DSU the 1890 Land-Grant Institution of the Year and US News and World Report ranked DSU as the 9th HBCU in the country.

DSU's School of Graduate Studies and Research offers graduate programs in Mathematics, as well as the Natural and Agro-Sciences. Our small graduate student-to-faculty ratio provides opportunities for student engagement not possible in larger settings.

Become a part of our growing graduate community at DSU where we are *Making Our Mark on the World*!

Table 16
Emory University
School of Medicine, MD/PhD Program
100 Woodruff Circle
Suite P375 B
Atlanta, GA 30322

Contact: Maxine Thompson, *mwthomp@emory.edu*

The Emory University MD/PhD program is designed to provide students with the in-depth, high-caliber research training and medical education required of future academicians. Students are enrolled in either the Laney Graduate School (or Georgia Tech) and the School of Medicine during the seven to eight years required to complete the program. The typical sequence is detailed on our website: *www.med/emory.edu/mdphd*. Those choosing non-traditional areas for PhD study may have a different sequence of training.

We recognize that a thriving, interdisciplinary physician-scientist training program is an integral and central component of top academic medical centers; through this combined educational experience, the Emory MD/PhD Program provides the training necessary for students to work at the forefront of a scientific field while concurrently developing outstanding clinical skills.

Table 13
Emory University
Laney Graduate School
201 Dowman Drive
209 Administration Building
Atlanta, GA 30322

Contact: Roy Sutliff, *rsutlif@emory.edu*

Emory University is located only 15 minutes from downtown Atlanta. Atlanta, Georgia is the ninth largest U.S. metropolitan area and is an international city that is home to numerous corporations and organizations. Atlanta is a hub for commercial and cultural contacts.

Emory University is a major research university with schools of Arts and Sciences, Business, Law, Medicine, Nursing, Public Health and Theology. As part of this great university, the Laney Graduate School is committed to graduate education that provides students with deep expertise in their chosen fields, creativity to cross disciplinary boundaries and courage to take on the most important and complex problems of our time.
The Laney Graduate School has more than 40 doctoral and master's programs across the humanities, the social, biomedical, and natural sciences, public health, nursing and business. Our graduate faculty is a diverse group of distinguished researchers and teachers, dedicated to both advancing inquiry and to teaching the next generation of scholars. We also engage in extensive research collaborations with organizations located in Atlanta, including the U.S. Centers for Disease Control and Prevention, the Yerkes National Primate Research Center, and The Carter Center.

Table 2
Florida International University
University Graduate School
11200 SW 8th Street
PC 230
Miami, FL 33199

Contact: Sonja Montas-Hunter, *smontash@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 & Tourism.

Table 32
Institute for Broadening Participation, IBP
PO Box 607
Damariscotta, ME 04543

Contact: Chris Cash, *ccash@ibparticipation.org*
Liv Detrick, *ldetrick@ibparticipation.org*

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. We believe that diversifying the STEM workforce is the best way to ensure our nation's economic vitality and solve global challenges.

Pathways to Science is a project of the Institute for Broadening Participation (IBP). The Pathways to Science website *www.pathwaystoscience.org* supports student 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 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.

Table 15
Massachusetts Institute of Technology
77 Massachusetts Avenue
Cambridge, MA 02139

Contact: Monica Orta, *acstoll@mit.edu*

The Massachusetts Institute of Technology (MIT) consists of six schools: Science, Engineering, Architecture and Planning, Humanities, Arts and Social Sciences, Sloan School of Management and the Whitaker College of Health Sciences and Technology. Increasing the representation of African Americans, Hispanic Americans, Native Americans and other underserved and underrepresented segments of the population in the graduate study of science and engineering is critical to the achievement of MIT's mission. This mission includes providing the intellectual stimulation of a diverse campus community for all of our students and serving the nation by contributing to the creation of a diverse pool of highly qualified scientists, engineers and academics.

Table 34
MassNanoTech Institute
University of Massachusetts Amherst
710 N. Pleasant Street
LGRT 370
Amherst, MA 01003-9305

Contact: Michael Westort, *mwestort@research.umass.edu*

The MassNanoTech Institute is the University of Massachusetts Amherst's campus-wide initiative for nanoscale science and engineering. With over 50 faculty investigators from eight departments in three colleges are working in the field of nanotechnology, the institute has generated over $40 million in research funding since 1997 from a variety of federal and industry sources. We offer a Research Experience of Undergraduates (REU) program in nanotechnology, and provide assistance to those wishing to apply to UMass graduate school or learn more about our graduate research.

Table 11
Michigan State University
Linton Hall
479 W. Circle Drive, Room 110
East Lansing, MI 48824

Contact: Steven Thomas, *deshawn@msu.edu*
Julius Jackson, *jhjacksn@msu.edu*
Tony Nunez, *nunez@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 51
Michigan Technological University
Graduate School
1400 Townsend Drive
Houghton, MI 49931

Contact: Kristi Isaacson, *kris@mtu.edu*

Michigan Technological University is a premier research university of international stature, delivering education, new knowledge, and innovation to meet the needs of our technological world. Our graduates have the skills and knowledge that allow them to create the future and change the world.

We offer 27 PhD programs and 35 master's programs, including the #1 Peace Corps Master's International program in the nation.

Nearly all of today's major challenges are technologically, culturally, and politically complex. At Michigan Tech, students are educated to understand and develop solutions to these challenges. Visit our website at *www.mtu.edu/gradschool* to learn more about our nationally ranked and internationally recognized programs.

Table 10
Mississippi Valley State University
14000 Highway 82 West
MVSU 7308
Itta Bena, MS 38941

Contact: Charles Bland, *bland.charles@gmail.com*

The Bioinformatics Graduate Program is a two year, multi-disciplinary program in molecular biology, computer science and mathematics. Students of the program receive training through a combination of core and advanced courses, workshops, lectures by leading scientists in various areas of bioinformatics, research, and internships, and seminars. Emphasis is placed on providing high quality research experience through close relations with scientist of the program and scientists from partnering institutions and industries.

Table 38
National Science Foundation EAPSI Program
4201 Wilson Blvd, II-1155
Arlington, VA 22230

Contact: Elena Hillenburg, *ehillenb@nsf.gov*
Amelia Greer, *agreer@nsf.gov*

The National Science Foundation (NSF) East Asia and Pacific Summer Institutes (EAPSI) Program provides U.S. graduate students in science and engineering with an opportunity to spend 8 weeks (10 weeks for Japan) during the summer conducting research at one of the seven host locations in East Asia and Pacific: Australia, China, Japan, Korea, New Zealand, Singapore, and Taiwan. The program is open to U.S. citizens and permanent residents enrolled in PhD or Master's degree programs in science or engineering.

Eligible fields of study include any discipline supported by NSF, i.e., Engineering; Computer and Information Science and Engineering; Mathematical and Physical Sciences; Biological Sciences; Geosciences; Social, Behavioral and Economic Sciences; Education (STEM); and Multidisciplinary Research.
NSF provides EAPSI Fellows with a $5,000 stipend and roundtrip airplane ticket to the host location. Foreign counterparts provide in-country living expenses and accommodations (arrangements vary by host location).

The Proposal submission deadline for summer 2015 EAPSI experiences is November 13, 2014.

For more information, please visit *www.nsf.gov/eapsi*.

Table 52
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Contact: Alonso Thelem, *athelem@nsf.gov*

The National Science Foundation (NSF) is an independent federal agency created by Congress in 1950 'to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense'. With an annual budget of about $6.9 billion (FY 2010), we are the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities. In many fields such as mathematics, computer science and the social sciences, NSF is the major source of federal backing.

Table 4
Norfolk State University
Center for Materials Research
700 Park Avenue
Norfolk, VA 23504

Contact: Jennifer West, *jdwest@nsu.edu*

At NSU, the materials science and engineering graduate and research program specializes in the synthesis and characterization of nanomaterials with special properties for photonic, electronic and magnetic applications.
Our research ranges from organic polymer synthesis to bulk crystal growth to nanoscale device fabrication, through molecular modeling. The program is at the cutting edge of science and technology, and at the interface of physics, chemistry, electrical and mechanical engineering and optics. This interdisciplinary facet presents an opportunity for a dynamic exchange between students of different backgrounds who enter the field.

We benefit from collaborations with academic institutions such as Purdue University, Georgia Institute of Technology, University of Virginia and University of Washington. Our students and researchers also actively use the facilities of the nearby Thomas Jefferson National Accelerator Facility and NASA Langley. Some of our students choose to spend the summer at one of our partners' campus. In the M.S. In Materials Science program the students develop analytical and technical skills, and research experience necessary for doctoral programs. Graduates are also ready for technical jobs involving the preparation and characterization of materials with tailored nano-structures and properties.

The MS Program in Materials Science consists of 33 credit hours, which include 6 core courses, three technical electives, one research and one thesis course. All students must write and defend thesis based on their research results as a requirement for graduation. Most students earn the degree in 2-3 years. We also offer the PhD. In Materials Science and Engineering program to prepare students for careers in industry, federal and private research laboratories and academia. Excellent technical and professional training, anchored in strong mentoring, leads to graduates who are confident and well prepared to take positions of leadership in research, teaching and management. The program requires 75 credits, including 45 research credits. All students must write and defend thesis based on their research results as a requirement for graduation. The program is designed for completion within 4-6 years.

Table 6
North Carolina State University
The Graduate School
Campus Box 7102
Raleigh, NC 27695

Contact: David Shafer, *david_shafer@ncsu.edu*

NC State University is a premier center for graduate study, known nationally for innovative degree programs, a world-renowned faculty, and groundbreaking collaborative research. The Graduate School is responsible for administering over 220 different graduate degrees (master's, Ph.D., and Ed.D.) across all 10 of NC State's academic colleges. Currently, more than 9,500 students from all areas of the U.S. and over 100 other countries are pursuing post-baccalaureate study at NC State. Our outstanding graduate programs emphasize real-world experience through original research opportunities, comprehensive extension and engagement activities, and partnerships with governments, industry, and other universities.

Our programs also offer students the advantages of over 2,500 world-renowned faculty, a global academic perspective, and a respect for diversity. In addition, NC State's Centennial Campus and Centennial Biomedical Campus provide a unique venue for university, government, and industry partners interacting in multidisciplinary programs. Together, these strengths create a uniquely hands-on learning environment that encourages our students to explore cutting-edge issues in their areas of study while building the essential inquiry, communication, and leadership skills they will need to succeed.

Table 46
Northwestern University
McCormick School of Engineering and Applied Science
2145 Sheridan Road
L261
Evanston, IL 60208

Contact: Bruce Lindvall, *b-lindvall@northwestern.edu*

The MS 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 10 disciplines, as well as 16 different MS 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.

Our students graduate with more than a degree: they enter their careers as collaborative leaders with the creative and analytical problem-solving skills needed to address the world's most challenging problems.

Table 25
Ohio State University Graduate School
230 N Oval Mall
247 University Hall
Columbus, OH 43210

Contact: Cyndi Freeman, *freeman.414@osu.edu*

Ohio State University is one of the world's best comprehensive, public research universities. We offer 94 doctoral programs and 108 master's programs, and countless opportunities for interdisciplinary work. Ohio State's reputation spans the globe. And that reach is tied to the research done by Ohio State faculty and graduate students. When you earn a graduate degree from Ohio State, you can be assured that your degree will be recognized nationally and internationally.

Table 9
Penn State University
Office of Graduate Educational Equity Programs
111 Kern
University Park, PA 16802

Contact: Stephanie Preston, *sdp163@psu.edu*
Joyce Hopson-King, *juh4@psu.edu*
Derek James, *daj17@psu.edu*

The Office of Graduate Educational Equity Programs leads the Graduate School's efforts to foster diversity and to provide a welcoming climate for both prospective and current graduate students of underrepresented groups. The office designs and implements mentoring programs; recruitment programs; professional development and retention programs; and conferences, seminars, workshops, and lectures. The office also leads the Summer Research Opportunities Program at Penn State and the Ronald E. McNair Post-Baccalaureate Achievement Program. Both programs provide connections with highly talented undergraduate students who are interested in attending graduate school.

Table 37
Princeton University
Department of Molecular Biology
334 Lewis Thomas Lab
Princeton, NJ 08544

Contact: Alison Gammie, *lgallagh@princeton.edu, agammie@princeton.edu*
Gillian Knapp, *gk@astro.princeton.edu*

As a world-renowned research university, Princeton University seeks to achieve the highest levels of distinction in the discovery and transmission of knowledge and understanding. Princeton is an independent, coeducational, nondenominational institution that provides undergraduate and graduate instruction in the humanities, social sciences, natural sciences and engineering. At Princeton University, we believe that the highest levels of research, scholarship, and teaching are obtained only through the combined participation of people with a diversity of viewpoints, backgrounds, and experiences. For this reason, the University welcomes underrepresented and socioeconomically disadvantaged students and faculty and provides an environment that embraces all races, ethnicities, genders, sexual orientations, backgrounds, and physical abilities.

Princeton offers many programs including:
**Summer Undergraduate Research: Molecular, Quantitative & Computational Biology: *http://molbio.princeton.edu/undergraduate/research/summer-research*
**Princeton Summer Undergraduate Research Experience: *www.princeton.edu/gradschool/diversity/prospective_students/summer*
**PRISM and PCCM Materials Science REU: *www.princeton.edu/pccmeducation/undergrad/reu Graduate*
**Programs List: *www.princeton.edu/gradschool/about/catalog/degree*

Table 24
Rensselaer Polytechnic Institute
Office of Graduate Admissions
110 8th Street
Troy, NY 12180

Contact: Tracy Morizio, *morizt@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 from five schools: Engineering, Science, Lally School of Management and Technology, Architecture, and Humanities and Social Sciences. 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. Students also have the opportunity to choose from a number of dual-degree options.

Table 7
Rice University
Duncan Hall, Room 1091
MS, 641
6100 Main Street
Houston, TX 77005

Contact: Theresa Chatman, *tlc@rice.edu*

Rice University is looking for outstanding students to train to become the next generation of leaders. Rice is located in Houston, Texas, the fourth largest city in the U.S. that is also very culturally diverse. If you qualify, we will provide you with amazing educational and research opportunities and pay you for pursuing your doctorate. Rice is consistently ranked among top universities, and our graduate students work on cutting-edge research with outstanding professors, including Nobel Prize laureates. Rice offers extremely attractive financial support to qualified doctoral students. If admitted, you will receive an application fee waiver, full tuition support (a value in excess of $35,000 per year), a stipend to cover your living expenses, and a health insurance supplement. That means you can earn a PhD and get paid for it. If you are interested, contact Theresa Chatman, Director of Graduate Recruitment and Retention Programs at *tlc@rice.edu* or visit the graduate recruitment and retention section at this Website: *diversity.rice.edu*.

Table 39
Rochester Institute of Technology
58 Lomb Memorial Drive
Part-time and Graduate Enrollment
Rochester, NY 14624

Contact: Jody Lehr, *jrlges@rit.edu*

The 3rd largest graduator of STEM majors in the United States, Rochester Institute of Technology is a nationally respected leader in professional and career-oriented education. Talented, ambitious, and creative students of all cultures and back-grounds "and from 50 states and more than 100 countries" have chosen to attend RIT. Few universities provide RIT's depth and breadth of career-oriented studies. RIT offers more than 90 different bachelor's degree programs in art and design, business, engineering, science and mathematics, criminal justice, photography, environmental studies, hospitality and service management, computer science, information technology, bioinformatics, and many other areas. See *www.rit.edu* for the full list of majors!

Table 18
St. John's University
8000 Utopia Parkway
Newman 109
Queens, NY 11439

Contact: Robert Medrano, *medranor@stjohns.edu*

St. John's University, a Catholic university in the Vincentian tradition, offers world class academic programs, taught by internationally recognized faculty, in a high-tech environment. The University offers over 100 career focused graduate degree programs on three residential campuses in the New York City area, a campus in Oakdale NY, and a Graduate Center in Rome, Italy. Classes are offered in convenient locations with flexible delivery options and schedules to meet the needs of adults balancing work and family.

Graduate programs are available in the following areas: St. John's College of Liberal Arts and Sciences, College of Pharmacy and Health Sciences, College of Professional Studies, The Institute of Biotechnology, Rome Campus–MBA and Master of Arts in Government and Politics, Peter J. Tobin College of Business, School of Education. Our programs include Public Health, Public History, Data Mining, Criminal Justice Leadership, Sport Management, International Communication, Toxicology, Speech Language Pathology.

We encourage you to visit our website *www.stjohns.edu* to read about our individual programs and how they can advance your career.

Table 35
Stanford University
Building One, Main Quad
450 Serra Mall
Stanford, CA 94305-2070

Contact: Joseph Brown, *jlbrown@stanford.edu*

Visit Table #35 to learn about Stanford University.

Table 42
Stony Brook University
Center for Inclusive Education
2401 Computer Science Building
Stony Brook, NY 11790-4422

Contacts: Angel Gonzalez, *angel.i.gonzalez@stonybrook.edu*
Amy Marschilok, *amy.marschilok@stonybrook.edu*
Kenneth Takeuchi, *kenneth.takeuchi.1@stonybrook.edu*
Karian Wright, *Karian.Wright@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 the science research. The Center for Inclusive Education, a division of the Graduate School, provides services and support to underrepresented students pursuing graduate education at Stony Brook. The Center is home to multiple externally funded initiatives aimed at increasing the participation of underrepresented students in graduate study: the NSF-sponsored REU in Nanotechnology, the NSF-sponsored AGEP-T FRAME Program, the New York state funded W. Burghardt Turner Fellowship, the GEM Fellowship, the NSF-sponsored LSAMP Bridge to the Doctorate Fellowship and the NIH-sponsored IRACDA NY-CAPS Postdoctoral Fellowship. All these programs share the same goal of pro-moting and integrating the talents of underrepresented students 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 40
Tufts University
Sackler School of Graduate Biomedical Sciences
136 Harrison Avenue
Boston, MA 02111

Contact: Naomi Rosenberg, *Naomi.Rosenberg@tufts.edu*
Kellie Melchin, *kellie.melchin@tufts.edu*

The Sackler School of Graduate Biomedical Sciences at Tufts University is located in the heart of downtown Boston. The School has eight PhD Basic Biomedical Programs: Biochemistry; Cell, Molecular, and Developmental Biology; Cellular and Molecular Physiology; Genetics; Immunology; Molecular Microbiology; Neuroscience and Pharmacology and Experi-mental Therapeutics. In addition, The School offers a Medical Scientist Training Program (MD/PhD), and specialized tracks including the Medically-oriented Research in Graduate Education - Infectious Disease Track (MERGE-ID) and the Mammalian Genetics JAX Track. 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 43
University of California at San Diego
Office of Graduate Studies
9500 Gilman Drive #0003
Student Service Center – 4th Floor
La Jolla, CA 92093

Contact: Veronica Henson-Phillips, *vhensonphillips@ucsd.edu*

UC San Diego's rich academic portfolio includes six undergraduate colleges, five academic divisions and five graduate and professional schools. The university's award-winning scholars are experts at the forefront of their fields with an impressive track record for achieving scientific, medical and technological breakthroughs.

Graduate programs at the University of California, San Diego continue to be highly ranked as noted in America's Best Graduate Schools, 2012 Edition released by U.S. News Media Group, publishers of U.S. News & World Report. Each year, U.S. News ranks professional-school programs in business, education, engineering, law and medicine. Of the 25 UC San Diego doctoral programs evaluated by the National Research Council, 60 percent are among the top 20 programs in their fields nation-wide. The National Research Council ranks UCSD 10th in the nation in the quality of its faculty and graduate programs. The NRC ranks UC San Diego's oceanography and neurosciences programs 1st in the nation. We offer a wide variety of academic and professional fields and we welcome talented prospective students from across the nation and around the world. UCSD graduates have gone on to assume prominent roles in academia, industry, government, and the arts and media in California and beyond.

Table 22
University of California, Riverside
Bourns College of Engineering
Department of Bioengineering
900 University Avenue
217 MS&E Building
Riverside, CA 92521

Contact: Denise Sanders, *denise@engr.ucr.edu*

Established in 1989, the Bourns College of Engineering is one of the newest and fastest-growing engineering schools in California and is ranked among the best public engineering colleges of its size in the nation. The college exemplifies excellence in its graduates, research, and contributions to both fundamental and applied engineering, and has a special mission of catalyzing growth in Inland Southern California. BCOE offers an interdisciplinary major in Materials Science and Engineering, as well as BS, MS, and PhD degrees through five college departments: Bioengineering, Chemical and Environmental Engineering, Computer Science and Engineering, Electrical Engineering, and Mechanical Engineering. The college administers more than one-quarter-million square feet of facilities for research, classroom instruction and administration.

Table 28
University of Chicago
5710 S. Woodlawn Avenue
Room 005
Chicago, IL 60615

Contact: Chinonye Nnakwe, *ccnnakwe@uchicago.edu*
Shay McAllister, *smcallis@bsd.uchicago.edu*
Nancy Schwartz, *n-schwartz@uchicago.edu*

The University of Chicago is one of the world's great intellectual destinations; this is a community of creative, demanding, inspired scholars who debate and collaborate to enrich human life through their work.

Located in the community of Hyde Park on Chicago's South Side, just 15 minutes from the city center, the University of Chicago is uniquely positioned to contribute to, and draw from, the strength and diversity of this world-class metropolis. We have also made an indelible mark on the world at large.

It was at Chicago that REM sleep was discovered and carbon 14 dating was developed. Our scientists laid the mathematical foundations of genetic evolution; executed the first controlled, self-sustaining nuclear chain reaction; conceived the study of black holes; and performed the nation's first living-donor liver transplant. Researchers here have also expanded our understanding of dinosaur evolution; reconstructed the evolution of the early universe in astonishing detail; proved that chromosomal defects can lead to cancer; and pioneered scientific archaeology of the ancient Near East.

The Medical Scientist Training Program was established in 1967 and is one of the longest running physician-scientist training programs in the country. The program is designed for students who seek careers in biomedical research and have a desire to apply both clinical and research expertise to solve the most pressing problems in medical science.

Table 33
University of Delaware
203 Hullihen Hall
Newark, DE 19716

Contact: Keeley Powell, *kpowell@udel.edu*

The Office of Graduate and Professional Education works collaboratively with departments and programs across campus to support a dynamic and enriching educational environment leading to advanced degrees and certificates. While ensuring best practices in graduate education, our Office seeks to recruit, retain and support the professional development of a growing and increasingly diverse graduate student population. In addition to ensuring high standards, our Office actively seeks and secures funding to, among other things, enhance stipends, provide global travel grants for presenting and conducting research, sponsor workshops in grant writing, dissertation preparation and career counseling. We hope you will consider joining the more than 3500 graduate students pursuing degrees from among our 43 doctoral and 115 masters degree programs.

Table 36
University of Illinois
Graduate College
204 Coble Hall
801 South Wright Street
Champaign, IL 61820

Contact: Ave Maria Alvarado, *amalvara@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 intended to support the pursuit of an advanced degree are extended to prospective and current graduate students. Illinois offers graduate degrees in over 130 programs, including those in the biological sciences, natural sciences, physical sciences, engineering, behavioral sciences, social sciences, and in the arts and humanities. The Illinois Professional Science Master's (PSM) offers M.S. degree programs combining science knowledge and business know-how. The programs are full-time, do not require a thesis, and are completed in 16-months – three semesters and one summer term. Numerous interdisciplinary and several joint degree programs, such as the MD/PhD, MBA/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. Ask about the Illinois ASPIRE early visit, early application, and early decision program. Please visit our website at: *http://www.grad.illinois.edu/* and *http://www.grad.illinois.edu/diversity*.

Table 50
University of Iowa
Graduate College
410 Gilmore Hall
Iowa City, IA 52242

Contact: Joseph Henry, *joseph-henry@uiowa.edu*

Located in Iowa City, The University of Iowa is a place that celebrates excellence and diversity, offers choices, and encourages exploration. It is only a 4-5 hour drive from 5 major Midwest cities-Chicago, Kansas City, Minneapolis, Omaha, and St. Louis.

In its 2012 "America's Best Colleges," which examines the overall quality of schools across the country, U.S. News And World Report ranked the UI among the top 30 public national universities. The University of Iowa is home to 11 colleges and enrolled 30, 893 students on a full-time basis for the 2011-2012 academic year. For that year, the Graduate College enrolled 5,617 students across 100 plus programs. Students from under-epresented racial/ethnic groups made up approximately 11.9% of our enrollment.

For more information on our fellowships, tuition scholarships, fee waivers and other opportunities, please contact Joseph Henry at *Joseph-henry@uiowa.edu* or by phone at (319) 335-2138. And be sure to learn about a wealth of other programs and resources at our UI Graduate College website at *www.grad.uiowa.edu*. Thank you for considering graduate education at Iowa!

Table 20
University of Michigan College of Pharmacy
Graduate/Professional Programs
428 Church Street
Ann Arbor, MI 48109

Contact: Cherie Dotson, *crdotson@med.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. Highly motivated students with research interests in these areas are strongly encouraged to apply. Graduate students in good standing receive full financial support (full tuition subsidy, competitive stipend, health insurance and fees).

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. After completion of the four year program, students are eligible for licensure as a pharmacist.

Further information about these programs can be found online at: *http://pharmacy.umich.edu.*

Summer undergraduate research opportunities are available through the NSF Interdisciplinary REU Program in the Structure and Function of Proteins (*http://pharmacy.umich.edu/reu*).

Table 31
University of Michigan
College of Literature, Science and the Arts
500 S. State Street
LSA Bldg, #2212
c/o Paula Trail Hathaway
Ann Arbor, MI 48109-1382

Contact: Bob Megginson, *ptrail@umich.edu*
Naim Edwards, *nkedward@umich.edu*

The College of Literature, Science, and the Arts (LSA) at the University of Michigan is an extraordinary center of creativity, inquiry, and discovery. Over 1,000 faculty – experts in anthropology through zoology – teach courses that explore the world's cultural, social, and scientific big questions. LSA's top research laboratories put faculty and students at the forefront of discoveries in life sciences, physics, and astronomy. 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 LSA.

Table 27
University of Missouri
Graduate Life Sciences Programs
150c Bond Life Sciences Center
1201 Rollins Street
Columbia, MO 65211

Contact: Debbie Allen, *allendebra@missouri.edu*
Brenda Peculis, *peculisb@missouri.edu*

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 30 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. *www.missouri.edu*

Table 17
University of Nebraska - Lincoln
1100 Seaton Hall
P.O. Box 880619
Lincoln, NE 68588-0619

Contact: Justina Clark, *jclark17@unl.edu*

The University of Nebraska-Lincoln is a public, land-grant research institution located in the heart of the Midwest. Nebraska is a leader in many disciplines including the life sciences, mathematics, materials science, psychology, and many others. We offer 58 doctoral degree programs and 68 master's degree programs in the fields of Agriculture and Natural Resources, Architecture, Arts and Sciences, Business, Education and Human Sciences, Engineering, Fine and Performing Arts, Journalism, and Law. At Nebraska, you'll find dedication to serving students and providing quality graduate education. Eighty-percent of Nebraska's full-time degree-seeking students are funded through assistantships and fellowships.

The Nebraska Summer Research Program, a competitive summer program made up of REUs and SROPs, offers undergraduate sophomores and juniors the opportunity to work closely with a faculty mentor, to conduct and present research, and to learn more about graduate school. All programs are focused in the science, technology, engineering, or mathematics fields.

Table 8
University of Pittsburgh
M216E Scaife Hall
3550 Terrace Street
Pittsburgh, PA 15261

Contact: Paula Davis, *pkd100@pitt.edu*
Philippa Carter, *pkc3@pitt.edu*
Maria Milleville, *millvill@pitt.edu*

The University of Pittsburgh (PA), is comprised of 17 undergraduate and graduate schools and colleges located at its urban campus. Adjacent to the flagship medical facilities of its affiliate the University of Pittsburgh Medical Center (UPMC), Pitt appears among the top public universities in both US and international rankings, and has been listed as a 'best value' in higher education by multiple publications. The 5th largest recipient of federally sponsored research funding among US universities, Pitt is a top 10 recipient of NIH funding. Pitt values diversity and welcomes scholars who reflect different cultures, ethnicities, socio-economic backgrounds, abilities, genders, religious affiliations and sexual orientations.

The Kenneth P. Dietrich Graduate School of Arts and Sciences: Faculty, graduate, and undergraduate students are actively engaged in interdisciplinary research efforts in the School and across the university. These partnerships have led to significant developments from nanoscience, neuroscience, to global studies.

The Quality of Life Technology Center: A unique partnership between the U of Pittsburgh and Carnegie Mellon that brings together a cross-disciplinary team to create revolutionary technologies that will improve and sustain the quality of life for all people.

The Office of Health Sciences Diversity: representing the Schools of Medicine, Dental Medicine, Health and Rehabilitation Sciences, Nursing, Pharmacy and Public Health.

Table 26
University of South Florida
College of Engineering
4202 E. Fowler Avenue, ENB 118
Tampa, FL 33620

Contact: Bernard Batson, *bbatson@usf.edu*

The University of South Florida 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, a distinction attained by only 2.2 percent of all universities. The Carnegie Foundation also classifies USF as a community engaged university. It is ranked 44th in total research expenditures and 34th in federal research expenditures for public universities by the National Science Foundation.

Signature research programs include Aging and Alzheimer's disease, Neuroscience, Cancer Biology, Environmental Biotechnology and Sustainability, Alternative Energy Systems, Advanced Materials and Nanotechnology, Bioengineering, Nanocomputing, Pattern Recognition, Information Systems, Cybersecurity, Marine Science, Rehabilitation Engineering and Rehabilitation Sciences.

Graduate funding opportunities are available through assistantships and fellowship programs. Summer undergraduate research positions are available in Applied Physics, Chemistry, and Environmental Science.

Table 48
University of the Virgin Islands
Master of Marine & Environmental Science Program
CSM UVI #2 John Brewer's Bay
St. Thomas, VI 08020

Contact: Sandra Romano, *sromano@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. There are two tracks of study in the MMES program: a science based track for those students who wish to focus on research, and a management based track for those students who wish to focus on resource management issues. 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.

Table 49
University of Wisconsin Madison
College of Engineering
1513 University Avenue, Room 2107
Madison, WI 53706

Contact: Kelly Burton, *kburton@engr.wisc.edu*
Douglass Henderson, *henderson@engr.wisc.edu*

Shannon Roberts, *scroberts@wisc.edu*
Kyana Young, *kryoung@wisc.edu*

The UW-Madison College of Engineering is among the nation's top colleges of engineering consisting of eight degree-granting departments: biomedical, chemical and biological, civil and environmental, electrical and computer, engineering physics, industrial and systems engineering, materials science and engineering, and mechanical. The college academic programs also include several certificates and interdisciplinary degree programs.

The college is home to 44 research centers and 21 research consortia, which collaborate directly with industry and government to identify and solve key engineering challenges. The Department of Engineering Professional Development annually delivers more than 300 continuing education courses in engineering, design, operations, production, maintenance, management and planning to more than 11,000 students. Additionally, it offers a suite of internationally acclaimed professional master's degrees, including six online master's degrees. In 2014, U.S. News and World Report ranked these online graduate programs No. 3 in the country in the categories of teaching practices and student engagement and student services and technologies.

Table 5
University of Wisconsin
Medical Physics
1111 Highland Avenue, L1 1005
WIMR
Madison, WI 53705

Contact: Ronald Wakai, *rtwakai@wisc.edu*

Medical physics is one of the most important and rapidly developing areas of applied physics. It involves the application of physics concept and techniques to the practice of medicine, mainly in the areas of diagnostic imaging and radiation therapy. We are the oldest and largest graduate medical physics program in the US, with faculty working in nearly every area of medical physics. Research assistantships and training fellowships are available on a competitive basis. Women and underrepresented minorities are encouraged to apply. *www.medphysics.wisc.edu*

Table 21
UT Southwestern Medical Center
Graduate School of Biomedical Sciences
5323 Harry Hines Blvd
Dallas, TX 75390

Contact: 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. *www.utsouthwestern.edu/gradschool*

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 29
Vanderbilt Graduate School
Fisk/Vanderbilt Bridge Program
2101 West End Avenue
Kirkland 411
Nashville, TN 37240

Contact: Don Brunson, *don.c.brunson@vanderbilt.edu*
Dina Stroud, *dina.m.stroud@vanderbilt.edu*

The Graduate School is one of the ten colleges and schools of Vanderbilt University. The Graduate School is the pathway and official school of record for Graduate School student applications, admissions, registration and enrollment, monitoring and recording of academic progress and milestones (residency, qualifying examinations, candidacy, defense of dissertation), and the awarding of degrees. The Graduate School also is a source of funding for internal scholarships and fellowships for students with demonstrated exceptional merit or promise, outreach to diverse student populations, and support for career development.

The Graduate School's Enhancing Diversity in Graduate Education Office is charged with providing leadership in the identification, recruitment, and retention of talented PhD students from underrepresented groups. Specifically, this means African-American, Hispanic, and Native American students across all fields, women in the science, technology, engineering, and math fields and some students whose background is classified as being both first-generation and low-income. While most of the work is still done at the college and department level, our job is to coordinate, supplement, and expand what faculty are already contributing to Vanderbilt's goal of recruiting and retaining talented young scholars from underrepresented groups.

Table 1
Worcester Polytechnic Institute
100 Institute Road
Worcester, MA 16090

Contact: Michael McGrade, *mmcgrade@wpi.edu*

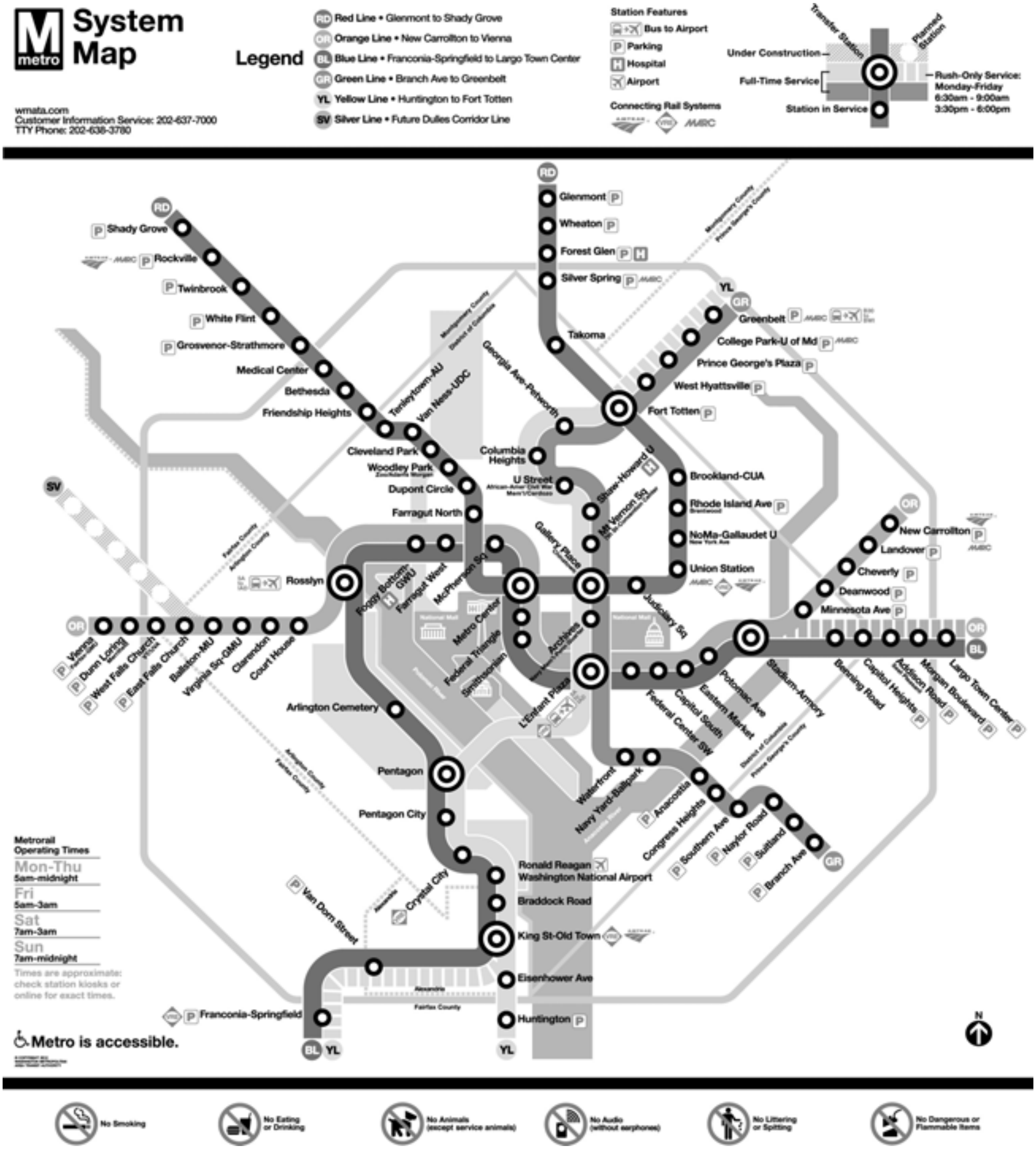
A leader in science, engineering, and business, Worcester Polytechnic Institute anticipated some of the latest trends in higher education by nearly two generations.

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.

Table 41
XSEDE: eXtreme Science and Engineering Discovery Environment
1201 New York Avenue, NW
Suite 430
Washinton, DC 20005

Contact: Linda Akli, *akli@sura.org*

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. An NSF funded project, XSEDE resources and services are open to US academic researchers and their collaborators. The XSEDE training program provides high quality, in-depth training provided by expert computational scientists and staff from among XSEDE service providers. XSEDE student engagement programs include training, internships and fellowships, mentoring, and recognition activities. The XSEDE education program provides professional development support for college and university faculty in the pedagogy of computational science and engineering, use of the technology, tools, and can provide assistance to institutions implementing formal computational science degree and certificate programs. Visit xsede.org to get more information.


metro
System Map
wmata.com
Customer Information Service: 202-637-7000
TTY Phone: 202-638-3780
Legend
RD Red Line • Glenmont to Shady Grove
OR Orange Line • New Carrollton to Vienna
BL Blue Line • Franconia-Springfield to Largo Town Center
GR Green Line • Branch Ave to Greenbelt
YL Yellow Line • Huntington to Fort Totten
SV Silver Line • Future Dulles Corridor Line
Station Features
Bus to Airport
Parking
Hospital
Airport
Connecting Rail Systems
MARC
Transfer Station
Planned Station
Under Construction
Full-Time Service
Station in Service
Rush-Only Service: Monday-Friday 6:30am - 9:00am 3:30pm - 6:00pm
Glenmont
Wheaton
Forest Glen
Silver Spring
Takoma
Shady Grove
Rockville
Twinbrook
White Flint
Grosvenor-Strathmore
Medical Center
Bethesda
Friendship Heights
Tenleytown-AU
Van Ness-UDC
Cleveland Park
Woodley Park
Dupont Circle
Farragut North
Georgia Ave-Petworth
Columbia Heights
U Street
Shaw-Howard U
Mt Vernon Sq
Gallery Place
Greenbelt
College Park-U of Md
Prince George's Plaza
West Hyattsville
Fort Totten
Brookland-CUA
Rhode Island Ave
NoMa-Gallaudet U
Union Station
Judiciary Sq
Montgomery County
District of Columbia
Prince George's County
Fairfax County
Arlington County
Rosslyn
Foggy Bottom-GWU
Farragut West
McPherson Sq
Metro Center
Federal Triangle
Smithsonian
Archives
L'Enfant Plaza
Vienna
Dunn Loring
West Falls Church
East Falls Church
Ballston-MU
Virginia Sq-GMU
Clarendon
Court House
New Carrollton
Landover
Cheverly
Deanwood
Minnesota Ave
Stadium-Armory
Benning Road
Capitol Heights
Addison Road
Morgan Boulevard
Largo Town Center
Potomac Ave
Eastern Market
Capitol South
Federal Center SW
Waterfront
Navy Yard-Ballpark
Anacostia
Congress Heights
Southern Ave
Naylor Road
Suitland
Branch Ave
Arlington Cemetery
Pentagon
Pentagon City
Crystal City
Ronald Reagan Washington National Airport
Braddock Road
King St-Old Town
Eisenhower Ave
Huntington
Van Dorn Street
Franconia-Springfield
Alexandria
Fairfax County
Metrorail Operating Times
Mon-Thu
5am-midnight
Fri
5am-3am
Sat
7am-3am
Sun
7am-midnight
Times are approximate: check station kiosks or online for exact times.
Metro is accessible.
N
No Smoking
No Eating or Drinking
No Animals (except service animals)
No Audio (without earphones)
No Littering or Spitting
No Dangerous or Flammable Items

Undergraduate Abstracts for Oral Presentation

Biological Sciences

OA #1
Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

The Impact of Dietary Jojoba Oil on the Development of Atherosclerosis

Tarek Karam, California State University, Los Angeles
Co-Author(s): Anahis Rincon, Brenda Beltran, and Cesar Cervantes, Cal State LA

Jojoba oil has been shown to maintain high-density lipoprotein (HDL) concentration in hypercholesterolemic New Zealand White (NZW) rabbits, suggesting that jojoba oil regulates HDL metabolism and has a protective effect against atherosclerosis, one of the leading causes of death worldwide. We thus hypothesized that jojoba oil decreases the development of atherosclerosis in NZW rabbits. As a preliminary study, five NZW rabbits were fed either a normal chow diet (N), or a normal diet supplemented with either 3% jojoba seed oil (J), 1% cholesterol (C), or 1% cholesterol + 3% jojoba seed oil (CJ) for 7 weeks; each diet group contained one rabbit, except the C-fed group which contained two. During the study, serum lipoprotein cholesterol concentrations were monitored via enzymatic assays and gel electrophoresis. Liver function was examined via serum albumin measurements. Rabbit aortas were extracted and assessed for the development of atherosclerotic lesions. Results indicated that NZW rabbits responded to the experimental diets as shown in previous studies. N and J-fed rabbits showed no change in their lipoprotein profiles. C- and CJ-fed rabbits had a decrease in HDL concentration; however, the decrease was less in the CJ rabbits than the C rabbits. Serum albumin measurement indicated proper liver function. Unfortunately, none of the rabbits developed atherosclerotic lesions and the effects on dietary jojoba oil on atherosclerosis development could not be assessed in this study. Despite the negative results, this preliminary study allowed us to better understand what must be done in order to study the original question of interest. In future studies, we plan to ensure atherosclerotic lesion development by conducting a dose response study.

Funder Acknowledgement(s): Raymond E. Garcia, Primary PI and Professor of Biochemistry at Cal State Los Angeles; Margaret Jefferson, Professor of Biology at Cal State Los Angeles and LSAMP Director; LSAMP - NSF grant HRD-0802628.

Faculty Advisor: Raymond E. Garcia, rgarcia@exchange.calstatela.edu

OA# 2
Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Use of Gaussian Computer Program to Study Hg+2 Coordination to 2-thiouracil

Andrea C. Moore, North Carolina Agricultural & Technical State University
Co-Author(s): Mufeed Basti, NC A&T State University

Organism intoxication by organic and inorganic mercury has been shown to cause significant effects on its cells including the cell's level of RNA, and the RNA base composition (1). 4-thiolated uridine (S4U) and 2-thiolated uridine (S2U) are two of the naturally-occurring modified nucleosides in the tRNAs of most organisms. Their presence is essential in the functionality of tRNA (2, 3). Studies have shown that Hg+2 coordinates strongly to S4U and S2U where Hg+2 coordinates more strongly to S4U than to S2U (4). Thus, the roles of S4U and S2U in the coordination of Hg+2 to tRNA have significant importance. Other studies have shown that the bases of S4U and S2U (meaning 4TU and 2TU, respectively), whether in the mono-meric or dimeric state, exist in several tautomeric forms. In these tautomeric forms, the monomer or the dimer could be either neutral or negatively charged (the single negative charge is on the sulfur). In this research the computational chemistry of 4TU and 2TU in their neutral, ionic and dimeric forms, and these forms when coordinated to Hg+2, were studied. Using Gaussian software, the total thermal energies for all tautomeric forms of 2TU were calculated in both acetonitrile (ACN) and water media. Results indicate that the thermal energy of 2TU in the dimeric form in water is less than that in ACN suggesting that hydrogen bonding is the likely driving force for dimer formation. The energy of the 2TU/Hg+2 1/1 and 2/1 (ligand/metal) complexes were also studied. The results suggest that the complex when Hg2+ coordinates to an oxygen atom from one ligand and a sulfur atom from another is more favored than the complex when Hg+2 coordinates to two sulfur atoms from the two ligands. The results of this study will guide the future research about other metal complexes.

References: (1) Angelow R.V., Nicholls D. M. (1991) The effect of mercury exposure on liver mRNA translatability and metallothionein in rainbow trout, Comparative Biochemistry and Physiology Part C: Comparative Pharmacology 100 (3) 439-444; (2) Bloomfield, V.A., Crothers, D.M. and Tinoco I. Jr. 2000. In Nucleic Acids Structures, Properties and Functions, pp 103, University Science Books, Sausalito, CA.; (3) Ajitkumar, P., and Cherayil, J. D. (1988) Thionucleoside in Transfer ribonucleic acid: diversity, structure, biosynthesis and function. Microbiological Reviews 52 No. 1, 103-113; (4) Kowalik-Jankowska, T., Varnagy, K., Swiatek-Koztowska, J., Jon, A., Sovago, I., Sochacka, E., Malkiewicz, A., Jan Spychata, J., and Koztowski, H. (1997) Role of sulfur site in metal binding to thiopurine and thiopyrimidine nucleosides J. Inorg. Biochem. 65(4), 257-262.

Funder Acknowledgement(s): This project was supported by NSF-funded Talent-21 Program at NC A&T State University.

Faculty Advisor: Mufeed Basti, Basti@ncat.edu

OA #3
Subcategory: Cancer Research

A Comparative Study of Metal Complexes in Amelioration of Toxic Kidney Injury

Khatiana R. Butler, University of Arkansas at Pine Bluff
Co-Author(s): Nicholas Braman and Alexei G. Basnakian, Department of Pharmacology and Toxicology, University of Arkansas for Medical Sciences
Richard B. Walker and Grant W. Wangila, Department of Chemistry and Physics, University of Arkansas at Pine Bluff

Background and Objective: It has been shown that metals have cytoprotective activity by stimulating antioxidant enzymes and inhibiting apoptotic enzymes. Zinc or copper combined with an antioxidant ligand has even greater cytoprotective effects. Studies show that zinc and copper complexes of amino thiols and salicylates have better cytoprotective activity than either metal or ligand. Both *in vivo* and *in vitro* data collected in this study strongly indicate that these metal complexes satisfy many of the criteria for prevention and treatment of kidney injury, as they are active, stable, and nontoxic antioxidants.

Methods and Results: The study started with synthesis of the new zinc and copper compounds, characterization by elemental analysis and spectrochemical methods, followed by antioxidant activity using ABTS assay (zinc compounds) and NBT assay (copper compounds) and *in vivo* toxicity studies. The compounds with lower IC50 and less toxicity *in vitro* were further studied *in vivo*.

The animal study involved the elaboration of the model to ensure that the used dose of cisplatin induces kidney injury but did not induce animal death. A total of 130 animals were used for these experiments. The mice were euthanized 96 h after cisplatin injection (IP, 20 mg/mg), and blood and kidneys were collected. The compounds were also tested in another model of acute kidney injury, rhabdomyolysis model induced by intramuscular glycerol injection (50% solution, 8 ml/kg). In both models our endpoints included: serum blood urea nitrogen (BUN) and creatinine to measure kidney function, and H&E histology to assess structural injury to the kidney.

Conclusions and Discussion: Zn-RibCys exhibits strong protection in the Rhabdo model, but not in Cisplatin model. Zn-Pen exhibits relatively strong protection in both models. Zn-PTCA may exhibit mild protection in both models. Cu-DIPS appear to be mildly protective in the rhabdo model, but not the Cisplatin model. In an interesting twist, Cu-DBS and Cu-DCS exhibit strong protection in the Cisplatin model, but none whatsoever in the rhabdo model. These metal complexes may be useful agents in preventing kidney toxicity and eventually can be used for nephroprotection during skeletal muscle trauma leading to rhabdomyolysis.

Funder Acknowledgement(s): The Arkansas INBRE (IDeA Networks of Biomedical Research Excellence) grant from the National Institutes of Health National Institute of General Medical Sciences, Grant Number P20 GM103429.

Faculty Advisor: Grant Wangila, wangilag@uapb.edu

OA #4
Subcategory: Cancer Research

Drug Screening for Heterochromatin Promoting Drugs in D. Melanogaster

Alex Chavez, University of California, San Diego

Dysregulation of the JAK-STAT signaling pathway is associated with the development of various forms of cancer in humans. Analogous studies in the genetic model organism Drosophila melanogaster have shown JAK-STAT to globally modulate heterochromatin stability. Elaboratively, increased heterochromatin formation is correlated by preliminary studies with the silencing of oncogene-regulated promoters and the suppression of tumorigenesis. Inversely, due to overactivation of the pathway, decreased heterochromatization has been observed as being a causal agent for the advancement of cancer. In this study, drug sets provided by the Developmental Therapeutics Program of the National Cancer Institute were screened in order to identify compounds with the ability to promote heterochromatin and potentially serve as anti-cancer therapies. Changes in heterochromatin following administration were verified through position-effect-variegation. Within the Approved Oncology Set III, one of several available drug sets, seven prospective heterochromatin promoting compounds were isolated.

Funder Acknowledgement(s): UCSD MARC Scholars Program (funded by NIH)

Faculty Advisor: Willis X. Li, willisli@ucsd.edu

OA #5
Subcategory: Cancer Research

Hibiscus Sabdariffa: Therapeutic Uses for Treating Pulmonary Hypertension

John J. Glenn Jr., Tuskegee University
Co-Author(s): Chastity Bradford, Tuskegee University

Pulmonary hypertension (PH) is a devastating disease that leads to progressive right heart failure and death. Despite limited success with current therapeutic approaches, PH remains a fatal disease. It has been proposed that risk factors coupled with predisposing genetic factors lead to imbalance between vasoconstrictive and vasodilator mechanisms, initiating a cascade of pathophysiological events in the lung leading to PH. This vasoconstrictor/vasodilator imbalance has made vasodilator therapy the main treatment for PH. Angiotensin II, a key component of the renin-angiotensin system, is abundant in pulmonary endothelial cells. ACE2, a key endothelial cell enzyme, produces Angiotensin. When enhanced, it attenuates the proliferative and fibrotic effects of Ang II. A balance between ANGII/(ACE) and Ang 1-7/ACE2 is critical in maintaining normal pulmonary vascular homeostasis. Strategies to enhance ACE2 and Ang 1-7 have proven to be effective targets in animal models of PH (1,2). The dried calyxes of Hibiscus sabdariffa Linn (HS) have demonstrated antihypertensive properties in models of dydtemic hypertension (3). Yet the effects of HS on Ang 1-7 expression in pulmonary vascular endothelial cells, whose dysfunction appears to be the key in the initiation of PH, have never been investigated. Therefore, in collaboration with Auburn University and the University of Florida we have harvested two cultivars of HS adapted to local conditions, prepared extracts, and treating human pulmonary micro vascular endothelial cells (PMEC). We hypothesize that HS enhances ACE2 and Ang (1-7) and decreases ANGII in PMECs. Utilizing our resources and expertise in organic and biochemistry, the results of this study has determined the role of HS as a potential therapeutic alternative for PH.

Funder Acknowledgement(s): The Herb Society of America.

Faculty Advisor: Chastity Bradford, cbradford@mytu.tuskegee.edu

OA #6

Subcategory: Cancer Research

Coordinated Changes on Relative Genetic Expression of Potential Cancer Biomarkers

Nicole J. Ortiz, University of Puerto Rico at Mayagüez
Co-Author(s): Yazeli Cruz, Enery Lorenzo, Jesús A. Rodríguez, Clara E. Isaza, and Mauricio Cabrera-Ríos, University of Puerto Rico, Mayagüez

Making sense of the large amounts of data from microarray experiments can be approached in many ways. Our group, for example, has successfully used multiple criteria optimization to detect potential genetic cancer biomarkers. The genes resulting from said analysis, however, must be further related to each other to elicit their joint effect as cancer occurs. This means that the genetic signaling path must be uncovered. Strictly numerically speaking, there exists a prohibitively large number of paths among a number of genes even at a low number of genes. For example, for 10 genes, there are 10! - 3,628,800 possible paths. In this work, the search for the most correlated path is carried out using a very popular integer optimization formulation known as the Travelling Salesman Problem (TSP). For a set of potential cancer biomarkers identified previously through multiple criteria optimization, a correlation coefficient is used to link every pair of genes. This information is used to create a mathematical graph, where genes are nodes and the absolute value of the correlation coefficient is applied to each directed arc. A branch-and-bound approach is used to find the optimal path, that is, the most correlated one. The idea has been shown feasible in our preliminary work using a cervix cancer microarray database, setting the stage for biological validation. If biological structure and function follows, then a powerful discovery methodology is at hand.

Funder Acknowledgement(s): This work was possible thanks to NIH MARC Assisting Bioinformatics Efforts at Minority Schools Project 2T36GM008789 and to NSF Award HRD 0833112.

Faculty Advisor: Mauricio Cabrera, mauricio.cabrera1@upr.edu

OA #7

Subcategory: Cancer Research

Role of Folate Receptors and Glucocorticoids in the Human Prostate Cancer

Jacquelle Tircuit, Southern University at New Orleans
Co-Author(s): Bashir M. Rezk, Southern University New Orleans, Department of Biology
Zakaria Y. Abd Elmageed and Asim B. Abdel Mageed, Tulane University School of Medicine, Department of Urology

Prostate cancer (CaP) is the most prevalent non-skin and least understood of all human malignancies in males in the world. In the United States it is estimated that 192,280 men were newly diagnosed with CaP and 27,360 died from the disease in 2009. There is a significant controversy about the role of treatment for prosate cancer patients. Practice guidelines recommend that these patients can be surgically operated on and treated with radiation, based on their tumor characteristics, prostate-specific antigen level, age, comorbidities, and preferences. Another potential treatment modality is androgen deprivation therapy (ADT) as monotherapy for localized prostate cancer. Although ADT has a well-defined role in patients with metastatic disease or with high-risk localized disease undergoing radiotherapy, its role as monotherapy in patients with localized disease has not been established in clinical trials and its use is not uncommon. Although, the adjuvant glucocorticoids therapy such as dexamethasone is provided to hormone-refractory prostate cancer (HRPC) patients and to ameliorate the pain cancer therapy, the recurrence of prostate cancer is high. The aim of this study is to investigate the correlation between gluco-corticoids and folate receptors.

Materials and Methods: The research project involved the use of the human prostate cancer cells from the cell line C4-2B and from the cell line PC3. The human prostate cancer cells from cell line C4-2B and from cell line PC3 were spilt, counted, treated, and cell viability was determined by WST-8 assay. The cell lines C4-2B and PC3 were treated with three different drugs and combinations of the drugs Dexamethasone, Folic Acid and Methotrexate. Treatment of prostate cells with dexamethasone or folic acid elevates the cell proliferation rates. However, co-treatment of both dexamethasone and folic acid reduced the proliferation rate of cancer cells. Furthermore, methotrexate induced apoptosis to cancer cells. Dexamethasone may be implicated in the enhancement of recurrence of prostate cancer in low folate levels, where dexamethasone may interact with folate receptors and enhance the proliferations of prostate cancer cells. Co-treatment with folate and dexamethasone reduced the prostate cancer cell proliferations which should be considered in the treatment protocol for prostate cancer patients. Methotrexate can be used as a chemotherapeutic agent for treatment of prostate cancer.

Funder Acknowledgement(s): Bashir M. Rezk, Southern University New Orleans, Department of Biology; Zakaria Y. Abd Elmageed and Asim B. Abdel Mageed, Tulane University School of Medicine, Department of Urology

Faculty Advisor: Bashir Atteia, bashir.rezk@gmail.com

OA #8
Subcategory: Cancer Research

Acinus Formation and Protein Expression by MCF10A Cells in 3D Matrices

Freda Yin, Clemson University
Co-Author(s): Jordon Gilmore, Erin McCave, Timothy C. Burg, and Karen J.L. Burg, Clemson University
Michelle M. Coleman, Stephen L. Rego, and Didier Dréauand, University of North Carolina at Charlotte

Development of breast cancer is dependent upon complex interactions between breast epithelial cells and the microenvironment. The composition and density of the extracellular matrix (ECM) have been shown to impact cell differentiation and aggressiveness *in vivo*. *In vitro* 3D culture systems have been used to investigate the influence of the ECM composition and density on breast cell differentiation. Previously, we demonstrated that culture of MCF10A cells in a 3D Matrigel and collagen combination lead to the formation of acini and duct-like structures. Furthermore, the density of the ECM lead to significant modifications of the acini and ducts formed. To improve our 3D breast tissue system and account for the heterogeneous densities observed within the breast tissue, we investigated the effects of embedding denser beads or fibers in the ECM on MCF10A formation of acini as well as specific remodeling-related protein expression. MCF10A breast epithelial cells were grown in 3D ECM cultures for up to 14 days. The modifications associated with embedding polylactide beads or fibers in different configurations and concentrations on the formation of polarized 3D structures and cell apoptosis were assessed by immunohistochemistry. Furthermore, the remodeling of the ECM was determined by measuring the fibrillar to globular collagen ratio. MCF10A cell expression of extracellular matrix proteins was also investigated. Differences between ECM and ECM embedded with beads or fibers were tested by Analysis of Variance and post-hoc tests. Preliminary observations suggest that (1) polylactide beads reduced the ECM stiffness and that (2) polylactide fibers increased the ECM stiffness. The analyses of the formation of polarized structures and of the expression of extracellular matrix proteins by MCF10A cells are presented. These observations will further refine the 3D *in vitro* breast tissue systems and are an essential step to develop a reliable tool to evaluate early breast cancer progression and specific therapies.

Funder Acknowledgement(s): This work was supported in part by a grant from the National Science Foundation EFRI program (CBE0736007).

Faculty Advisor: Karen Burg, kburg@clemson.edu

OA #9
Subcategory: Cell and Molecular Biology

Activin A-Nodal Signaling in Mouse Embryonic Stem Cells

Christopher Benson II, University of Georgia
Co-Author(s): Jonathan Eggenschwiler, University of Georgia

When the vertebrate forms, the cells that make up the various organs and tissues are very important during all phases of fetal development to ensure survival. Referred to as pluripotent, Mammalian Embryonic Stem Cells (ESC) are important because they can proliferate into the three primary germ levels—endoderm, mesoderm, and ectoderm. Within these three germ levels, these cells in each level perform a certain function in the vertebrate. We want to understand the pathway that signals the unified cells to split into the three germ levels and if it occurs in multiple phases or only one phase of the cell cycle. Nodal is the protein that is responsible for the patterning of the nervous system and separating them into their dorsal and ventral regions. In order to activate this pathway, Nodal proteins must bind to the Activin/Activin Receptors. This interaction leads to the induction of the target cells needed to complete the pattering process. We are using Mouse ESC to see if they respond to Chemically Defined Medium (CDM) plus Activin A in concentrations of 20ng/ml, 2ng/ml, and no Activin A. When

CDM and Activin A are combined, this supports the dorsoanterior-like mesoderm formation in the stems cells. Using Polymerase Chain Reaction (PCR), we tested the response of Lefty1, Lefty2, and Pitx2 (proteins that determine left/right asymmetry) with the extracted RNA from the Activin A induced stems cells. The results from our experiment showed that the Activin-Nodal signaling was not present in most of the proteins and Activin A concentrations we tested. In the Electrophoresis Gel, some of the RNA produced the appropriate bands while some did not. We concluded that our ESC may have been in the CDM plus Activin A too long as the cells were incubated in the medium for 48 hours. Also, other experimental errors such as not collecting enough RNA could have been another reason why we saw those results in our experiment. Currently, we are retesting the stem cells by not incubating the cells in CDM plus Activin A with a concentration of 2ng/ml. Therefore, we will only be using CDM plus Activin A with a concentration of 20ng/ml and CDM without Activin A. Also, we decided to only incubate the stem cells for 24 hours in CDM. We are expecting to see better results by eliminating the extra day of incubation and focusing on the two extremes of Activin A concentrations in the CDM.

Funder Acknowledgement(s): This project was supported, in part, by a grant from the Peach State LSAMP Alliance to Jonathan Eggenschwiler, Department of Genetics, University of Georgia.

Faculty Advisor: Jonathan Eggencschwiler, jeggensc@uga.edu

OA #10
Subcategory: Cell and Molecular Biology

The First Analysis of the Electroretinogram in *Gromphadorhina portentosa*

Wil Bogue, Northeastern Illinois University
Co-Author(s): Andrew Urdiales, Edgar Mantes, Frederick Prete, and Aaron Schirmer, Northeastern Illinois University

The electroretinogram (ERG) is a sub-corneal, extracellular recording reflecting the summed electrical responses of the compound eye photoreceptors in response to square wave light pulses. Previous studies using several species of cockroach have shown the ERG to be a robust technique by means of which to analyze changes in photoreceptor under various experimental conditions. Currently, no data has been published on the ERG of the apterous cockroach, *Gromphadorhina portentosa.* Our current research provides a novel source of data by means of which to elucidate the possible phylogenetic variability of this taxon's visual system**.** ERG responses were elicited by an LED diode (λ 458 nm) and recorded with stainless steel wire electrodes. The data revealed that *G. portentosa's* ERG consists of three distinct components: an ON potential (with transient and sustained components) elicited by stimulus onset, and a sustained OFF potential elicited by stimulus offset. The ON potential represents photoreceptor depolarization due to phototransduction induced opening of (Na^+ and possibly Ca^{++}) cation channels. These channels appears to be similar to the transient receptor potential-like channels (TRPL) seen in other cockroach species and in certain fly mutants. The OFF potential represents photoreceptor hyperpolarization caused by voltage gated, outward K^+ currents. The latter is characteristic of depolarizing photoreceptors. Increasing stimulus duration from 100-6500 ms caused exponential decreases in both the repolarization rate of the ON potential, and the latency to the maximum amplitude of the OFF potential. That is, sustained illumination slowed but did not eliminate photoreceptor rectification, and it increased the rate at which photoreceptor hyperpolarization reached its maximum. Further, under increasing ambient light (1-1200 *lux*), sensitivity (V/logI) curves flattened; that is, the ability of photoreceptors to respond to luminance changes diminished as the photoreceptors became more saturated. Further, ERGs recorded at 15 minute intervals over 72 hours in constant dark conditions showed rhythmic oscillatory changes in the ON and OFF potentials reflecting increased sensitivity during the subjective night and decreased sensitivity during the subjective day. These changes may be due to circadian modulation of potassium channels as is the case in some other arthropods. Our data suggest evolutionary adaptations in the visual system of *G. portentosa* that make it well suited to life in its dimly lit ecological niche. Future work is aimed at discovering the molecular bases of the acute changes in the ERG in response to luminance fluctuations, and the mechanisms by which it is modulated by circadian rhythms.

Funder Acknowledgement(s): This study was supported by the Title III HSI-STEM Biomedical Environmental Science grant. Additional support came from the Northeastern Illinois University Department of Biology.

Faculty Advisor: Frederick Prete, fprete@neiu.edu

OA #11
Subcategory: Cell and Molecular Biology

Development of Methods for Characterization of *S. Dimorphus* Pale Mutants

Mohamed Dumbuya, University of the District of Columbia
Co-Author(s): Foina Nohilly, Sophie Wehrkamp-Richter, and Steven P. Briggs, University of California, San Diego

Scenedesmus dimorphus are freshwater unicellular green algae. They are autotrophs, photosynthetic and sensitive to primitive fungi called chytrid. *S. dimorphus* algae are important because they can be used for biofuel production due to their high lipid content and they grow faster. We hypothesized that by mutation we can insert a vector and develop an insertion mutant library screen. This is done so that we can acquire

mutants that will be more resistant to the fungus than that of the wild type. We also observed that some of the mutants appear to be pale green in color. Twenty-two of these pale mutants were selected and inoculated in an algae media. Furthermore, we hypothesized that the vector inserted can serve as a guide to identify the flanking DNA sequence of the algae's genome and the effects of the mutation. Genomic DNA was extracted from nine of the mutant algae followed by agarose gel electrophoresis. An ongoing TAIL-PCR was conducted to identify the location of the vector and amplify the genome of the mutant algae, and then a quantitative polymerase chain reaction (qPCR) and plaquing were conducted to determine the quantity and effectiveness of the fungal DNA in our infection sample. Results from the DNA extraction process indicate that our bands have a high molecular weight thus proving that the process was successful. Data collected for qPCR and plaquing indicate that we have a good and effective infection source for our pale mutants. Data for TAIL-PCR and mutant infection are still been collected and analysis will be done at a future time.

Funder Acknowledgement(s): My research was supported by grants from: NSF/HBCU-UP-HRD-0928444, NIH/NCI-5R25CA129035 and MARC-NIH/NIGMS-1T34GM087172-01A1.

Faculty Advisor: Carolyn Cousin, Freddie Dixon, fdixon@udc.edu

OA #12

Subcategory: Cell and Molecular Biology

Identification of Cell Fate Determinants Through Single Cell Profiling

Diane Fru, Iowa State University
Co-Author(s): Jeff Trimarchi and Jillian Goetz, Iowa State University

Purpose: Previous attempts to decipher the combinations of genes that control the development of retinal ganglion cells, the output neurons of the retina, sampled the genes expressed in the entire retina. However, retinal ganglion cells comprise an exceedingly small proportion of the total tissue (~2%) and are a very diverse cell population (at least 20 distinct types). Therefore, these whole-tissue approaches only uncover the most highly expressed genes and fail to reveal the dynamic gene networks that drive the differentiation and maturation of retinal ganglion cells.

Methods: Our lab employs single-cell transcriptomic profiling techniques to discern the combinations of factors involved in the cell fate decision process and early maturation of retinal ganglion cells. Briefly, we compare the data from mouse cells to those isolated from the zebrafish. By using these comparisons, we expect to identify the most conserved gene networks to be used in future functional studies.

Results: Our experiments have revealed insights into retinal ganglion cell fate acquisition and identified many marker genes for newborn ganglion cells. We have validated the expression of these genes using *in situ* hybridizations in the zebrafish retina. Our previous data was acquired using microarrays and we are currently performing additional experiments using next-generation sequencing. Discussion: Analyses of the single cell transcriptomes from developing retinal cells have revealed conserved expression networks that we predict are operating in developing retinal ganglion cells. Once we assemble our complete gene networks, we will employ loss of function experiments in zebrafish to examine the retina phenotypes associated with these genes.

Funder Acknowledgement(s): This research is funded by Iowa State University and its Center for Integrated Animal Genomics.

Faculty Advisor: Jeff Trimarchi, jtrimarchi@iastate.edu

OA #13

Subcategory: Cell and Molecular Biology

Parkin Moderates Hypertrophy and Heart Failure Following Cardiac Overload

Eileen R. Gonzalez, University of California, Los Angeles/ University of California, San Diego
Co-Author(s): Dieter A. Kubli, Nicole H. Purcell, and Äsa B. Gustafsson, University of California, San Diego

The E3 ubiquitin ligase Parkin has been identified as an important regulator of mitochondrial autophagy (mitophagy) by selectively marking damaged mitochondria for removal. We previously found that Parkin plays an important role in clearing dysfunctional mitochondria after myocardial infarction (MI), and mice deficient in Parkin (Parkin-/-) have increased injury and mortality after MI. However, it is currently unknown if Parkin also plays a role in adapting to hemodynamic stress. Here, we investigated the functional importance of Parkin in pathological cardiac hypertrophy. Wild type (WT), Parkin-/-, and cardiac-specific Parkin transgenic (Parkin-TG) mice were subjected to trans-aortic constriction (TAC). Compared to WT mice, Parkin-/- mice failed to develop cardiac hypertrophy in response to TAC. While WT mice showed increased heart weight/tibia length, myocyte size, and up regulation of hypertrophy markers ANF, skeletal muscle actin, and b-myosin heavy chain (MHC-b) two weeks post-TAC; Parkin-/- mice did not. Parkin-/- hearts did have a blunted hypertrophic response, but cardiac function was still preserved. In contrast, Parkin-TG mice had an exacerbated hypertrophy response compared to WT mice. Parkin-TG mice had increased expression of MHC-b, significantly lower %FS (14.3% $\pm$ 2.7% for Parkin-TG vs. 23.1% $\pm$ 2.6% for WT) and %EF

(30.2% ± 5.5% for Parkin-TG vs. 46.7% ± 4.5% for WT) than WT, and had developed pulmonary edema at this time, indicative of accelerated progression to heart failure. These data suggest that over expression of Parkin may lead to excessive clearance of mitochondria via mitophagy and increased susceptibility to heart failure in response to hemodynamic stress. However, lack of Parkin results in a failure to activate hypertrophy in response to hemodynamic stress, suggesting that Parkin plays a critical role in the hypertrophy response. This study also demonstrates that the functional role of Parkin differs depending on the stress stimulus; Parkin may have a novel role in regulating hypertrophy via pathways distinct from its canonical role in mitophagy.

Funder Acknowledgement(s): This study was supported, in part, by a grant provided by CSU-LSAMP from NSF HRD-1302873 and Office of the Chancellor.

Faculty Advisor: Äsa B. Gustafsson, asag@ucsd.edu

OA #14
Subcategory: Cell and Molecular Biology

Species Delimitation Using DNA Barcoding of *Cochliopodium* Species

Samantha D. Kelly, Spelman College
Co-Author(s): Yonas I. Tekle, Spelman College

The genus *Cochliopodium* consists of a group of microbes that are discoid in shape and contain a granular region with flexible dorsal scales. A clear “halo” region called a hyloplasm surrounds this granular region. In unfavorable conditions *Cochliopodium* species undergo a state of dormancy where they form cysts. The classification of *Cochliopodium* is based on morphological characters related to size, shape and ultrastructural attributes related to nucleus, mitochondria and scale structure. However, classification based on morphological data alone has created confusion due to overlap and plasticity of the characters used to define species. In this study we examined five described species of *Cochliopodium* that are difficult to distinguish at light microscopy level. The objective of the study was to test the utility of cytochrome oxidase 1 (COI) as a DNA barcode to help delimit amoebas at species level. DNA barcoding based on COI has been shown effective in many animal groups (e.g. Chen et al. 2011). COI sequences are compared with similar sequences in a barcoding database to identify species. When the best match between two sequences is highly divergence, sequences can be delimited or determined not related (Virgilio et al. 2012). In this investigation, DNA was extracted from cell cultures of *C. pentatricurcatum* sp. (sp. 5), *C. megatetrastylus* sp., (sp. 6), CON1, *C. minus*, and *C. spiniferum* and PCR was performed to amplify COI gene in the 5 species. Amplified COI genes were then cloned and sequenced. Itrastrain and interstrain divergences were calculated in *Cochliopodium* species using a combination of different software [MEGA, PAUP, and Automatic Barcode Gap Discovery (ABGD)] and models [no model, Kimura 2 Parameter (K2P, and General Time Reversible (GTR)]. The method of determination is similar to Chen et al 2011, where the maximum intraspecific divergence and the minimum interspecific divergence were measured and this range was defined as the DNA barcoding gap. Intraspecific divergence ranged from 0% to 0.79% in the 5 *Cochliopodium* species and interspecific divergence ranged from 3.42% to 15.49%. The most divergent species was CON1 (0.79%) and the species that were most closely related were species 6 and *C. Minus* (3.42%). Therefore, a barcoding gap of 0.79% to 3.42% was determined using the maximum intrastrain divergences to the minimum interstrain divergence and may be used to delimit species of amoeba. The gap did not differ based upon different evolutionary models. The development of a more comprehensive *Cochliopodium* COI gene database will provide ease with identification of new species and solve taxonomic problems in the genus Cochliopodium.

Funder Acknowledgement(s): Investigation was supported by HBCU-UP Award 0714553 from the National Science Foundation.

Faculty Advisor: Yonas I. Tekle, ytekle@spelman.edu

OA #15
Subcategory: Cell and Molecular Biology

Transcription Factors Effect on *C.Elegan* Development and Reproduction

Denise Levy, Cornell University/University of Massachusetts Boston
Co-Author(s): Ella Chang, Sarah Gordon, and Sylvia Lee, Cornell University

It has been found that moderate reduced function of the mitochondrial electron transport chain (METC) in *C. elegans* results in longer lifespan compared to wildtype, albeit with slower developmental rates and reduced reproduction. A general goal of our lab is to find the molecular means by which longevity is regulated. Since METC mutants display these phenotypes simultaneously, longevity and development may be regulated by similar molecular mechanisms. Homeobox protein CEH-23 has been identified as a transcription factor that mediates this effect. Along with CEH-23, two other proteins have been identified: CEP-1 a homolog to human tumor suppressor p53, and hypoxia inducing factor HIF-1. For my project I will examine how these proteins interact with each other to regulate developmental rate. The effect of CEH-23, CEP-1 and HIF-1 on reproduction of clk-1 METC mutant will also be examined by scoring number of viable progeny. The developmental rate of strains containing mutations of cep-1, hif-1 and ceh-23 was determined for two trials. Results suggest that while CEH-23 alone has no effect on ETC mutant background, it may be needed for cep-1 to restore developmental rate of the isp-1 ETC mutant. The total brood size was determined for five trials. Results suggest that CEH-23 and HIF-1 have no effect on reproduction of the clk-1 ETC mutant. These results may shed light on the molecular pathways for longevity regulation, giving insight into to the pathogenesis of age related disease.

Funder Acknowledgement(s): Research opportunity supported by an NIH R01 grant AG024425.

Faculty Advisor: Sylvia Lee, sylvia.lee@cornell.edu

OA #16
Subcategory: Cell and Molecular Biology

Role of CaMKK2 and SRC-3 in Macrophage-mediated Inflammation

Kenyaria Noble, University of South Florida/Baylor College of Medicine
Co-Author(s): Fumin Lin, Brian York, and Bert O'Malley, Baylor College of Medicine

The laboratory of Dr. Bert O'Malley is focused on understanding the functions of steroid receptor coactivators, SRC-1, -2, and -3, as master regulators of gene expression within the cell. In particular, SRC-3 has been found to play a role in brain and muscle metabolism as well as regulation of the inflammatory response in peritoneal macrophages. Similarly, the calcium/calmodulin-dependent protein kinase kinase 2 (CaMKK2), a central regulator of the calcium-responsive kinase cascade, has also been found to play a role in the regulation of the macrophage development and the inflammatory response. The purpose of this project was to deduce the effect that lack of SRC-3 or CaMKK2 has on myeloid progenitor cells to differentiate into macrophages, polarize to either a pro- or anti-inflammatory state, and produce an inflammatory response. Analysis of genes associated with macrophage differentiation, polarization and inflammation by qPCR was utilized to reveal the role of SRC-3 and CaMKK2 during these processes. Additionally, western blot and qPCR analyses were employed to investigate how SRC-3 and CaMKK2 respond during macrophage differentiation and polarization. It was observed that SRC-3 and CaMKK2 play a role in differentiation and polarization of macrophages based on the abundance of the macrophage marker F4/80. Expression analysis of inflammatory genes, such as TNF-α, IL-6, and IL-1, also revealed that KO of CaMKK2 suppresses the immune response while ablation of SRC-3 leads to hyperactivation of the inflammatory response. The results of western blot analysis of the protein samples found that knockdown or inhibition of CaMKK2 results in an increase in SRC-3 protein levels. These results indicate that CaMKK2 and SRC-3 play a role during macrophage development and overall function while indicating some molecular relationship between the two proteins. Future experiments will focus on understanding how loss of CaMKK2 leads to increased SRC-3 protein and by what mechanism these two proteins are functionally connected. By understanding the role that CaMKK2 and SRC-3 play in macrophage development and function, as well as the functional relationship between the two, novel therapeutic targets for the treatment of inflammatory diseases may be uncovered.

Funder Acknowledgement(s): NIH Grant 2 R01 GM033976-27A1/30

Faculty Advisor: Bernard Batson, bbatson@usf.edu

OA #17
Subcategory: Cell and Molecular Biology

Understanding Cell Division in Budding Yeasts

McKeith Pearson II, Purdue University
Co-Author(s): Arpita Sen and R. Claudio Aguilar, Purdue University

Several neurodegenerative disorders are caused by the expansion of the amino acid glutamine (polyQ). For example, polyQ expansion in the huntingtin protein causes Huntington's disease. This disease usually affects the elderly, causing a loss of memory as well as motor functions. Interestingly, the expansion of polyQ in huntingtin inhibits its interaction with the huntingin Interacting Protein 1 (HIP1); and this loss of interaction is known to contribute to neuronal death. Although budding yeast do not contain a homologue for hunitingtin, Epsin (Ent2) is one of many proteins that are rich in polyQ regions. Similar to huntingtin, Ent2 also functions in the regulation of cell division and viablility. We hypothesized that the polyQ regions of Ent2 contributes to its function in the regulation of cell division. Indeed, our preliminary data suggests that these Ent2 polyQ regions genetically interact with Sla2 coiled coil domains to bring about proper cytokinesis. We believe that this project will not only help us have a better understanding of Ent2 and Sla2 interactions, but it will also help us to obtain insight on the functional relevance of the huntingtin-HIP1 interaction.

Funder Acknowledgement(s): Department of Biological Sciences and Center for Science of information, Purdue University

Faculty Advisor: R. Claudio Aguilar, claudio@purdue.edu

OA #18
Subcategory: Cell and Molecular Biology

Reduction of Fibrosis in Type 2 Diabetes by (-)-epicatechin

Lila Peltekian, California State University, Los Angeles
Co-Author(s): Alfonso Brito, Kseniya Karseko

Studies have shown that heart failure and stroke are among the top ten leading causes of death in Type 2 diabetes. Mitochondrial dysfunction and oxidative stress in diabetic hearts have been shown to lead to cardiac cell death and eventually, fibrosis. Fibrosis is the buildup of connective tissue, mainly collagen, due to cell death, thereby decreasing the contractility and the elasticity of the heart leading to heart failure. In this study we looked at the effects of (-)-epicatechin (EPI) on reducing the progression of type 2 diabetes and fibrosis *in vivo*. Type 2 diabetes was induced by feeding rats a high energy diet (HED) consisting of 10% lard and 20% glucose mixed with their normal chow. After 4 weeks, a low dose streptozotocin (30 mg/kg) was given IP to cause partial dysfunction of pancreatic β-cells and suppress insulin secretion. Control animals were maintained on normal chow and received an IP injection of vehicle (water). Animals were also treated with EPI (1 mg/kg/day) or water by oral gavage. Body weights and plasma glucose levels were measured weekly to monitor the progression of type 2 diabetes. After 12 weeks of HED, hemodynamic measurements were taken to measure changes in cardiac contractility. Tissue was collected for histological and biochemical analysis.

Our results demonstrated that the diabetic animals had significant weight gain (~44%) and increased blood glucose levels (519 mg/dL) compared to control animals (37% and 185 mg/dL, respectively). EPI significantly reduced changes in body weight (~33%) and blood glucose levels (351.2 mg/dL) compared to diabetic animals. No differences in hemodynamic measurements were seen. Histological analysis using Masson's trichrome stain showed that diabetic hearts contained more collagen than the control hearts. EPI reduced the amount of collagen present. In conclusion, our results demonstrate the ability of EPI to reduce body weight, plasma glucose levels and fibrosis in type 2 diabetes.

Future experiments include assessing mitochondrial function and oxidative stress levels to evaluate early cellular events, matrix metalloproteinase activity to evaluate the activity of key proteases involved in the development of fibrosis, as well as performing western blots to determine if EPI is modulating the cell death signaling pathway as a means of conferring protection. While differences in cardiac contractility was not detected between any of the groups at this early time point (3 months), cardiac function will be evaluated at a later time point (i.e, 6 months) to determine if EPI reduces cardiac dysfunction that results from fibrosis long term.

Funder Acknowledgement(s): Support provided by CSU-LSAMP from NSF HRD-1302873 and Office of the Chancellor.

Faculty Advisor: Katrina Yamazaki, kyamaza@calstatela.edu

OA #19
Subcategory: Cell and Molecular Biology

Proteomic and Histological Evaluation of Porcine Airways from Animals Reared in Swine Confinement Facility Units

Sherrell Pettiford, North Carolina Agricultural and Technical State University
Co-Author(s): Chakia McClendon, Dawn Conklin, and Jenora Waterman, North Carolina Agricultural and Technical State University

In North Carolina and across the nation, the majority of pigs are reared in swine confinement facility units (SCF); however, a respectable herd of hogs are maintained outdoors. The issue of diminished air quality in confinement facilities has resulted in chronic inhalation of SCF dust particles, which consists of feed particles, animal dander, endotoxins, gases and organic particles, in both swine and workers. This exposure has been shown to elicit or exacerbate respiratory abnormalities and diseases in farm workers and potentially in pigs. Furthermore, SCF dust may cause inflammation, goblet cell metaplasia and protein infiltration within the airway. Due to respiratory similarities between pigs and humans, porcine subjects serve as a good model for understanding the impact of SCF dust on the airways and potential differences that can be identified in airway epithelia of animals reared in both environments.

Therefore, we hypothesized that there are proteomic and goblet cell differences within the airway of pigs reared indoors compared to those reared outdoors. Porcine tracheas were obtained from pigs reared in confinement at the North Carolina Agricultural and Technical State University Swine Research Facility and outdoor samples were collected from a local abattoir. Tracheal portions (2-3 cm rings) were fixed in paraformaldehyde, post treated in sucrose and then sectioned at six microns on the Leica CM 3050S cryostat. Tracheal sections were stained with Periodic Acid Schiff stain to visualize mucus-secreting goblet cells, counter stained with Harris Hematoxylin, dehydrated and cover-slipped. Sections were evaluated for goblet cell visibility and quantitative comparison between each method of swine production, as well as morphology. Proteomic analysis was performed by homogenizing approximately one gram of tracheal epithelial tissue from pigs *ex vivo*. Protein levels were determined using the Bradford Assay. Protein extracts were then subjected to western blot analyses coupled with densitometry. Statistical investigation, including one- and two-way analysis of variance (ANOVA) with p-value ≤ 0.05, were employed to evaluate significant differences among means followed by Bonferroni post-test corrections.

Histological evaluation of airway sections revealed a 1.4 fold increase in the total population of goblet cells in tracheas of indoor pigs (p-value<0.0152) versus outdoor pig tracheas. Protein levels of indoor porcine tracheal epithelia were significantly higher compared to outdoor samples. Some of the proteins identified via western blot are known to play key roles in airway inflammation and cellular stress, examples include cyclooxygenase-2 (COX-2), heat shock protein 70 (HSP70), and PON3 were present within the porcine airway tissue samples *in vivo*. These observations indicate animals reared indoors may have distinct airway differences compared to those reared outdoors, which may, in part, explain their ability to live within confinement houses without any apparent complications. However, the significance of these distinctions is not yet clear. Analysis is ongoing and this work is expected to further elucidate the impact of SCF on pigs and SCF workers.

Funder Acknowledgement(s): USDA/NIFA (NC.X-255-5-11-120-1 and 2011-38821-30967) awarded to Jenora T. Waterman, North Carolina Agricultural and Technical State University. Sherrell G. Pettiford was a National Science Foundation North Carolina Louis Stokes Alliance for Minority Participation Fellow.

Faculty Advisor: Jenora Waterman, jdwaterm@ncat.edu

OA #20
Subcategory: Ecology

Difference of HSP70 Stress-level Between Infected Adult and Juvenile Snails

Oumsalama Elhelu, University of the District of Columbia
Co-Author(s): Michael Smith, William Wiggins, Stephanie Graves, and Carolyn Cousin, University of the District of Columbia
Matty Knight, George Washington University

The stress protein heat shock protein 70 (Hsp 70) is a protein that is present in the *Biomphalaria glabrata* throughout its life cycle. Susceptible strains of *B. glabrata* allow miracidia to freely develop inside its tissue once penetrated. The progression of the process in susceptible snails involves development of the mother sporocyst, daughter sporocyst, and cercarial stages. On the other hand, in resistant snails the invading miracidia are encapsulated and killed not long after post penetration. Mechanism(s) shaping these outcomes involves the parasite's ability to evade the snail's defenses. Using western blot analyses, on both snail lines and chemiluminescent substrate, protein analyses from resistant (BS-90), and susceptible (NMRI) juvenile and adult *B. glabrata* infected with *Schistosoma mansoni* revealed that stress-related genes, Hsp 70 were co-induced early in NMRI snails, but not in BS-90. Upon heat shock, adult snails show no differences. However, upon heat shock at 15 minutes, there are more protein levels; whereas in the 30 minutes heat shock there are possibly high molecular chaperon proteins shown.

These data will aid in understanding molecular events involved in stress response transcriptional regulation of Hsp 70 in juvenile and adult snails. This study will pave a way towards the eventual identification of genes involved in schistosome/snail interactions.

Funder Acknowledgement(s): UDC NSF HBCU-UP grant and NIH grant 5R25CA129035-04

Faculty Advisor: Carolyn Cousin, ccousin@udc.edu

OA #21
Subcategory: Ecology

DsRNA Introduced to Resistant Snails Causes Vulnerability to Schistosome

Michael Smith, University of the District of Columbia
Co-Author(s): Carolyn Cousin, University of the District of Columbia
Matty Knight, George Washington University

Biomphalaria glabrata is the intermediate snail host for *Schistosoma mansoni*, the causative agent for schistosomiasis. These snails are known to display a wide range of susceptibility phenotypes depending on the genetics of the snail and the parasite. Studies have shown that using double stranded RNA with the non-viral inert cationic delivery agent, poleyethyleneimine (PEI), successful gene silencing in the snail host can be achieved. Since high basal levels and early expression of Cathepsin B was found to correlate with resistance to *S. mansoni* in the resistant BS- 90 snail host, we hypothesized that knock down of Cathepsin B (CathB) gene will cause susceptibility. Using the corresponding CathB dsRNA and PEI delivery method, the expression of CathB will be suppressed, thereby reduce/prevent the early destruction of the parasite normally seen in these snails. Twelve snails were soaked for 48 hours with dsRNA/PEI nanoparticle complexes before exposure to the parasite. At 6 weeks post- exposure, experimental and control snails were monitored for cercariae shedding. RT-PCR with CathB gene specific primers was used to validate the successful knock down of the CathB gene in dsRNA/PEI transfected snails, done in parallel using control mock myoglobin dsRNA/PEI transfected snails. Change in qualitative expression of CathB was determined relative to the housekeeping actin gene. The knockdown of CathB allowed the miracidia to enter the snail and continue to the daughter sporocyst into multiple pre-emerging cercariae. Further study included qRT-PCR.

Funder Acknowledgement(s): NSF HBCU-UP-HRD-0928444, NIH NCI-5R25CA129035, MARC-NIH NIGMS-1T34GM087172-01A1

Faculty Advisor: Carolyn Cousin, ccousin@udc.edu

OA #22
Subcategory: Genetics

An *In Vitro* Model of Differentiation in the Brain

Jonathan C. Bolden, University of Arkansas at Pine Bluff/ Washington University School of Medicine
Co-Author(s): Brett Maricque and Barak Cohen, Washington University School of Medicine, St. Louis

Neurological diseases, such as multiple sclerosis, often result from genetic mutations that affect specific cell types. Large scale genomic studies have demonstrated that disease related mutations are found in both coding and noncoding regions of the genome. This poses two major problems for studying neurological diseases: 1) isolating pure populations of specific brain cells for observation using *in vivo* methods is very challenging, and 2) determining the contributions of noncoding mutations to disease is limited by our lack of knowledge regarding the function of noncoding sequences. The goal of this project was to develop an *in vitro* model for studying cellular differentiation in the brain. This model will allow us to study isolated population of cells and to conduct efficient studies of noncoding mutations. To this end, we differentiated embryonic stem cells (ESCs) down into four of the most common cell types in the brain and utilized lentiviral constructs to insert a set of controlled noncoding sequences into ESCs. We used intracellular antibody staining for the nestin protein to confirm successful induction of ESCs to neural progenitor cells. Our results indicate that the protocol developed for ESC differentiation is robust. Furthermore, we demonstrated that our lentiviral constructs successfully inserted the controlled noncoding sequences into the ESC genome. However, results from fluorescence microscopy indicate that ESCs are actively silencing the expression of our transgenes. Overall, our results suggest that ESCs can serve as a model for brain differentiation, but protocols for introducing noncoding sequences into ESCs require further development.

Funder Acknowledgement(s): NIH GRI:R25HG006687

Faculty Advisor: Anissa Buckner, Bucknera@uapb.edu

OA #23
Subcategory: Genetics

Pooled Sequencing Power Analysis of Simulated Genomic Data

Darius Bost, North Carolina A&T State University
Co-Author(s): Takahiro Maruki and Michael Lynch, Indiana University
Scott H. Harrison, North Carolina A&T State University

Pooled population sequencing using high-throughput sequencing technologies is becoming a widely used, cost-effective method of characterizing genetic variation, although this procedure can have high rates of error. The purpose of the project was to assist in the development of a maximum-likelihood estimator for the frequency of an allele in a pooled sample, taking into account sequencing error. Our hypothesis was that either coverage or sample size would be the major factor in detecting polymorphisms.

Our methodology involved a maximum likelihood estimator algorithm processing 18 different simulated data sets (populations) that varied across factors of three sample sizes, three depths of sequencing coverage, and two error rates. We employed a statistical power analysis on data from each iteration. False-positive rates were an outcome of false estimations of polymorphisms, and false-negative rates were an outcome of false estimations of monomorphisms.

Our results showed improved power for detecting true polymorphisms with increased coverage, but this was dependent upon the underlying true minor allele frequencies. For the populations being analyzed, results indicated that coverage has more effect on detecting polymorphisms than sample size. We generally found that as coverage increased and error rates decreased, the estimations of allele frequencies improved. We conclude that the future application of this work will improve detection of genetic variation in multiple populations and help control for the necessary sampling and coverage thresholds needed for examining pooled sequencing data with varying levels of error.

Funder Acknowledgement(s): This study was supported, in part, by the Indiana University Summer Scholars Institute; an NSF iBLEND grant awarded to Professor Gregory Goins, Dept. of Biology, North Carolina A&T State University; NSF Division of Environmental Biology Grant #1257806 awarded to Professor Michael Lynch, Dept. of Biology, Indiana University; NIH-NIGMS MARC Grant awarded to Professor Mary A. Smith, Dept. of Biology, North Carolina A&T State University.

Faculty Advisor: Scott Harrison, scotth@ncat.edu

OA #24
Subcategory: Genetics

A Novel Polymorphic AluYb8 Insertion in 8q24 is Associated with Prostate C

Symone Jordan, Bowie State University/University of Illinois at Chicago
Co-Author(s): Terry Fitzpatrick and Rick Kittles, University of Illinois at Chicago

Globally, African-American men have the highest incidence of prostate cancer and are more than twice as likely to die of the disease as Caucasian males. The causes of higher prostate cancer rates among black men remain largely unknown. Genetic factors may, in part, contribute to higher prostate cancer incidence and mortality among African Americans. We recently identified an AluYb8 insertion/deletion polymorphism on chromosome 8q24 that may be associated with increased risk for prostate cancer in African-American men. To test this hypothesis, we genotyped the polymorphism in 121 African-American men with prostate cancer and 390 African-American healthy male controls and evaluated its association with prostate cancer. African-American men with at least 1 copy of the AluYb8 insertion had an increased risk of prostate cancer (odds ratio, 1.6; 95% confidence interval, 1.0-2.5) compared with those without the polymorphism. Our results suggest that the AluYb8 insertion/deletion polymorphism is significantly associated with increased prostate cancer risk in African American men.

Funder Acknowledgement(s): NSF HBCU-UP.

Faculty Advisor: Rick Kittles, rkittles@uic.edu

OA #25
Subcategory: Genetics

Whole-Genome Association Study of Silver Resistance Pathways

Imani N. Sharpe, North Carolina A&T State University
Co-Author(s): Quincy L. Cunningham, Mehrdad Tajkarimi, Joseph L. Graves, and Scott H. Harrison, North Carolina A&T State University

Some bacteria have adapted to hostile environments, including those with metallic toxins such as silver. The genetic basis for this survival can be due to specific resistance pathways encoded in the bacterial genome, many of which have been attributed to horizontal transfer of resistance genes across independent evolving lineages. Our hypothesis was that there may be an additional range of cellular pathways, many of which are vertically inherited, that are associated with bacterial resistance to silver. We implemented a workflow to investigate variation in the genomic encoding for metabolic pathways through the use of the Department of Energy Joint Genome Institute Integrated Microbial Genomes (IMG) resource. The IMG allows cross-comparisons to be conducted across gene functions, genomes, and an IMG-curated set of 908 cellular pathways. Our workflow began with identifying those fully sequenced genomes of strains with a genotype of silver resistance based on the presence of the silE gene (n=8). We then identified a potentially silver sensitive group of strains that did not have the silE genes, and were annotated for plant-host associations (n=11). The next step for the comparison examined each of the 908 IMG pathways for those that are over-represented or under-represented in the silver resistance group compared to the silver sensitive group. A Monte Carlo resampling method was used to generate z-scores for quantifying this comparison. Specifically, differences that were measured across the silver resistance and sensitive groups were compared to a resampling that randomly drew from a merged collection of both groups. For further analysis, we created word clouds and identified separating lists of keywords from gene function annotations that, overall, illustrate how a non-logarithmic growth phase may be a strategy for those strains expected to have silver resistance. We have generally found that our computation of these pathway differences illuminated prior perspectives in the literature on silver resistance and bacterial metabolism, even spanning back to the pre-genomic era. By tapping into the growing resource of bacterial genomic data, this overall analysis has comprehensively quantified associations between a large set of cellular pathways and silver resistance.

Funder Acknowledgement(s): This study was supported, in part, by the BEACON Center (NSF Cooperative Agreement DBI-0939454); an NSF iBLEND grant awarded to Professor Gregory Goins, Dept. of Biology, North Carolina A&T State University; NIH-NIGMS MARC Grant awarded to Professor Mary A. Smith, Dept. of Biology, North Carolina A&T State University.

Faculty Advisor: Scott H. Harrison, scotth@ncat.edu

OA #26
Subcategory: Genetics

Maximum Likelihood Analysis of Population-Genetic Pooled Sequencing

Sade A. Wilson, North Carolina A&T State University
Co-Author(s): Takahiro Maruki and Michael Lynch, Indiana University
Scott H. Harrison, North Carolina A&T State University

Genetic variation in a population can occur at different frequencies. Different variations of the same gene are known as alleles. Single nucleotide polymorphisms (SNPs) are alleles resulting from changes in single nucleotides at specific locations. Within a population, when there is only one allele for a single nucleotide locus, that is a monomorphism. In this study, we detect SNPs based on two different strategies. The first strategy used fully sequenced chromosomes of *Drosophila melanogaster* strains from the *Drosophila* Genetic Reference Panel (DGRP) project. The second strategy was based on a published report of pooled sequencing for these strains. The pooled sequencing detection strategy made use of a maximum likelihood estimator program. We then catalogued those instances of discordance between the two detection strategies for SNPs versus monomorphisms. As was originally hypothesized, the maximum likelihood statistic revealed measurement errors and allelic variation different than the variation found in databases containing fully sequenced chromosomes. We plan to examine this further by evaluating PHRED scores of the FASTQ data files,

and carry out this comparative analysis on other sets of strains for which there is both pooled sequencing and individual whole genome data.

Funder Acknowledgement(s): This study was supported, in part, by the Indiana University Summer Scholars Institute; a grant from NSF iBLEND awarded to Professor Gregory Goins, Department of Biology, North Carolina A&T State University; and an NSF Division of Environmental Biology Grant #1257806 awarded to Professor Michael Lynch, Department of Biology, Indiana University.

Faculty Advisor: Scott H. Harrison, scotth@ncat.edu

OA #27
Subcategory: Geosciences and Earth Sciences

The Impact of Fluoridated Water Pollution on the Growth of *Rana catesbeiana*

Jennifer Bailey, Norfolk State University
Co-Author(s): Rebecca Hopkins, Norfolk State University

Fluoride is essential to prevent tooth decay but is a pollutant to marine organisms in our nation's waterways. Sodium fluoride is a compound used in toothpaste and mouthwash for the prevention of cavities by stopping and reversing the tooth decay process while strengthening the tooth enamel. The Environmental Protection Agency determined the Maximum Contaminant Level Goal for fluoride in drinking water to be 4.0mg/L, a level that poses no adverse health risk. The EPA determined a secondary standard for fluoride being 2.0 mg/L, a level approved for children's drinking water with no adverse cosmetic and aesthetic effects. The City of Norfolk has a fluoride concentration of 0.7 mg/L mandated by the state of Virginia. This study examines the effects of sodium fluoride on *Rana catesbeiana* as an endocrine disruptor. American bullfrog pre-metamorphic tadpoles were placed in fluoride polluted aquatic environments containing 26 liters of deionized water with 0.7mg/L and 2.0 mg/L sodium fluoride pollutant and unpolluted aquatic environment control. The tadpoles were exposed to the sodium fluoride pollutant daily for 4 weeks of bioaccumulation. They were observed daily for the onset of metamorphosis. The mortality rate for both experimental tanks was 100%. This exposure resulted in the tadpoles exhibiting an environmental adaptation, living longer than those exposed to less sodium fluoride. The control tank exhibited no mortality.

This investigation demonstrated tadpoles exposed to 0.7mg/L and 2.0mg/L had an absence of hind and forelimb development compared to the control tank, which exhibited 100% hind limb development. This research establishes that sodium fluoride is a pollutant and endocrine disruptor for marine organisms by inhibiting metamorphosis. The impact of personal care product pollution is detrimental to the growth, development, and vitality of marine organisms.

Funder Acknowledgement(s): This research would have not been possible without the funding of the National Science Foundation Grant #0714930.

Faculty Advisor: Maureen Scott, mscott@nsu.edu

OA #28
Subcategory: Microbiology/Immunology/Virology

Isolation of DNase and Protease Producing Bacteria on Wild and Store-Bought Catfish

Gina Accumanno, Delaware State University
Co-Author(s): Jung-Lim Lee, Delaware State University

Fish spoilage is a concern that the average consumer and producer alike have to deal with. The purpose of the study was to show the effects of DNase and protease producing bacteria on catfish spoilage. The catfish was acquired from an aquaculture facility at Delaware State University. The samples were plated on rich and selective/differential media. The catfish obtained from an aquaculture facility took approximately 3 weeks to reach the stationary phase at log 10 CFU/g with limited DNase producing bacteria counts, but a great amount of protease producing bacteria. In addition, the catfish purchased from a local retail source took 15 days to reach the stationary phase at log 10 CFU/g with increasing numbers of protease and DNase producing bacteria found throughout the entire trial. Unique colonies of DNase and protease producing bacteria were isolated and amplified by Polymerase Chain Reaction assay with genus specific primers, of which 40/62 were positive for *Pseudomonas* species. Bacteria samples were cross-bridge plated on both methyl green and milk plate agar to see if there were any that could produce both DNase and protease simultaneously. From there, 30 bacteria were sequenced for identification. The majority of the bacteria were *Pseudomonas*, *Shewanella* and *Aeromonas* spp. In conclusion, *Pseudomonas*, *Shewanella* and Aeromonas are likely to be major spoilage bacteria from catfish. For further research, DNase and protease from isolated bacteria will be studied.

Funder Acknowledgement(s): This project was funded by NSF HRD0928404 SMILE Program of Delaware State University.

Faculty Advisor: Jung-Lim Lee, jlle@desu.edu

OA #29
Subcategory: Microbiology/Immunology/Virology

Role of Lactosylceramide in the Central Nervous System Autoimmunity

Nadya Ali, Michigan State University College of Human Medicine/Harvard Medical School

Co-Author(s): Francisco Quintana and Lior Mayo, Harvard Medical School

Multiple Sclerosis is a disease of degradation of the myelin sheath due to an autoimmune response. Although the cause of the immune response remains unknown, previous studies have discovered that a lipid molecule, lactosylceramide (LacCer), is present in high levels in Multiple Sclerosis patients. Furthermore, an inhibitor molecule, D-Threo-1-phenyl-2-decanoylamino-3-morpholino-1-propanol HCl (PDMP), inhibits the synthesis of LacCer. The goal of this project was to establish a model with astrocytes and microglial cell lines that will allow for genetic manipulation and further mechanistic studies. An additional goal was to understand the role of LacCer in the pathogenesis of Multiple Sclerosis in both the innate and adaptive immune responses. To do this, we treated both CD4 effector T cells, Th1 and Th17, as well as astrocytes and microglial cells in the Central Nervous System with PDMP. These results will allow for a target molecule to be manipulated as a potential therapeutic tool for Multiple Sclerosis.

Funder Acknowledgement(s): Harvard Catalyst Summer Clinical and Translational Research Program

Faculty Advisor: Francisco Quintana, fquintana@rics.bwh.harvard.edu

OA #30
Subcategory: Microbiology/Immunology/Virology

Analysis of Plasmids from *Streptococcus Parauberis* Infecting Fish

Armonee Avent, Norfolk State University
Co-Author(s): Ian Copeland, Norfolk State University

Streptococcus parauberis is a gram-positive lactic acid bacterium that can be found in fish and dairy cows. This bacterium infects the kidneys and brain causing inflammation and necrosis of tissue, which can lead to death in certain fish species. It has been found in aquacultured fish in Spain and Korea and recently in striped bass in the Chesapeake Bay. In these fish strains of *S. parauberis*, a plasmid was identified recently. A plasmid is a genetic structure that can replicate independent of the chromosomes. As part of this project, the genes of this plasmid are being sequenced. This will assist in the identification of antibiotic resistance genes, virulence genes, and host-specificity genes. Another goal includes the characterization of this plasmid using a recently proposed plasmid classification system. Understanding the types of plasmids as well as any antibiotic resistance genes found in these pathogenic strains should facilitate the effective treatment of infected aquaculture fishes. These data may also contribute towards future development of a vaccine for this bacterium. Together these efforts should improve the profits of fishing industries and limit the emergence of this pathogen in wild populations, such as here in the Chesapeake Bay.

Funder Acknowledgement(s): Thurgood Marshall College Fund/ Department of Defense

Faculty Advisor: Ashley Haines, anhaines@nsu.edu

OA #31
Subcategory: Microbiology/Immunology/Virology

Effectiveness of Single Chamber Microbial Fuel Cell

Sajeeda Chin, Howard University

Microbial fuel cells serve as an ideal clean energy source because they operate like a battery that runs on the respiration of microorganisms. As a comparison to previous results that used a double chamber fuel cell, a single chamber microbial fuel cell was constructed using Proteus to see the effectiveness of a single chamber fuel cell. Glucose was used as the fuel and Neosepta membrane was used as the proton exchange membrane separating the anodic and cathodic compartments. Carbon cloth was used as the electrodes. The voltage was measured using VCMeter program. Output voltage was produced in small amounts throughout the course of the experiment. This research showed that compared to previous studies that used a double chamber fuel cell, the single chamber was less effective because there was more opportunity for interference from outside sources. This information will encourage the search for alternative clean energy.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Rowena Royan, rowena.royan@gmail.com; Mana Sriyudthsak, mana.s@chula.ac.th

OA #32
Subcategory: Microbiology/Immunology/Virology

Recovery of High Quality DNA from Ixodid Ticks Collected Off *Odocoileus virginianus* (White-tailed Deer) in the Virgin Islands National Park

Tasha Corneille, University of the Virgin Islands
Co-Author(s): Shannon Emmanuel, University of the Virgin Islands

In recent years, there have been numerous tick-borne diseases reported in the continental U.S. In hearing this, one cannot help

but wonder whether or not the U.S. Virgin Islands is at risk. The Virgin Islands National Park (VINP) is a popular site for tourist attraction and a home to White-tail deer (*Odecoileus virginianus*). They were brought to the Virgin Islands for recreational purposes and are currently under investigation to see if they host ectoparasites that may carry pathogens. Considering how these deer can potentially lead to deadly diseases such as Rickettsia, Anaplasma and Babesia, deer that reside in the VINP are vehicles of these tick-borne diseases that could ultimately land on a passer-by. To conduct this research project, ixodid ticks were identified to the genus-level based on their morphological type, life stage, and gender. DNA extraction was done on a series of 40 deer ticks using the Qiagen DNAeasy Blood and Tissue Kit. The efficiency of the Qiagen DNAeasy ticks was analyzed based on the concentration and purity of the tick DNA extractions using UV spectroscopy. Data from the spectroscope was measured from six ixodid deer ticks (1, 15, 25, 27, 30, 34). For ticks 1 and 25, the 230 wavelength expressed high contaminant levels. Also ticks 1, 25, 27, and 34 at the 325 wavelength reported values that indicated high particulate levels present in the sample. Furthermore, three ticks (27, 30, and 34) had low DNA yield whereas ticks (1, 15 and 25) yielded concentrated DNA extractions. Overall, tick 15 showed no sign of large particles or other contaminates. Moreover this sample had high levels of tick DNA with a concentration of 2.03µg/ml. To further acknowledge the quality of these tick DNA extractions, gel products were compared. As expected, tick 15 had conversely high quality DNA, as visualized by clean, bright bands on the gel electrophoresis results. To understand the levels of low yield DNA present in DNA extractions, the Qiagen kit troubleshooting section stated that lower yields could be attributed to poor storage prior to DNA extraction and that DNA yields are dependent on the type, size, age and the storage of material. Despite the flaws present in the DNA extraction, the Qiagen DNeasy Blood and Tissue kit was effective at yielding high quality tick DNA.

Funder Acknowledgement(s): This research was funded by HBCU Grant 1137427.

Faculty Advisor: Jennilee Robinson, jrobins@live.uvi.edu

OA #33

Subcategory: *Microbiology/Immunology/Virology*

Immunomodulation of Cystic Fibrosis Cells by *Pseudomonas Quinolone* Signal

Dewayne L. Garner Jr., Onondaga Community College/Syracuse University
Co-Author(s): David R. Wilson, Patricia R. Wardwell, and Rebecca A. Bader, Syracuse University

Pseudomonas aeruginosa is an opportunistic human pathogen that causes severe infection in compromised individuals, including persons with cystic fibrosis (CF). The expression of many virulence factors in *P. aeruginosa* is controlled by quorum sensing molecules (QSMs) that are synthesized and secreted by this bacterium. Recent studies suggest that QSMs are also capable of interspecies communication, with exposure of mammalian cells to N-acyl homoserine lactones (AHLs) and *pseudomonas quinolone* signal (PQS) resulting in an immunomodulatory response. Although the initial immune response is intended to clear/contain the infection, this process is ineffective in CF lungs, and the persistent, excessive inflammation eventually leads to structural damage to the tissue.

The goal of this study was to examine the response of IB3-1 CF airway epithelial cell line to PQS alone and in conjunction with bacteria-derived lipossacharides (LPS). LPS at 100 µg/ml and/or PQS at 10 µg/ml or 1 µg/ml were incubated with IB3-1 cells at 37°C. After 24 hours, the supernatant was removed and the concentrations of two markers of inflammation, interleukin-6 (IL-6) and interleukin-8 (IL-8), were determined by enzyme-linked immunosorbent assay. The measured concentrations for the cells exposed to PQS and/or LPS were compared to those obtained for unstimulated control cells. In contrast to results obtained with other cell types, particularly macrophages and T-cells, which suggest that PQS is anti-inflammatory, PQS induced inflammation in the IB3-1 CF cell line and significantly exacerbated inflammation when administered simultaneously with LPS. Specifically, LPS combined with PQS (at 10 or 1 µg/ml), yielded significantly higher levels of IL-6 and IL-8 relative to the values obtained for PQS or LPS alone. Moving forward, the mechanism by which PQS enhances inflammation when combined with LPS will be examined by blocking the toll-like receptor 4 (TLR4) prior to co-stimulation. LPS is known to activate the nuclear factor-kB (NF-kB) proinflammatory signaling pathway via TLR4. This study verified that PQS does have an immunomodulatory impact on epithelial cells and suggested that the nature of the immunomodulation may be cell type dependent. A better understanding of the role that PQS plays in the inflammatory response can potentially lead to new strategies to minimize airway destruction.

Funder Acknowledgement(s): This study was supported by NSF grant EFRI-1137186.

Faculty Advisor: Rebecca Bader, babader@syr.edu

OA #34

Subcategory: Microbiology/Immunology/Virology

Small Intestine Development in Calves Fed an *Aspergillus Oryzae* Extract

Alexis Gibson, Cornell University
Co-Author(s): Yairanex Roman-Garcia, University of Puerto Rico, Mayaguez

Taylor Yohe, Emily Dudash, Rachel Townsley, Kellie O'Diam, and Kristy Daniels, Ohio State University

Direct fed microbials (DFM) can enhance feed efficiency and have suspected benefits on gut health. DFM inclusion in young ruminant diets is underexplored. The DFM used in this trial was Amaferm (AMF), a fungal extract from *Aspergillus oryzae*. The effect of feeding microbes directly to bull calves on small intestine morphology was assessed in this trial. The hypothesis was that calves fed 2g of Amaferm daily, delivered in calf milk replacer, for the first 4 weeks of life and top-dressed on starter thereafter, will exhibit an effect on small intestine development and may vary by location within the small intestine. Fifty-two Holstein bull calves were raised (CON; n=27, AMF; n=25) on a diet of milk replacer (MR; 22% CP, 20% fat, DM basis) and 20% CP (DM basis) starter grain. At 4 weeks of age 16 calves (CON; n=8, AMF; n=8) were slaughtered and the intestines removed with samples from the jejunum and ileum cut for histology. The samples were preserved in formalin, embedded in paraffin, and microscope slides were made. Slides were then stained with hematoxylin and eosin. Average villus height and crypt depth were measured from 4-5 intact villi found randomly on a slide.

The data has shown not to be significant. For villus height, there was no interaction between treatment and location (P=0.72). There was no effect of treatment on villus height (P=0.56), and there was no effect of location (P=0.59). For crypt depth, there was no interaction between treatment and location (P=0.75). There was no effect of treatment on crypt depth (P=0.97) and there was no effect of location (P=0.24). Contrary to our hypothesis, AMF did not affect small intestine development in calves when assessed at 4 weeks of age.

Funder Acknowledgement(s): This study was funded in part by Biozyme Inc. The Ohio Dairy Producers Association also provided monetary support. This research opportunity was provided by the Summer Research Opportunity Program of the Ohio State University.

Faculty Advisor: Kristy Daniels, daniels.412@osu.edu

OA #35
Subcategory: Microbiology/Immunology/Virology

Decreased Expression of Foxp3 Is Correlated to Epigenetic Mechanisms in Lupus

Jarren Oates, University of Arkansas at Pine Bluff
Co-Author(s): Beverly D. Lyn-Cook, National Center for Toxicological Research, Jefferson, AR

Systemic lupus erythematosus (SLE) is an autoimmune disease that affects women at an alarming rate. In addition, African Americans and Hispanics account for a significant majority of SLE patients compared to European Americans. However, very few studies have been conducted in these populations. Modulation of expression of the forkhead family transcription factor, Foxp3, have been shown in autoimmune diseases and animal studies. Foxp3 plays an important role in innate immunity and the development of Treg cells. Animal studies have shown decreased levels of Foxp3 in animal models with lupus. Human studies suggest that modulation of Foxp3 expression reflects the activation of CD4(+) T cells and disease activity. Previous studies in our laboratory demonstrated that the promoter of Foxp3, using methylation arrays, were hypermethylated in lupus patients compared to age-matched non-lupus patients. The present study demonstrates that Foxp3 expression was significantly (P=0.038) decreased in lupus patients compared to aged-matched non-lupus patients. Additionally, expression correlated to disease activity.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the Food and Drug Administration Office of Women's Health to Beverly Lyn-Cook, National Center for Toxicological Research, Jefferson, AR.

Faculty Advisor: Anissa Buckner, bucknera@uapb.edu

OA #36
Subcategory: Microbiology/Immunology/Virology

***Streptococcus Pneumoniae* Biofilm Under Environmentally Germane Conditions**

Aneeta Uppal, Rochester Institute of Technology
Co-Author(s): Robert C. Osgood, Rochester Institute of Technology

Streptococcus pneumoniae (Spn) continues to be a lead etiological agent of acute otitis media (AOM), a leading cause of disease in children and responsible for billions of dollars of cumulative annual financial burden. Various studies have been performed to investigate Spn biofilm formation, however, to our knowledge, previous experimental designs have failed to account for environmentally germane conditions which may encourage biofilm formation when present. The aim of this investigation is to ascertain the role of oxygen and pH on Spn biofilm formation.

This investigation of biofilm formation was predicated upon the hypothetical environmental conditions created within the inflamed middle ear with the accompanying fluid accumulation and Eustachian tube dysfunction associated with AOM, thereby testing our experimental hypothesis: Changes in pH and altered atmospheric concentrations of oxygen in the middle ear during AOM induce Spn biofilm formation. Overnight tryptic soy broth supplemented to 1% with yeast extract (sTSB) cultures of seven AOM Spn clinical isolates were subjected to individual crystal violet biofilm assays under microaerophilic (10% oxygen) and anaerobic (0% oxygen) conditions over a pH range of 4.5 – 10.

Each assay consisted of four replicates of the experimental isolate at 12 pH conditions, similarly a positive control isolate and a negative control on each of three (triplicate) plates for each condition. Methodologically, 1/200 dilutions of each Spn isolate were made into fresh sTSB for each pH tested and 150µl was aseptically pipetted into the wells of a 96-well microtiter plate. Subsequent to incubation at 37°C for 48 hours, the wells of each plate were stained with crystal violet, washed, dried and finally incubated with 150µl of absolute ethanol for 30 minutes. The final crystal violet solution was measured spectrophotometrically at 595nm. Additionally, middle ear fluid (MEF) samples from a clinical study were obtained by Tympanocentesis procedure and tested immediately for pH. Various degrees of biofilm formation were seen under both conditions for all isolates tested. Surprisingly, most of the MEF samples registered at a pH of 8 to 8.5.

These findings support our hypothesis and strongly suggest that Spn biofilm formation is possible when oxygen levels are reduced or nonexistent over a limited pH range. Furthermore, microaerophilic and anaerobic Spn biofilm formation can occur at the pH of the tested MEF samples. Future investigations will include the use of a combination of confocal microscopy and a specialized biofilm visualization program, Comstat, to further characterize Spn biofilms for biomass, biofilm height and distribution as well as biofilm density.

Funder Acknowledgement(s): This study was supported by the Department of Biomedical Sciences in the laboratory of Robert C. Osgood at the Rochester Institute of Technology.

Faculty Advisor: Robert C. Osgood, rcoscl@rit.edu

OA # 37
Subcategory: Physiology and Health

Correlation of Organ Donations and Morbidity in Marginalized Communities

Barbara Okeke, Norfolk State University
Co-Author(s): Victoria Meadows and Staci Walton, Norfolk State University

Organ and tissue donation by members of minority populations is nominal given the tremendous need for transplantation in these very same racial and ethnic groups. This problem is most clearly demonstrated in the African-American community. In order to increase awareness of this health issue, we initiated a novel relationship between student organizations at Norfolk State University, a Historically Black College and University in an urban setting, and a nationally recognized organ procurement/ dissemination organization. In so doing, we aim to increase the organ donor pool in the African-American community, thereby decreasing the morbidity and mortality for the myriad of diseases that can be ameliorated by organ transplant.

The initial phase of this undertaking required that we determine key issues that have hindered organ donation by African Americans. Through various venues (i.e. church health fairs, community outreach programs), we conducted a preliminary study utilizing feedback from organ donors and persons who refused donor registry enrollment. We obtained demographic data and personal reasons that influence decisions regarding participation in organ donation programs. We then conducted an extensive literature review to gain greater insight concerning the disparity that exists in organ donation, specifically in the African-American population. We found that deeply rooted religious beliefs and a strong mistrust of the healthcare system were the major reasons that persons of minority groups refused to become organ donors. These issues transcended such variables as educational status, gender, and socioeconomic status. This information has been utilized to establish a model donor awareness community outreach program. It was implemented through a strategic collaboration between a nonprofit organ procurement organization and a biology/health-related student organizations at Norfolk State University, an institution known to serve as an effective intermediary for information dissemination to underrepresented communities.

Funder Acknowledgement(s): Norfolk State University STEM

Faculty Advisor: Staci Walton, scwalton@nsu.edu

OA #38
Subcategory: Physiology and Health

ApoE Deficiency Does Not Alter IGF-1 Signaling During Skeletal Muscle Regeneration

Taylor Osborne, University of Arkansas at Pine Bluff
Co-Author(s): Lem Brown, Alyssa Papineau, and Tyrone A. Washington, University of Arkansas

High cholesterol impacts many people across the globe and ultimately can lead to cardiovascular disease (CVD). ApoE, a ligand for lipoprotein receptors, mediates the uptake of triglycerides, cholesterol, and other lipids into the cells and liver. Muscle, when subjected to damaging stimuli, initiates a complex and coordinated regenerative response. ApoE KO is used as a model to demonstrate hypercholesterolemia. The physiological role of hypercholesterolemia and its impact on skeletal muscle regeneration is unclear. PURPOSE: To determine if skeletal muscle would adapt normally during regeneration from bupivacaine injection in the absence of the apoE gene. METHODS: C57/BL6 (WT) and apoE KO were given either bupivacaine (injured) or phosphate buffered saline (PBS) (uninjured) in the tibialis anterior (TA). Muscle was extracted 3 days post-injection. Western Blot technique was run to determine protein expression of AKT and p-AKT. Real-Time PCR was conducted to determine gene expression of IGF-1. RESULTS: TA muscle wet weight in both WT and apoE KO mice showed a

decrease. There was no difference in AKT protein expression but a four fold increase was observed in p-AKT. IGF-1 data shows nearly 5 fold increase in WT and nearly 4 fold increase in apoE KO. In summary, aopE KO mice had an increase in IGF-1 and p-AKT levels during muscle regeneration. CONCLUSION: ApoE gene deficiency does not alter IGF-1 signaling compared to wild type mice during muscle regeneration. Future directions include learning more about the plasticity nature of skeletal muscle, and beginning to understand those pathways regulating that plasticity, examining later time points post injection, observing downstream targets, and measuring satellite cell activity.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Tyrone Washington, tawashin@uark.edu

OA #39
Subcategory: Physiology and Health

Sex Differences in Neuronal Activation During Siesta Sleep in Mice

Jeroson Williams, Morehouse College
Co-Author(s): Allison Brager and Ketema Paul, Morehouse School of Medicine
Alexandra Hightower, John Hopkins University

Mice, nocturnal animals, experience their largest periods of wake at night. The siesta in mice is the time period around midnight in which mice take a nap during their active period. During the siesta period, males have been found to be more tired than their female counterparts. Females are typically more active and sleep less than their male counter parts. With the understanding that there are differences in sleep activity for males and females this phenomenon raises the questions: What happens neurologically to create sex differences in sleep? What neural region is responsible for higher male sleep propensity? The genetic marker for sleep propensity has not yet been identified. This investigation can provide a means of identifying sleep propensity by classifying neuronal activity in sleep-deprived mice in their wake period siesta. c-Fos, a proto-oncogene, is associated with neuronal activity. By observing the neuronal activity of the mice, we can see which region of the brain is most active before the mouse falls asleep and determine whether or not sleep propensity is sex related. The central hypothesis of this investigation is that the areas of the brain responsible for sleep propensity will show more neuronal activity in male mice than in female mice. To observe the sex differences in mice during their wake period the male and female mice must equally be deprived of sleep for 24 hrs. All mice are gonectimized. The deprivation lasts until the siesta in which the mice are euthanized by cervical dislocation once they fall asleep. The brains of the mice will be harvested for further investigation. Immunohistochemistry is used to locate the biomarker c-Fos, which is a marker of neuronal activity. Because of the sex related sleep differences the mice have to be sleep deprived for 24 hrs as a control. In order to truly observe sex differences in brain activities all other sex unique hormones or responses must be removed. By euthanizing the animals while they are asleep you able to preserve the neuronal state of the mouse. The experiment yielded consistent results. The male mice in fact showed higher c-Fos levels in the regions of the brain that drives sleep, the ventrolateral preoptic area. Male mice displayed significantly higher levels of c-Fos. In the region of the brain that drives wakefulness, the suprachiasmatic nucleus, female mice had higher neuronal activity depicted by c-fos levels. This allows us to conclude that both sleep regulatory and circadian substrates mediate sex differences in sleep during the mid-active period. We can also state that sleep deprivation eliminated sex differences in neuronal activation in these areas.

Funder Acknowledgement(s): This work was supported by NIH grants (U54 NS060659, R01 078410, NSS21MD000101) and by the National Aeronautics and Space Administration Cooperative Agreement NCC 9-58 through the National Space Biomedical Research Institute (04-02-0013). The investigation was conducted in a facility constructed with support from Research Facilities Improvement Grant #C06 RR-07571 from the National Center for Research Resources, NIH.

Faculty Advisor: Keetma Paul, kpaul@morehouse.edu

OA #40
Subcategory: Plant Research

Ug99 Stem Rust Resistance in Barley

Andra Bates, University of Arkansas at Pine Bluff
Co-Author(s): Brian Steffenson, Austin Case, and Mary Brakke, University of Minnesota
Joseph Onyilagha, University of Arkansas at Pine Bluff

The goal of the project was to identify a barley line that is resistant to stem rust race Ug99 (also known as TTKSK). Ug99 is considered to be a major threat to world food security due to its virulence in over 97% of barley cultivars worldwide, including barley lines that have the Rpg1 gene. The only genes known to confer resistance to Ug99 are the rpg4/Rpg5 resistance locus that was characterized from the Steptoe x Q21861 cross. QCC was isolated from MCC in order to prevent contamination because it was discovered to be virulent on Rpg1 plants in North Dakota. It is crucial to segregate the two races in order to obtain optimum results and decrease error. Barley line Q21861 has a high resistance to QCC as well as race TTKSK and it contains both Rpg1 and rpg4/Rpg5. So this was our standard control. We injected the plants in their early stages by direct inoculation via needle injection of spore inoculum. Through the course of the barley plant's life time, the severity of each plant was rated and recorded with Allegro. Due to the fluctuating climates, we used various forms of inoculation in order to keep the process going: dew chambers and a low spray machine. After the plants continued their life cycle and became close to senescence, one barley line conferred resistance to stem rust in the nursery throughout its growth stages based on observational analysis. The line, IV/32, was found to actually have a higher resistance rating than the Q21861 standard that was used in the nursery.

Funder Acknowledgement(s): This study was supported, in part, by a grant from TCAP awarded to Dr. Steffenson, the Lieberman-Okinow Endowed Chair of Cereal Disease Resistance, University of Minnesota.

Faculty Advisor: Anissa Buckner, bucknera@uapb.edu

OA #41
Subcategory: Plant Research

Hydroponic Green Roof Systems for Conservation of Energy and Cooling

Tameka Bland, Virginia State University
Co-Author(s): Sarah Witiak, Shaundra Cook, and J. Mason, Virginia State University

Growing greenhouse vegetables is one of the most exacting and intense forms of all agricultural enterprises. Because of their many energy-saving and environmental benefits, green roofs are a promising technology for energy-efficient buildings. In combination with greenhouses, hydroponics is becoming increasingly popular, especially in the United States, Canada, Western Europe, and Japan. The use of a green roof compared to conventional roofing surfaces has a significant impact on the energy balance within a given building and on the immediate environment. Traditional green roofs can be quite costly and their weight requires special building designs. The main components are waterproofing, soil, and plants. The Executive Order 13123, Greening the Government, directs agencies to improve the energy performance of their buildings, reduce the use of potable water, and assist in curbing the greenhouse gas emissions. There are two distinct types of green roofs: extensive and intensive. An extensive green roof contains shallow soil and low-growing, horizontally spreading plants. These plants are primarily succulents that can thrive in the somewhat alpine conditions of many rooftops. In other words, there is not much water or soil, but the roof does experience a significant amount of exposure to the sun and wind. We tested a hydroponic green roof system on the Engineering Building of Virginia State University to expand the number of roofs that can support vegetation and to increase the variety of species that are planted. Three different crop plants, kale, mezuna and cherry tomatoes were grown with nutrients and water, and no soil. These systems were very water efficient, and supported crop plants that actually increased cooling through increased transpiration compared to xerophytes. The light dynamics and roof surface and air temperatures were measured. The leaf temperature of these crop plants was also measured to assess their cooling potential. We found that hydroponic systems promote cooling efficiently as well as produce crops that can be eaten. The results showed that though all plants were cooler than non-plant control, the kale leaves were much cooler than mizuna or cherry tomato plants. This cooling could be harnessed to increase the efficiency of rooftop solar panels as well by keeping air temperatures lower during the hotter parts of the day. We found that hydroponic systems promote cooling efficiently as well as produce crops that can be eaten.

Funder Acknowledgement(s): Dominion Virginia Power

Faculty Advisor: Shobha Sriharan, sriharan@vsu.edu

OA #42
Subcategory: Plant Research

Differential Expression of Proteins to Abiotic Stresses in Soybean

Nitya Murthy, Emory University
Co-Author(s): Ramesh Katam, Florida A&M University

Glycine max (soybean) is a legume that provides a significant source of proteins and fatty acids in both human and animal diets. The production of soybean is severely limited by several abiotic factors, which include flooding, and drought. Water stress (WS) is one of the most debilitating factors of soybean crops. Dehydration in plants can lead to a disruption in the water potential gradients, denaturation of proteins, and an unraveling of the cellular membranes. Heat stress (HS) affects germination by decreasing the seed vigor, which leads to difficulties in membrane biogenesis and germination. To obtain insight into the effects of WS and HT on molecular and cellular functions of soybean, changes in leaf protein composition was studied by 2-DE Gel electrophoresis complemented with Mass spectrometry. Two soybean cultivars were exposed to different heat and water conditions. Sixty-one proteins were differentially expressed in response to WS and HT in both cultivars. PD Quest analysis revealed at least 200 proteins in both cultivars. Differentially expressed leaf proteins were excised from 2-DE gel, and trypsin digested. The peptide sequence tags generated from the spots were queried through MASCOT search. Gene ontology analysis for each protein reveals functional categories including photosynthesis, metabolism, transport, stress and defense, and glycolysis. The majorities of heat responsive-proteins were up regulated during heat stress and combined stress in cultivar B; these proteins were down regulated to water stress. However in cultivar A, the heat shock proteins were generally down regulated to all levels of stress. Proteins involved in folding and biosynthesis were either over expressed or did not change due to heat stress.

This study reveals the differentially expressed proteins in two contrast genotypes and their possible role in drought tolerance, as well as the possibility of the plant's development of cross-stress tolerance. Our studies showed that differentially expressed proteins involved in antioxidant defense were mostly up-regulated, whereas proteins associated with photosynthesis, secondary metabolism, and amino acid and protein biosynthesis were down-regulated in response to heat stress.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF/REU awarded to Virginia Gottschalk, Assistant Professor, Department of Biological Sciences, Florida A&M University.

Faculty Advisor: Ramesh Katam, ramesh.katam@gmail.com

OA #43
Subcategory: Plant Research

Study of the Factors Influencing Agrobacterium-mediated Plant Regeneration

Ashley Norris, Fort Valley State University
Co-Author(s): Seema Dhir, Fort Valley State University

Moringa olifera Lam., commonly known as drumstick, has potential as a commercial medicinal and nutritional supplement. The present investigations were attempted to develop the rapid *in vitro* plant regeneration system and to standardize the *Agrobacterium tumefaciens* mediated transformation protocol from axillary shoot and via somatic embryogenesis. Axillary shoot growth was induced by supplementing MS medium with cytokinins. Of the three cytokinins tested, namely benzylaminopurine (BAP), kinetin (KN), and thidiazuron (TDZ), BAP at 2.5 μM was found to be optimal in inducing bud break, producing an average of 12-18 axillary shoots per explants after 4 weeks of culture. The elongated shoots were transferred individually on a root induction medium containing 0.5 μM indole-3-butyric acid (IBA) and within 4 weeks roots were produced. Fast growing white 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. Early detection of plant transformation events is necessary for the optimization and to enhance the virulence to increase the transformation procedures. For this purpose some important parameters like types of explants, co-cultivation time and optical density of *Agrobacterium* culture medium were studied. *Agrobacterium* strain containing neomycin phosphotransferase (NPTII) gene as selectable marker and β-glucuronidase (GUS) as a reporter gene was used for transformation. Transient and stable GUS expressions were studied in transformed explants and regenerated calli respectively. Highest transient GUS (70%) expression was observed at pH 5.8 after 3 days of co-culturing in 2-day-old explants. Optical density of 560nm=1 was considered optimal to obtain the highest transformation rate. Primary leaves showed higher transformation efficiency (80%) than hypocotyl (60%) or root (40%) explants. Results obtained were based on the percentage of GUS expression which was observed 2 days post-transformation. The optimized parameters evaluated in this study can be key factors for other recalcitrant Moringa as soon as the methodological are optimized in *Agrobacterium*-mediated 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.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #44
Subcategory: Plant Research

Characterization of Tomato Rub1/Nedd8-conjugating Enzymes SlUbc18/19

Dolapo Odeniyi, University of Arkansas at Little Rock
Co-Author(s): Lirong Zeng, Ravi Mural, and Bangjun Zhou, University of Arkansas at Little Rock

Ubiquitination has emerged in recent years as an important regulatory mechanism underlying plant immune signaling. The ubiquitination process attaches ubiquitin, a highly conserved 76-amino acid protein to a substrate through stepwise reactions mediated by three different classes of enzymes, ubiquitin-activating enzyme (E1), ubiquitin-conjugating enzyme (E2), and ubiquitin ligase (E3). Of the three enzymes, E2 ubiquitin-conjugating enzyme was often considered as "carrier of ubiquitin" with auxiliary roles that have seldom been investigated. Nevertheless, increasing evidences suggest that E2 is critical in determining the fate of substrates of the ubiquitination system and plays a key role in regulating mammalian immunity. Previously, we found by bioinformatics analysis the *Arabidopsis* homolog of tomato (*Solanum lycopersicum*) Ubc18/19 (SlUbc18/19) that encodes a putative E2 enzyme of the rubylation/Neddylation process was significantly induced upon pathogen infection.

To better understand the function of SlUbc18/19 in plant immunity, we cloned the two genes. Functional characterization of SlUbc18/19 via virus-induced gene silencing (VIGS) using *Nicotiana benthamiana* plants indicated silencing of SlUbc18/19 results in a stunted growth as compared to control plants, which is consistent with the previous finding that rubylation regulates plant response to developmental hormones such as Auxin.

Similarly to ubiquitination, rubylation attaches RUB (related to ubiquitin, or Nedd8 in yeast and vertebrates) to the Cullin subunits of the Cullin-Ring-like (CRL) E3 ubiquitin ligases through cascading reactions of the same classes of enzymes. SlUbc 18/19 and SlRCE 1, the Arabidopsis E2 enzyme for RUBylation share high percentage of similarity in their amino acid sequences. Based on the high homology of these proteins and the growth defect observed in our VIGS experiment, we hypothesize that SlUbc18/19 are involved in the Rubylation/Nedylation pathway and are crucial to plant development and probably immunity as well. The tomato genes involved in this pathway have been cloned. Presently, constructs for expressing and purifying recombinant proteins of these genes are being built. Additionally, *in vitro* rubylation reaction using the purified proteins will be reconstituted to determine the E2 enzymatic activity of SlUbc18/19 in the rubylation pathway. By manipulating the molecular mechanisms that impact plant immunity and development, knowledge gained from this study will facilitate the improvement of crops.

Funder Acknowledgement(s): This study was partially funded by the grants awarded to Dr. Lirong Zeng by the National Science Foundation Integrative Organismal Systems Program and United States Department of Agriculture/National Institute of Food and Agriculture, Biology of Agricultural Plants Program and the TRIO-Ronald E. McNair Postbaccalaureate Program.

Faculty Advisor: Janet Lanza, jxlanza@ualr.edu; Lirong Zeng, Lxzeng@ualr.edu

OA #45
Subcategory: Plant Research

Comparison of High Tunnel and Field Grown Ginger Root for Yield and Quality

Ibn-Raqib Rahim, Virginia State Universit , College of Agriculture
Co-Author(s): Reza Rafie and Chris Mullins, College of Agriculture, Virginia State University

Nationally, consumer demand for locally grown fresh fruits and vegetables is on the rise. In addition to this, consumers in the U.S are also considering food products with recognized health benefits. Ginger root is an Asian plant spice with numerous health benefits that has crossed over to the main stream American food market, and it is commonly used in different cuisines and beverages. In 2008, the United States imported a total of 41,468.3 metric tons of ginger with a value of 37.2 million dollars. The market demand for locally grown ginger roots is high. Currently most ginger that is grown in Virginia is produced under high tunnel condition. High tunnels, are unheated greenhouses that can help commercial farmers extend their growing season, therefore they can improve the profitability and productivity of their farms. Many farmers cannot afford to construct a high tunnel in their farms. No research information is available to show whether it is possible to grow ginger under field conditions in Virginia. An experiment was established to compare the yield and quality of field grown ginger (treatment A) with that grown under high tunnel conditions (treatment B). Each treatment was replicated eight times. Each plot contained three ginger plants. This experiment is currently on going, the plots for each treatment will be harvested in mid-November of this year. The data will be collected, analyzed and the results will then be presented at the next Emerging Researchers National Conference.

Funder Acknowledgement(s): This study was supported, in part, by a grant from Virginia Department of Agriculture and Consumer Services awarded to Reza Rafie, Professor, Horticulture Extension Specialist, College of Agriculture, Virginia State University.

Faculty Advisor: Reza Rafie, arafie@vsu.edu

OA #46
Subcategory: Plant Research

Diversity and Systematics of the Genus Dicymbe (*Leguminosae*; *Caesalpinioideae*)

Christopher Wellman, University of the District of Columbia

Members of the tribe *Deteriae* (*Leguminosae*; *Caesalpinioideae*) are of special interest because they are morphologically diverse, economically important and grossly understudied. Like other members of *Detarieae*, Dicymbe (20 spp.) occurs only on the Guiana Shield, one of the oldest geological formations in South America. Some species of Dicymbe have ectomycorrhizal associations, can form monodominant stands, and exhibit mass synchronized flowering/fruiting events. The genus contains both widely distributed taxa and narrow endemics found only on the tepuis. The biogeographic interest of Dicymbe is enhanced as its sister group, *Polystemonanthus,* is restricted to West Africa. No modern comprehensive monographic revision has been done for Dicymbe, and species boundaries remain unclear. This study surveys the utility of two additional plastid markers, psbA-trnH and matK, for species resolution. DNA was isolated using Qiagen Plant DNeasy. Amplification using polymerase chain reaction and fluorescent sequencing was done following established molecular methods. For herbarium collections, the Phire and Phusion Hot Start DNA polymerase (Finnzymes) methods were utilized. Phylogenetic inference was done using parsimony (NONA and PAUP).

We explored partitioned and combined morphological and molecular datasets to detect the level of information provided by different types of data and their potential incongruence. We found that the individual psbA-trnH and matK partions did not provide adequate variation to resolve all species. Using a total evidence approach combining previously attained morphological and trnL sequence data, radiation patterns of these Shield endemics are. The plastid data set included 750 molecular characters; 102 characters were phylogenetically informative including 8 gap characters. The plastid analysis showed moderately supported clades at the generic level and resolved some species level relationships. Furthermore, the matK and psba-trnH analyses, like recent family-and generic based phylogenies, placed *Polystemonanthus* as sister to Dicymbe. Future research will include exploring the utility of additional molecular markers including ITS, trnL, CNGC4, and rbcl for resolving species-level relationships. A comprehensive species-level phylogeny will allow us to explore and assess the relationships among tepui endemics, lowland taxa and the African sister group.

Funder Acknowledgement(s): This study was supported by the University of the District of Columbia's STEM program in providing stipend for the principal investigator and the actual research was funded by NSF-DIG and SI-BDG grants.

Faculty Advisor: Karen Redden, kredden@udc.edu

OA #47
Subcategory: Social Sciences/Psychology/Economics

Do Humans Have a Taste Perception for Fat?

Marlyn Bernardo, North Carolina A&T State University
Co-Author(s): Andre Hall, Vinaya Kelkar, Patricia Lynch, Catherine D. White, Mary A. Smith, and Jian Han, North Carolina A&T State University

In humans, taste is perceived by chemoreceptors called gustatory receptor cells, which assemble with other supporting cells to compose an individual taste bud. Each gustatory receptor cell contains a gustatory hair, which enters the outside environment of the cell through the taste pore to sense for molecules. As molecules mix with saliva in the mouth, they enter the taste pore and interact with the gustatory hairs, which in turn cause a taste sensation. The five specific tastes received by gustatory receptors are salty, sweet, bitter, sour, and umami which means protein related. The precise orosensory inputs engaged for dietary lipids and the role of the gustatory system in fat perception in humans are unknown. The purpose of this study was to discover if humans have gustatory receptors for tasting fat. Three types of food were used in the study: macaroni and cheese, lasagna, and vanilla cake. Two samples of each food type with high or low fat were prepared for gustatory tasting. Eleven young adult subjects participated in the study. The subjects were blind-folded and asked to taste the food samples and identify which contained the most of fat. The results showed that 100% of the participants were able to correctly identify the two different samples of macaroni and cheese (high fat or low fat), 92% for the lasagna, and 25% for the cake. Our preliminary results suggest that the subjects were able to detect the difference in some foods that varied in fat content (macaroni and cheese and lasagna) but not in cake. The high content of sugar in the cake might affect the gustatory receptor for tasting fat. To further confirm that fat content is the sole determining factor for fat tasting gustatory receptor, future study will be performed with larger size of the subjects (n=35).

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF awarded to Guoqing Tang, Chairperson of the Department of Mathematics, North Carolina A&T State University.

Faculty Advisor: Jian Han, jhan@ncat.edu

Chemistry and Chemical Sciences

OA #48
Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Use of Gaussian Computer Program to Study Hg+2 Coordination to 4-thiouracil

Kiersten Bethea, North Carolina A&T State University
Co-Author(s): Mufeed Basti, North Carolina A&T State University

Organism intoxication by organic and inorganic mercury has been shown to cause significant effects on its cells including the cell's level of RNA, and the RNA base composition. 4-thiolated uridine (S4U) and 2-thiolated uridine (S2U) are two of the naturally-occurring nucleoside modifications in the tRNAs of most organisms. Their presence is essential in the functionality of tRNA. Studies have shown that Hg+2 coordinates strongly to S4U and S2U where Hg+2 coordinates more strongly to S4U than to S2U. Thus, the roles of S4U and S2U in the coordination of Hg+2 to tRNA have significant importance. Other studies have shown that the bases of S4U and S2U (meaning 4TU and 2TU, respectively), whether in the monomeric or dimeric state, exist in several tautomeric forms.

In these tautomeric forms, the monomer or the dimer could be either neutral or negatively charged (the single negative charge is on the sulfur). In this research the computational chemistry of 4TU and 2TU in their neutral, ionic and dimeric forms, and these forms when coordinated to Hg+2, were studied. Using Gaussian software, the total thermal energies for all tautomeric forms of 4TU were calculated in both acetonitrile (ACN) and water media. Results indicate that the thermal energy of 4TU in the dimeric form in water is less than that in ACN suggesting that hydrogen bonding is the likely driving force for dimer

formation. The energy of the 4TU/Hg^{+2} 1/1 and 2/1 (ligand/metal) complexes were also studied. The results suggest that the complex when Hg^{2+} coordinates to an oxygen atom from one ligand and a sulfur atom from another is more favored than the complex when Hg^{+2} coordinates to two sulfur atoms from the two ligands. The results of this study will guide the future research about other metal complexes.

Funder Acknowledgement(s): This project was supported by NSF-funded Talent-21 Program at NC A&T State University

Faculty Advisor: Mufeed Basti, basti@ncat.edu

OA #49
Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Cloning and Characterization of the Regulatory Region of a PKC Novel Isoform

Alyssa Cobbs, University of Arkansas at Pine Bluff
Co-Author(s): Tatyana Igumenova and Taylor Cole, Texas A&M University

Protein kinase C, a family of eleven isoforms, has a variety of cellular functions including cell proliferation, apoptosis and differentiation. These serine/threonine kinases are used in signal transduction pathways and are associated with growth factor-dependent cellular responses. Protein kinase C isoforms are lipid-activated enzymes comprised of a regulatory domain and highly conserved catalytic domain. Protein kinase C δ is a novel isoform that lacks calcium coordinating acidic residues in its C2-like domain, differing from most conventional types of PKCs, and is activated mainly by diacylglycerol / phorbal 12-myristrate 13-acetate. In this study, cloning was the first method necessary to begin the process of characterizing the regulatory region of PKC δ.

During this process, we amplified the regulatory region of PKC δ and infused it into the expression vector, pet28A_SUMO. However, due to complications during the ligation process, the recombinant DNA of the regulatory region of PKC δ was not expressed. In addition to cloning, we did a series of induction, solubility and protein expression tests with other PKC isoforms. These tests were implemented on a three domain chimera which includes the regulatory regions of C1BC2 in PKC α and C1A in PKC γ. We obtained good expression with rosetta 2 pLysS cell lines and good solubility by inducing at 24°C.

Funder Acknowledgement(s): Gary Kunkel, Mary Bryk, and Tatyana Igumenova, Biochemistry and Biophysics Department, Texas A&M University.

Faculty Advisor: Antonie Rice, ricea@uapb.edu

OA #50
Subcategory: *Biochemistry (NOT Cell and Molecular Biology and Genetics)*

The Modification of Aspirin

Mandisa Taqqee, Savannah State University
Co-Author(s): Adegeboye Adeyemo, Savannah State University

Aspirin, also known as acetylsalicylic acid, is a salicylate drug, often used as an analgesic to relieve minor aches and pains, as an antipyretic to reduce fever, and as an anti-inflammatory medication. Aspirin was first isolated by Felix Hoffmann, a chemist with the German company Bayer in 1897. Salicylic acid, the main metabolite of aspirin, is an integral part of human and animal metabolism. While in humans, much of it is attributable to diet, a substantial part is synthesized endogenously. Aspirin also has antiplatelet effect by inhibiting the production of thromboxane, which under normal circumstances bind platelet molecules together to create a patch over damaged walls of blood vessels. We believe the chemical properties of aspirin can be modified by introducing certain atoms and group of atoms such as F, Cl, NH_2 and CH_3, to the phenyl ring or the side chain of acetylsalicylic acid. It is hoped that such modification could reduce most of the side effects associated with aspirin usage. Each reaction mixture in deionized water was gently heated in a boiling water bath for ten minutes. The reaction mixture was then chilled in an ice bath until crystals of aspirin were visible. A vacuum filtration apparatus was set up to decant the liquid and minimizing any transfer of the solid aspirin and each of its derivatives. Recrystallization was done by adding ethanol to the crystals and heated in a 60˚C water bath to minimize the impurity of the solution. The solution was then set in an ice bath to form the final needle-like crystals. The crystals were then washed with ice water and collected by the vacuum filtration and put aside to dry so the melting point and percent yield could be determined. We have successfully reconstructed the chemical reaction of aspirin in three different ways. The continued goal of this research is to compare the physical and chemical properties of each aspirin derivative with the original aspirin. The effectiveness of these aspirin derivatives will then be assessed and compared with that of aspirin.

Funder Acknowledgement(s): National Science Foundation/ PSLSAMP

Faculty Advisor: Adegboye Adeyemo, adeyemoa@savannahstate.edu

OA #51
Subcategory: Cancer Research

Beta-Nitrostyrene Synthesis

Sharla Gadson, North Carolina A&T State University

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 mechanisms which cause 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 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): Laboratory of Marion Franks

Faculty Advisor: Marion Franks, mafranks@ncat.edu

OA #52
Subcategory: Chemistry (NOT Biochemistry)

Antimicrobial Activity of Halogen-substituted Ferrocene Ketoenols

Jessica Cole, Claflin University

In the pursuit for unique metallorganic synthons with enhanced catalytic, molecular recognition, and bioactivity (Weng, Yang and Ho 2009) (Pan, Sin and Lai 2005), the incorporation of electroactive and photoactive organometallic moieties in the ligand skeleton is becoming more and more interesting. This research discusses the impact of structural modification on the redox properties of halogeno-substituted ferrocene-based ketoenolates and their ketoiminate analogues. The goal is to synthesize ketoimine analogues of ferrocene-based ketoenols with halides occupying various positions on the pyridine moiety and to test the impact of structural variations on electrochemical and biological activity. The hope is to establish a correlation between electronic effects in our ligand analogues with their antimicrobial effectiveness.

Antimicrobial studies have been performed with ferrocene-substituted heterocycles, such as fluorouracils, by Kowalski, et. al. In their experiment, they determined that one of their fluorouracil analogues linked to a ferrocene, which is similar to our halogeno-substituted ferrocene pyridines, significantly affected the growth of *S. epidermidis* and *S. aureus*. In our studies, we used four ketoenols and tested their antimicrobial effects against ten bacteria, both gram positive and gram negative. One of the ketoenols, Fcpy3Cl4acac, showed great antimicrobial affects against *S. epidermidis* and *S. aureus*. Further studies will be done using halogeno-substitued ferrocene ketoenols with varying halogen substitutions.

Funder Acknowledgement(s): Department of Defense (ARO Grant number #59042-CH-REP); NSF HBCU-UP

Faculty Advisor: Muthukrishna Raja, mraja@claflin.edu

OA #53
Subcategory: Chemistry (NOT Biochemistry)

Cleansing of Biogas While Effectively and Safely Removing H2S and CO2

Allison Hester, Howard University
Co-Author(s): James Kamau Mbugua, Howard University

The anaerobic digestion of biodegradable materials produces biogas, which contains the lethal gas, hydrogen sulfide. This by-product not only emits a rancid smell that can pollute an entire community's supply of water, but more importantly, poses both an environmental and life-threatening issue due to its high toxicity. This is specifically significant for international slum communities that have inadequate systems of waste disposal.

This research study served to find the most cost-effective and environmentally-safe method of removing hydrogen sulfide from biogas. The use of seven chemical agents, which included hydrogen peroxide, potassium permanganate, ferric chloride, ferrous sulfate, sodium hydroxide, potassium hydroxide, and Fe (III)/EDTA, as well as recycled rubbers and tires were compared individually to determine which procedure reduced the most amount of hydrogen sulfide. The chemical calculations conducted on each process indicated that an average of over 94.32% of the hydrogen sulfide was removed, which indicates the effectiveness of both the chemical and physical oxidizing agents. Four chemical agents – hydrogen peroxide, ferric chloride, potassium hydroxide and sodium hydroxide – were successful in generating a reduced amount of smell. The high cost of Fe(III)/EDTA renders it an inappropriate agent to be used in a wastewater treatment plant. The recycled tires and rubbers were determined to be the most cost-effective method and can be applied in a large-scale treatment plant; thus they are highly recommended for future use in hydrogen sulfide removal. It is also suggested that future studies investigate the use of a gas analyzer to reinforce the effectiveness of these chemical agents in removing hydrogen sulfide. I would like to thank my partner, James Kamau Mbugua from the University of Nairobi, who participated in the findings of this study.

Funder Acknowledgement(s): This study was supported by Professor G. Kamau and Dr. J. Mwaniki of the University of Nairobi and funded by the National Science Foundation (NSF). This material is also based upon work supported by NSF Grant No. 1238466. Any opinions, findings, and conclusions or

recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Tiffany Lathan Smith, tlathan@howard.edu; Wayne Patterson, wpatterson@howard.edu

OA #54
Subcategory: Chemistry (NOT Biochemistry)

Computational Modeling of Transition States of Organic Reactions

Darius Lang, Central State University
Co-Author(s): Daqing Gao, Central State University

Accurate evaluation of chemical reaction energies, transition state barrier heights and structural features are essential in understanding thermodynamic properties of chemical processes and mechanisms. This often requires high level *ab initio* molecular orbital calculations such as the gold standard CCSD (T)/CBS or MP2/CBS methods which are too computationally demanding to be practical in modeling many real chemical reactions. Thus, many approximate, computationally efficient density functional theory models have been actively developed over the past 15 years. There were examples showing failures in evaluating some organic chemical reaction energies and mechanisms of the most widely used DFT functional B3LYP which was developed 20 years ago. However, are there any dramatic improvements in many recently developed DFT functionals? Are these new DFT methods outperforming B3LYP in modeling some type of organic reactions?

We present results of our extensive benchmark, high-level electron correlation calculations of the reaction pathways and energies of both uncatalyzed and acetone-catalyzed decarboxylation reactions of aminomalonic acids with the MP4SDQ/6-311++G(d,p) and MP4SDQ/6-31+G(d), as well as MP2 calculations. The high level MP4 electron correlation calculations confirmed that both the uncatalyzed and catalyzed reactions are step-wise, non-concerted in the gas phase with two transition states and one intermediate structure. The computed relative reaction barriers for the uncatalyzed reaction for the reactant, transition state 1, intermediate, transition state 2, and product complex are 0, 12.94, 12.88, 31.7, and 29.2 kcal/mol, respectively, while for the acetone-catalyzed reaction, the corresponding values are 0.0, 10.8, 9.5, 27.3, 18.1 kcal/mol, respectively. The effect of acetone catalysis was evident from lowering of the barrier heights for the catalyzed reaction. We studied the reaction profiles of two decarboxylation reactions by 25 DFT methods including B3LYP, M06-2X, B3PW91, wB97x, wB97xD, etc.

We have obtained important and interesting observations. For example, for the uncatalyzed decarboxylation reaction, a step-wise mechanism with two transition states was found from MP4SDQ, B3LYP, wB97x and wB97xD calculations, while MP2, M06-2X, B3PW91 showed a concerted mechanism. All the MP4SDQ, MP2, B3LYP, M06-2X, B3PW91, xB97x, and wB97xD calculations gave a concerted mechanism for the acetone-catalyzed reaction. Results from all the 25 DFT functionals calculations are compared to the benchmark MP4SDQ values. The assessment of the DFT methods are needed as many of them are unreliable in evaluating some type of organic reaction barriers heights and energies, as well as structural features. Several selected DFT methods will be used to study other types of decarboxylation reactions.

Funder Acknowledgement(s): This research is supported by a HBCU-UP RIA grant from NSF awarded to Daqing Gao, Central State University, and by Ohio Supercomputer Center.

Faculty Advisor: Daqing Gao, dgao@centralstate.edu

OA #55
Subcategory: *Chemistry (NOT Biochemistry)*

Studies on the Reaction of Triorganotins and Picolinic Acid N-Oxide

Adewola Osunsade, University of the District of Columbia
Co-Author(s): Xueqing Song, University of the District of Columbia

Triorganotin complexes with O donors have been extensively reported, in which O atoms are bonded to the tin atom either covalently or via a coordination mode. Carboxylic acids have been widely used to prepare triphenyltin ester via a substitution reaction of either Triphenyltin Chloride or Triphenyltin Hydroxide. Recent research in our laboratory has been involved with synthesis of the picoline N-oxide adducts of triphenyltin. X-ray crystallographic studies have clearly shown the formation of a 5-coordination picoline N-oxide adducts of triphenyltin via an addition reaction. To see the competition between the two different reactions, Picolinic Acid N-oxide was used in the work.

We hypothesize that both the oxygen atom for N-oxide and the oxygen in carboxylic acid have the potential to bond to the tin atom. However, the tin atom in both triphenyltin compounds will preferentially bond to the oxygen in the carboxyl group of the Picolinic Acid N-oxide as opposed to bonding to the oxygen attached to the pyridyl group as the oxygen in the carboxyl group has a greater partial electron density. Reactions between Picolinic Acid N-oxide and triphenyltins were conducted. The reactions involved mixing the triphenyltin compounds with the Picolinc Acid N-Oxide in a 1:1 molar ratio dissolved in ethanol (1 mole of dicyclohexylamine was added to the Triphenyltin Chloride reaction to neutralize the possible by-product hydro-chloric acid). Both reactions were refluxed with stirring for two hours, and allowed to cool until a product crystallized out of solution. Preliminary results have shown the successful creation of a complex of Triphenyltin Hydroxide and Picolinic Acid N-Oxide. The products of the reactions were isolated and will be purified through recrystallization. To confirm the structures of the products, elemental analysis, Infrared (IR) and nuclear magnetic resonance (NMR) spectroscopies will be performed to determine the structure of the adducts. Suitable crystals will be sent for X-ray crystallographic analysis. Future studies will include bacterial studies to assess the toxicity of our complexes and comparing them to those of their parent compounds.

Funder Acknowledgement(s): Financial support from the Science, Technology, Engineering, and Math Program at the University of the District of Columbia is gratefully acknowledged.

Faculty Advisor: Xueqing Song, xsong@udc.edu

OA #56
Subcategory: Chemistry (NOT Biochemistry)

Preliminary Assessment of Volatile Organic Compounds

Raven Reed, Texas Southern University
Co-Author(s): Siobhan L. Tarver, Renard L. Thomas, and Bobby L. Wilson, Texas Southern University

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 petro-chemicals industries emitting VOCs, and the several days each year that it experiences a high ozone level. 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 followed by ground commercial parking garages. It can be assumed that the VOCs are greater where there is little to no ventilation.

Funder Acknowledgement(s): National Science Foundation, Texas Southern University College of Science and Technology.

Faculty Advisor: Bobby Wilson, wilson_bl@tsu.edu

OA #57
Subcategory: Chemistry (NOT Biochemistry)

Accurate Calculation of Hydrogen Bonding Interactions in Solution

Taylour Robinson, Central State University
Co-Author(s): Daqing Gao, Central State University

Hydrogen bonding plays an important role in structural biology, supramolecular chemistry and materials sciences. Recently, use of hydrogen bonding along with other type of non-covalent interactions has been instrumental in the design and synthesis of new functional polymeric materials with potential applications in many fields. The thermodynamic stability of hydrogen-bonded complexes in molecular recognition is controlled by many factors observed experimentally. Theoretically, some newly developed computationally less demanding density functional theory methods such as the Minnesota DFT family of functionals now are becoming popular in a broad range of applications in chemistry. In particular, it has been demonstrated that the M06-2X method was able to accurately evaluate hydrogen bonding interactions. We have obtained the free energies of association of 37 hydrogen bonded complexes which belong to medium and large size both in the gas phase at the M06-2X/cc-pvdz level and in organic chloroform solution at the SMD/M06-2X/cc-pvdz level. Some complexes were also studied in dichloromethane solvent. This represents the first comprehensive solution phase evaluation of free energies of association of H-bonded complexes which covered all the H-bonding interaction patterns of doubly and triplyH-bonded complexes.

We have justified that our computational protocol can give reliable interaction free energies of hydrogen bonded complexes in organic solvent chloroform and dichloromethane by comparing computed results to some experimental values which were determined through different methods and by different groups. We have obtained computational insights into the electronic, conformational, steric, preorganization, substitution and solvent effects to rationalize the experimental binding energy values of many structurally and energetically related complexes and some experimental inconsistencies. The many structures that we have studied in this work will be used to establish a database of medium- and large-size hydrogen-bonded complexes which will be used in benchmark studies of evaluating many newly developed density functional theory models.

Funder Acknowledgement(s): This research is supported by a HBCU-UP RIA grant from NSF awarded to Daqing Gao, Central State University, and by Ohio Supercomputer Center.

Faculty Advisor: Daqing Gao, dgao@centralstate.edu

OA #58
Subcategory: Chemistry (NOT Biochemistry)

Catalytic Conversion of Sugars to CMF Using Metal Chlorides

Britney Michelle White, Claflin University

As we know, fuel is a very significant topic in the world of energy. The movement for alternative fuel has gone towards renewable fuels. Scientists are exploring the idea of creating a product using a plant-derived substance to create biofuel. Compounds used as fuel contain a carbon count from 12-18. There are many intermediate compounds before getting to this point, and this is what the research focuses on. We proposed that we could make a functional protocol to synthesize Chloromethyl furfural, a key biofuel intermediate compound, using sugars. For this experiment, we used sugars, an acid, and metal chlorides to conduct our reaction. All these components were placed in a pressure-stoppered tube. The components were heated, mixed and refluxed for 2 hours. The tube was cooled to room temperature. The reaction mixture was worked up and washed successively. The existence of the product was verified by thin layer chromatography. The solvent was removed by rotary evaporation. The compound was confirmed by an NMR and GC analysis. The CMF was created, and we generated a protocol for the CMF using D-fructose, HCl and NaCl in Ch_2Cl_2; the parameters to obtain the results were 100°C for the heating temperature, 1:1.6 equivalence of the sugar to metal chloride, and a 2-hour reaction time.

Many different protocols and parameters were explored before for we reached the conclusion. A functional protocol was created that synthesized CMF from D-fructose. However, there are limitations for the synthesis of CMF from others sugars, for example, glucose. This method has a great promise with molasses. The yield was not great, but further research could potentially generate a method ideal for the synthesis of CMF using molasses. CMF is a key intermediate because now we can modify this compound to reach the 12-18 carbon. CMF is a multifunctional compound, where chemical modifications can be done on the aldehyde functional group, chloromethyl group, and the furan ring. The next step is to create a protocol to increase the carbon count.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the Defense Advanced Research Projects Agency awarded to Muthukrishna Raja, Associate Professor of Chemistry, School of Natural Sciences and Mathematics, Claflin University.

Faculty Advisor: Muthukrishna Raja, mraja@claflin.edu

OA #59
Subcategory: Water

Production of Biodiesel from Microalgae Growing at Ruai Wastewater

Patrick Beckley, Howard University
Co-Author(s): Phillis Emelda Ochieng and Daniel Waithaka, University of Nairobi

Large amounts of algae in the Ruai wastewater plant are a direct link to the staining of the finished treated water that flows into the Nairobi River. This discoloration is a poignant reminder of the plant's inefficiency. Development of biodiesel from the natural biooil produced from microalgae cannot only reduce the discoloration in the Nairobi River, but it also has sustainable energy potential that the company can use for its own energy consumption or economic gain. With the increased global demand for transport fuels, microalgae's unparalleled production of biomass appear to be the leading source of renewable energy that is capable of meeting these needs.

The intent of this study is to reduce discoloration and to produce biodiesel from natural microalgae grown in the Ruai sewage treatment plant. Developing 1 liter of biodiesel from Ruai's wastewater algae would allow for characterization of energy output from the wastewater biodiesel, biooil, and biomass. Microalgae was collected, characterized, sun dried, and soaked in hexane. Mass transfer separation methods like distillation were used to extract biooil from the biomass. Biodiesel was obtained by transesterfication conversion of biooil using methanol. A bomb calorimeter was used to determine thermal energy in dry biomass, biooil, and biodiesel. Results showed decent energy output affirming algae from Ruai's wastewater's energy potential. Considerations for scale-up processes would be the use of a hydraulic press to extract biooil from biomass after sun drying. In Nairobi, a lot like the rest of the world where energy demand exceeds the amount of available energy, wastewater biodiesel would enhance sustainable efficiency and provide renewable clean energy.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Wayne Patterson, wpatterson@Howard.edu

Computer Sciences and Information Management

OA #60
Subcategory: Computer Engineering

Cryptography and the Eclipse Software: A Glimpse of Eclipse

Cherith-Eden Clements, Howard University

This study examined methods of encryption and decryption in relation to the implementation of programming languages in embedded devices. Both methods derive from the ancient study and practice of cryptography, once used for secure communication in the presence of third parties. Most modern cryptography is primarily composed in mathematical theory and computer science. It is commonly used to maintain confidentiality when sending important digital documents. We hypothesized this technology could be implemented into mobile applications.

Consequently, we programmed an Android application to encrypt and decrypt plaintext messages, based on user input and using four different algorithmic ciphers. This type of application was selected because the majority of Android software, both mobile and PC, is compatible with this type of application. Then, we measured factors such as time, CPU, and battery usage to evaluate overall program functionality on Android mobile phones. An evaluation of this caliber was necessary to present the question of why an application of this design (i.e. that included the most common cipher commands) is not currently available on the market. We expected this was due to the complexity of the Dalvik and Java programming languages used in the Android developer program, Eclipse (2004). The coding process composed of two main parts: understanding the Dalvik and Java programming languages, and correctly implementing such syntax.

Once the coding process was completed, we found using these programming languages was far less complex than originally perceived and was based on an object-oriented design. However, this was a small-scale version of an application and could use multiple algorithmic ciphers. Currently, there is no Android application successfully incorporating multiple algorithmic ciphers within a single energy efficient program, due to hardware and software limitations. Based on these results we concluded this modern process of mobile encryption and decryption can occur, but is limited by today's mobile devices, and Android's UI. With this in mind, making a full scale version of this program would prove quite difficult. If future updates to Android's UI system and mobile hardware were to support mobile cryptography applications that contain multiple algorithmic ciphers, users could utilize encryption and decryption methods outside of a normal PC environment. This would greatly benefit the future of mobile-specific clients and their data security.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Silas E. Burris, burris.silas@gmail.com

OA #61
Subcategory: Computer Engineering

Time Characterization and Protocol of Optical Control Signals

Jordan Davis, Cornell University/University of California, San Diego
Co-Author(s): George Papen and Alex Forencich, University of California, San Diego

This project is based on a prototype hybrid optical circuit-switched/electrical packet-switched network for datacenters called Mordia (Microsecond Optical Research Datacenter Interconnect Architecture). Mordia utilizes an electrical packet switch and an optical circuit-switched architecture stemming from a wavelength-selective switch that has a measured mean port-to-port network reconfiguration time of 11.5 µs. The performance of large-scale data centers is limited by the internal network connectivity. Researchers have addressed this issue by developing hybrid network architectures that consist of a combination of electrical switching and optical switching. Part of the Mordia project is testing new photonic devices in a testing facility that is remote from Mordia. This involves remotely delivering data control signals to various photonic devices. Through interactions with Mordia, these devices can be tested on a systems level for performance and reliability. The purpose of this project is to characterize the time required to transmit, propagate, and decode these control signals. First a direct fiber optic connection is established from the Mordia control processor to the prototype optical devices. A FPGA (Field -Programmable Gate Array) then receives and decodes Ethernet frames containing the control signals, sent from Mordia. We conclude there is a 9 ns transmission delay to propagate a signal from Mordia to a prototype photonic device. The FPGA is also responsible for decoding a protocol created to interact with any connected photonic device. The current plan is to use this system to test a prototype hybrid-integrated silicon photonics switch developed by IBM.

Funder Acknowledgement(s): This project was supported, in part, by a grant from the NSF awarded to CIAN-ERC and Nasser Peyghambarian, University of Arizona.

Faculty Advisor: George Papen, gpapen@ucsd.edu

OA #62
Subcategory: Computer Science & Information Systems

An Implementation of a Biological Data Management System

Jaleesa Harrigan, Howard University

Due to the relative increase of diseases in Africa, efforts have been made to efficiently locate and understand the sources of these local maladies. It is important to understand the populations at risk and their associated environmental factors in order to detect diseases at an earlier rate, with a higher accuracy, and with the ultimate goal of developing new drugs to treat these diseases. This research study evaluates the effectiveness of a bio-specimen data management system in assisting with disease control. Using a combination of genomic science and correlating forms of technology, a BioSampler Application was developed as an implementation of a barcode reader that scans and submits testing information collected from the bio-specimen bank into a private online database. While this application is not complete, it shows promise in providing an efficient means of storing this testing information. Implementing several modifications to the application, which include privacy and security settings as well as a camera function to call another barcode reader application, will make this BioSampler Application an effective method to enhance the current bio-specimen data management systems used across the globe.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Rowena Royan, rowena.royan@gmail.com

OA #63
Subcategory: Computer Science & Information Systems

Exploring the Creative Destruction of 3D Printing Through IP Analysis

Benjamin D. Horne, Union University/Cornell University
Co-Author(s): Stephanie M. Santoso and Stephen B. Wicker, Cornell University

Extreme growth in the consumer 3D printing market, recent government support, acquisitions by key 3D printing industry players, and high research and development efforts in both academia and government are strong indications that 3D printing is undergoing what Austrian economist and political scientist Joseph Schumpeter called, “creative destruction.” In this paper, we examine the development of 3D printing through the lens of Schumpeter’s creative destruction. Simply put, creative destruction is the idea that periods of innovation destroy established corporations, while new enterprises emerge, take root and become economic drivers. Not only have we noted early indications of creative destruction in the 3D printing industry, but we have also noted that intellectual property and peer-to-peer information sharing has driven or stifled technical innovation in the past, including in the 3D printing industry. Here we focus on how the tensions between the technology’s open source movement, peer-to-peer sharing of digital object designs and efforts to protect intellectual property associated with the technology impact who can use the technology, how it can be utilized and how the technology will evolve moving forward. This research consists of a combination of case study analysis, informal discussions with members of the 3D printing community and an online survey designed to understand the sharing practices and intellectual property concerns of those who are using the technology. Some salient findings of the survey include increasing accessibility and geographical localization of 3D printing technology, continuous concerns of enterprise control of the technology through patents despite many key patents expiring in the early 2000s and new concerns of online repositories claiming ownership of users shared 3D object designs. We assert that creative destruction has not taken place in the 3D printing industry, but “creative erosion,” which is a movement towards creative destruction, is fully underway.

Funder Acknowledgement(s): Team for Research in Ubiquitous Secure Technology (TRUST)

Faculty Advisor: Stephen B. Wicker, SBW11@cornell.edu

OA #64
Subcategory: Computer Science & Information Systems

Perception or Reality

Paquilla Jones, Howard University

Augmented reality is a computer science tool that can be used in science to create a controlled virtual environment for testing. Fear is a primitive human emotion that is present when terror is present and phobia is an exaggerated, inexplicable and illogical fear of a particular object. The main difference between fear and phobia is phobia is irrational and fear is innate. This paper explores the use of exposure therapy using perceptual computing to create a therapy tool for Ophidiophobia or the fear of snakes. In this paper we focus on the differences between fear and phobia, how fear and or stress can be measured using EEG equipment and the ethical issues with using exposure therapy. A base line was not established during the research; this led to inconclusive results. Ethical issues in this research include putting people through the traumatic environment of exposing them to their phobia and is still under research to establish the best ethical treatment.

Funder Acknowledgement(s): This research study was supported by Paul Angelo Cabrera, Raul William Liobrera and Maxwell Clement Lozno of the Computer Science Department of Ateneo De Manila University, who were the principal investigators of this original research study. This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Rowena Royan, rowena.royan@gmail.com

OA #65
Subcategory: Computer Science & Information Systems

Computer Vision Research

Sarah Jones, Howard University

Computer Vision is a relatively new science that combines artificial intelligence and optics. Recent work has been devoted to finding new methods and algorithms that will support research on machine learning and object recognition. In order to accomplish this task, past research has found that the use of specific image features are necessary (e.g. color, texture). The objective of this study was to identify effective methods that specifically used RGB data features that recognize colors in an image or texture-based features that recognize repetitive elements on a surface for object recognition. After an extensive literature review, we selected a method called “Color Texture Moments for Content Based Image Retrieval” (CBIR) developed by Yu, Li, Zhang, and Feng (2002). In our estimation, this theoretical and methodological framework has the potential to make significant contributions to the current computer vision research field. This method represents image contents using both RGB and texture-based features, and argues that the combination of the two features, as opposed to the typical use of just one feature, will result in improved computer vision.

While implementation of this method is still underway, we anticipate CBIR will work seamlessly in conjunction with current computer vision research. The overarching goal of this research is to develop machine technology that can replicate how humans perceive things and eventually identify objects with human precision. Specifically, we hypothesize that implementing this method will improve the current computer vision technology used in physics and neurobiology, and will have practical implications for military research.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.

Faculty Advisor: Silas Burris, burris.silas@gmail.com

OA #66
Subcategory: Computer Science & Information Systems

Evaluating the Impact of Subnet Management on Network Performance

Fabrice Mizero, Philander Smith College

The performance of the parallel message passing application greatly relies on the quality of the network. The Infiniband Architecture provides high bandwidth, low latency communication for parallel message passing applications. However, network congestion, ineffective routing, topological issues, and the way in which the subnet manager deals with dysfunctional links can contribute to unexpected poor network performance. In particular, the Infiniband subnet manager constantly scans the entire network to identify dysfunctional links. Dysfunctional links will force the recalculation and distribution of new routing tables. In large-scale networks with a large number of dysfunctional links, the recalculation overhead can be significant, thus leading to unexpected performance variability.

Our research throughout the summer has been focused on identifying the main causes of Yellowstone (NCAR Supercomputer, 17th Top500) latency issues, correlating them to the overhead associated with the Subnet Manager (OpenSM) tasks, and evaluating how changes in routing algorithms could help lower the aforementioned overheads. Using the Infiniband Management Simulator (IBMgtSim), we simulated a virtual infiniband fabric. On top of the fabric, we booted up a subnet on which to conduct our experiments using the Infiniband OpenSM. Experiments consisted of failing different links in the fabric, replacing the routing algorithms, and recording the subnet recovery times. On average, we found a 6s overhead caused by subnet management. In addition, the more the number of dysfunctional links in the fabric, the longer the overhead.

In conclusion, parallel message passing applications, running on a large scale network with dysfunctional links, can suffer huge overheads due to subnet management.

Funder Acknowledgement(s): This research was funded by an NSF grant to John Dennis, National Center for Atmospheric Research, Summer Internships in Parallel Computational Sciences.

Faculty Advisor: John Dennis, dennis@ucar.edu

OA #67
Subcategory: Computer Science & Information Systems

Development of an Outbreak Mapping and Surveillance System for Francophone

Naomi Nkinsi, University of Washington/Harvard Medical School
Co-Author(s): Sumiko Mekaru, Clark Freifel, and John Brownstein, Boston Children's Hospital

The use of online news reports and social media as a means of public health surveillance such as the HealthMap web and smart phone applications have successfully provided real-time information to the public and health officials. Providing up-to-date disease outbreak alerts relies heavily on compiling and processing large volumes of data from various official and unofficial news sources, and different settings require different techniques. For some regions of the world, global surveillance networks like HealthMap have had difficulty collecting data for use in their systems. We describe the process by which real simple syndication (RSS) feeds are integrated into the existing HealthMap infrastructure to increase incoming data from an area of comparatively limited coverage in the HealthMap system, Francophone Africa. Using integration of RSS feeds allowed for the collection of 143% more data than the traditional method of scraping Google News.

While much of this data was irrelevant, as it was not related to disease events, this approach detected several disease-related events which were missed by the established approach. With additional refinement to reduce the volume of irrelevant alerts, the newly developed system will supplement the existing approach by capturing events that would otherwise be missed, thereby improving the overall sensitivity of the system.

Funder Acknowledgement(s): This research was funded by USAID/WCS grant (GHN-A-00-09-00010-00) awarded to John Brownstein, Harvard Medical School Training Grant (T32HG2295 -10) and the i2B2 grant (U54LM008748-09).

Faculty Advisor: Sumiko Mekaru, Sumiko.Mekaru@childrens.harvard.edu

OA #68
Subcategory: Computer Science & Information Systems

Gaming Instructional Module for Array and Objects Using Virtual Reality

Emmanuel Ossuetta, Bowie State University

Programming language such as Java, C++, and Python include key terminologies such as; arrays and objects. Sometimes, key programming terms are difficult for students to comprehend, especially students who are newly introduced to arrays and objects. Testbook authors try to solve these problems by repetitively changing the illustrative design of the textbook for every edition produced, which isn't enough to simplify the structure of an array.

The goal of this project is to create a gaming instructional module for computer science students using Virtual Reality educational course modules with more inquiry-based problem-solving activities, and hands-on experiences. Programming courses are offered in universities as general education courses and include students from biology, mathematics, nursing, etc. Programming courses are typically considered as difficult by college students and exhibit high failure rate. Through the use of this gaming instructional module, students will be able to learn the concepts of multidimensional arrays and objects.

Our hypothesis is that the use of gaming instructional modules will lead to better student learning outcomes. We propose to conduct user studies after the gaming modules are developed to prove our hypothesis. We intend to build an interactive module to help students get a better grasp of what an array structure should be, and how its functions could be implemented before or while taking the class.

Our proposed instructional module uses a gaming metaphor in demonstrating the concepts of Multidimensional Arrays and objects. The proposed model is designed and developed using 3Ds Max and Vizard. We have created a 3D grid table as a structured array. With the help of a standby avatar created as an instructor, users would be able to navigate their way through the game module. First the avatar introduces the concept of the game and then the user clicks the "s" button to start the game. Also, on the left side on the screen, there is a list of object tools the user would use as data examples for the array grid table. As the game starts, the instructor randomly generates question trivia for the users to answer, by doing so the user would advance to the next level. If by any chance the user gets stuck in a complicated trivia question which they're unable to answer, they can press "Space-bar" key for the instructor to lend a helping hand. In conclusion, the game module is currently in its development stage.

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 #69
Subcategory: Computer Science & Information Systems

A Dish Named Augmented Reality

John Rose, III, Norfolk State University
Co-Author(s): May Hou, Norfolk State University

Augmented Reality (AR), is one of the hottest technology trends that is gaining momentum with mobile device and video game console users. This technology involves using a camera that identifies a picture, a physical object, or an AR code. These items are known as markers. Once the marker is identified, a 2D image or a 3D model, which gives instant visual aids, will appear to be there as if they are real through a live feed to a mobile device screen, a computer monitor, or a television. When combining virtual objects with the real world environment, one can use this as a cost effective means to accomplish otherwise expensive tasks. One of the biggest problems in America is obesity. We believe that the obesity problem can be reduced if people are aware of what they are eating. The focus of this project will be to use AR technology to create an android application to help users identify what type of food they will be ordering from a restaurant menu. When the user scans the image of the menu item, a virtual model will appear. Along with the virtual image, an information panel will pop up. This panel can tell the user the ingredients of the item and the nutrition facts. The 3D models that appears using AR can be a replacement for real nutrition cards. AR codes inside restaurant menus can be used to display the menu items in real time to the user. Furthermore, this application will be able to help users stay on track with their diets or to check to see if there any ingredients listed that they are allergic to. So the users will be more conscious about their intakes. In conclusion we have currently successfully implemented two 3D models for a pizza and fruit dish into the android application. Our future project will be to create an effective food ingredient and recipes database. The application will help the user fight obesity and keep them aware of the ingredients and nutrition facts instantly over every item ordered.

Funder Acknowledgement(s): NSU STARS Program grant number-0714930

Faculty Advisor: May Hou, mthou@nsu.edu

OA #70
Subcategory: Computer Science & Information Systems

Educational Module: Programming Loops and Conditions Using Virtual Reality

Jeff Ruffin Jr., Bowie State University

Starting an educational career in computer science or computer technology can be a very challenging journey. There are so many languages to learn and concepts to remember with C++ being the main language taught at colleges. What if there was a visual way to visualize the concepts of programming and give students a way of learning basic concepts of C++. Alternatively, using method of teaching via gaming that can help students grasp these concepts faster than just using the traditional notes in a classroom and running a compiler for feedback. Using Virtual Reality as a platform, this project uses a gaming approach to create a visual experience for students in the early learning stages of computer science.

Our hypothesis is that the use of instructional modules will lead to better student learning outcomes. We are conducting user studies to prove our hypothesis. We intend to build an interactive module to help students get a better grasp of what a looping structure should be, and how its functions could be implemented. Our proposed educational module is developed using WorldViz Vizard toolkit. Upon starting the educational module a displayed description informs the students about the concept of the game. In practice mode, the student is able to get a feel for how the game operates. A menu on the top left of the screen is where the student can select a game to play for concepts such as if/else statements, nested if/else, nested if/else in a specific order, if/else/if, switch statements, for-loop, and while loop. Each concept selected has a display informing the student how to accomplish the goal of each game. The game is a shooting game that has rows of color coded ducks. The red duck has the lowest score while the green duck has the highest. The ducks move at a variable speed. Using the mouse for aiming, the student will shoot a ball at the ducks. Depending on which game has been chosen, the collision triggered animation will occur if the right concept has been followed for that game.

Methods used to develop this game involve two phases. In the first phase, 3ds Max was used to model the 3D environment suitable for the game. The 3D environment was then exported as an IVE file for further development in Vizard. In the second phase, Vizard was used for developing the game mechanics in python language. Finally an executable file was created for the game so that it could be used on multiple computers. In conclusion, the game is complete, and the user studies are in progress. The game runs smoothly; it was tested on multiple computers and laptops. So far user testing has been limited to the VR lab students who gave feedback about the game. We believe, the visual concepts of looping will help students learn the concepts faster and more effectively. This will lead to more gaming instructional modules being developed for other concepts such as arrays, linked list tree or any other programming concepts that students struggle with.

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 #71
Subcategory: Computer Science & Information Systems

A Scalable Classifier-based System to Detect Smartphone Malware

Waled Tayib, Tennessee State University
Co-Author(s): Husam Adas, 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. The worldwide market penetration of Android based smartphones has attracted attention of malware developers. A study conducted by the Department of Homeland Security in 2012 shows that 79% of malicious attacks infect Android smartphones. This research project presents a lightweight real-time classifier of URLs generated by smartphone web browsers to determine if the associated websites are malicious. The classifier is implemented on a Hadoop-based cloud-computing platform to ensure real-time response. First, the performances of three different machine-learning techniques in the Mahout library were examined in order to choose the best classifier. After testing, results showed that the decision forest technique was much faster compared to the Naïve Bayes and logistic regression methods. Also, performance evaluation of the system has shown that 85-90% accuracy is achieved with a response time of 120 milliseconds.

Funder Acknowledgement(s): This study was funded in part by the NSF Research Initiation Award granted to Sachin Shetty, College of Engineering, Tennessee State University.

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

Ecology, Environmental and Earth Sciences

OA #72
Subcategory: Civil/Mechanical/Manufacturing Engineering

Are Hydrogen Vehicles Still A Rational Investment?

Joshua Brown, Howard University
Co-Author(s): Jordan Gill, Howard University
Huseyin Yavasogluh, Istanbul Technical University

Hydrogen is a well-known, abundant element that is believed to be the next major fuel source for automobiles because it contributes to fuel efficiency nearly double that of fossil fuel automobiles. According to the Istanbul Metropolitan Municipality, there is an overwhelming number of public transportation vehicles, including 5,356 buses as well as approximately 25,000 taxis in Istanbul, Turkey. These vehicles are the cause of excessive amounts of exhaust and emissions being released into the atmosphere, which fueled the initiation of a hydrogen fuel cell-powered bus designed by engineering students at Istanbul Technical University. The purpose of this research was to examine the global feasibility of hydrogen fuel cells for use in everyday vehicles and how it is applicable to public transportation in Istanbul. A literature review that encompassed engineering thesis papers as well as upcoming motor company and university-based research on hydrogen fuel cell vehicles was conducted to investigate their effectiveness in reducing the amount of vehicle emissions, the safety of hydrogen as a fuel source, and finally, the feasibility of the mass-production of hydrogen fuel cell vehicles. This research indicated that, after major breakthroughs in 2013 that significantly lowered fuel cell costs, as well as government support, the hydrogen fuel cell has become more affordable in the private sector, making it an excellent new alternative for public transportation.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Tiffany Lathan, tlathan@howard.edu

OA #73
Subcategory: Ecology

How Aphid Endosymbionts Affect the Survival of the Invasive Lady Beetle

Candice Gaul, Spelman College

An endosymbiont is an organism that lives cooperatively within another organism. Primary endosymbionts generally provide essential nutrients to their host. Facultative endosymbionts can aid in host survival via protection against parasites, pathogenic organisms, extreme climates, etc. One well-characterized system in which to explore the effects of endosymbionts on their host species is the pea aphid *Acyrthosiphon pisum*. This experiment sought to determine if predatory ladybeetle survival is affected by the type of symbiont harbored by their aphid prey. We hypothesized that the presence of aphid facultative symbionts would lower the fitness of their lady beetle predators by significantly affecting the larvae survival to pupation, survival from pupation to adulthood, and weight at emergence. Adult, larvae, and eggs of the invasive ladybeetle *Harmonia axyridis* were collected from Spelman College. They were fed symbiont free aphids. Their eggs were collected, raised, and fed aphids harboring either the enodsymbionts *Hamiltonella*, *Serratia*, or *Regiella* or aphids without a facultative symbiont. Ladybeetles were fed daily and weighed on larval day eight, pupation, and

adult emergence. Survival from hatching to pupation was not affected. However ladybeetles fed aphids with *Hamiltonella* weighed significantly more at larval day eight than those fed other aphids and were 12.96% more likely to die during pupation. Ladybeetles fed aphids with *Regiella* weighed significantly less than those fed other aphids at adult emer-gence. These data indicate that the type of symbiont present in the aphid prey does affect survival, supporting the hypothesis that the aphid's facultative symbionts affect the fitness of their lady beetle predators via survival from pupation to adulthood and weight at emergence. This demonstrates yet another benefit endosymbionts can confer on their host. The next step is to determine whether the endosymbionts provide nutritional value to the aphid and in turn the ladybeetle by way of additional/ fewer proteins based on the type of endosymbiont present.

Funder Acknowledgement(s): This study was supported by NSF/ASPIRE Spelman College.

Faculty Advisor: Jennifer Kovacs, jkovacs@emory.edu

OA #74
Subcategory: Ecology

Support for the Inverse of Bergmann's Rule in Slevin's Bunchgrass Lizard

Ivan V. Monagan, Jr., Virginia State University

Bergmann's rule is an ecogeographic principle postulating an intraspecific increase in body size with increasing latitudes or increasing elevation, each correlating with decreasing environmental temperatures. The influence of body size on thermoregulation is the primary physiological basis for this rule. A decreased surface area to volume ratio of larger body size increases an animal's ability to retain heat and sustain internal temperature. There is general support for this rule in homeotherms (e.g., birds and mammals) which maintain body heat through metabolism. The application of Bergmann's rule to ectotherms (e.g., reptiles) which acquire heat via thermoregulation, remains controversial. Larger body size in ectotherms should be selected in cooler environments because of the increased time necessary for heat absorption to carry out daily functions when compared to smaller sized conspecifics.

However, research on a number of spiny lizards (genus *Sceloporus*) show support for Bergmann's rule. We use Slevin's bunchgrass lizard, *Sceloporus slevini*, a species that occurs at both high and low elevations to test the hypothesis that ectotherms should show a reversed size relationship than the one hypothesized by Bergmann's rule. Body size measurements to the nearest 0.01 mm were taken using digital calipers from five populations from high, mid-range and low elevations in southeastern Arizona. Body size at different elevations was compared using a one-way ANOVA and pairwise differences in means were evaluated using Tukey's multiple comparison test (when the overall ANOVA's were significant). Our findings demonstrate a significant size difference between high and low elevation populations. The mean body size (snout-vent length) of individuals at higher elevations was significantly smaller than conspecifics at lower elevations ($F_{4,100}=5.40$, $p= 0.001$). These results indicate an inverse correlation to Bergmann's rule. Rapid thermoregulation in ectotherms, achieved by decreased body size and increased surface to volume ratio, supports a physiological explanation for this phenomenon. Future research involves understanding the interaction of factors such as sexual selection on male body size and female fecundity, factors that may help explain why all ectotherms don't follow the inverse of Bergmann's rule.

References: Angilletta, M.J., Niewiarowski, P.H., Dunham, A.E., Leache, A.D. & Porter, W.P. 2004. Bergmann's Clines in Ectotherms: Illustrating a Life-History Perspective with Sceloporine Lizards. American Naturalist. 164(6):168-183.

Ashton, K.G. & Feldman, C.R. 2003. Bergmann's Rule in Nonavian Reptiles: Turtles Follow It, Lizards and Snakes Reverse It. Evolution, 57:1151-1163.

Bergmann, C. 1847. Uber die Verhaltnisse der Warmeokonomie der Thiere zu ihrer Grosse. Gottinger Studien, 3:595-708.

Funder Acknowledgement(s): I thank K. Robinson and P. Scott for help in the field. L. Kennedy and R. Cogan at the National Audubon Society Appleton-Whittell Research Ranch provided logistic support. I also thank A. Ansari and P. Kaseloo for their help. Funding was provided by an NSF/ HBCU-UP grant to C. d'Orgeix.

Faculty Advisor: Christian d'Orgeix, cdorgeix@vsu.edu

OA #75
Subcategory: Environmental Engineering

Subterranean Termite (*Reticulitermes* sp.) Mortality and Preference to Three Different Formulations of Poly (N-vinyl caprolactam)

Ishara Emerson, Spelman College/Morehouse College

Termites are extremely efficient examples of cellulose degradation into simple sugars. Because of this, analysis of the digestive process of termites can be used as a potentially cost and energy efficient model 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 three different formulations, each with a different molecular weight, of a combination of cellulose and synthetic fibers, known as Poly (N-vinyl caprolactam) [PVCL], which were labeled PVCL-1, PVCL-2, or PVCL-3. The termites were collected on the campus of Morehouse College and the

Atlanta Outdoor Activity Center (OAC) located two miles away from Morehouse.

The two questions posed in this study were: Will there be a difference along the three different PVCL's in regard to toxicity, which was measured by weight and mortality and will the termites prefer one type of sample over the other two which was measured by feeding duration and the number of physical contacts with the different samples? In addition to presenting the termites with the three types of PVCLs in the lab, we also add a fluorescent tag dichlorotriazinylaminofluorescein (DTAF) to allow us to detect the enzymatic activity under a fluorescent microscope. The termites were starved for 48 hours, then 10 termites were put in petri dishes with fluorescent tagged PVCL, 1,2, or 3. It has been hypothesized that termites used in our study would have a higher preference for one PVCL/cellulose over the others, and it was anticipated that this preferred PVCL would have a lower toxicity.

This experiment consisted of three phases: conjugating the DTAF to PVCL/cell sample, conducting the feeding experiment, and fluorescent microscope imaging. The DTAF fluorescent microscope imaging showed cellulose activity was easily detected within the abdomen of the termite after six days of feeding the termite groups PVCL-1/cell/DTAF. PVCL-1 and PVCL-3 yielded the two lowest changes in weight and PVCL-1 yielded the lowest mortality rate. An additional experiment to study preferences in the termites was conducted. Ten termites were placed in a petri dish with PVCL 1,2, and 3, and they were video recorded for six hours. To code the data (feeding duration and number of physical contact to the PVCLs) we used the Observer XT 11 program, which is a highly advanced system for the collection, management, and analysis of observational data. According to the number of contacts and duration, the data suggests that PVCL-1 was most preferred. 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.

Funder Acknowledgement(s): This research is supported by the following grants: NSF-HRD-1043330 and Morehouse College M-WISE Program

Faculty Advisor: Duane Jackson, djackson@morehouse.edu

OA #76

Subcategory: Plant Research

A Study on Camassia Quamash on the Flathead Indian Reservation

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 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 predictive modeling for *C. quamash* habitat, and such modeling could prove very useful to any conservation efforts that could be made. Based on a literature review of this plant's eco-physiology, a model of habitat suitability was created reflecting these characteristics. The traditional ecological knowledge of this plant's habitat requirements gives 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. More research will be needed to accurately measure buffer zones, soil types, and vegetation indices. This kind of modeling could provide a tool for restoration of camas into ecosystems across the Northwest and is of special concern to the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation where this research was conducted.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Patricia Hurley, pat_hurley@skc.edu

OA #77

Subcategory: *Plant Research*

Cucumber Necrosis Virus Investigating Virus Transmission

Sharnice Johnson, Mississippi Valley State University
Co-Author(s): Thomas Smith, Aaron Allen, and Miriam Khalil, Danforth Plant Science Center, St. Louis

Cucumber Necrosis Virus (CNV) is not your typical plant virus. This particular virus is more like an animal virus than nearly all other plant viruses. CNV is transmitted by the zoospore, *Olpidium bornovanus*. Like animal viruses, it has specific receptors on the vector surface; polymers of mannose. This is unique because there is no other known example of a receptor for a plant virus, nor is there any structure of an animal virus complexed with a vector receptor. Also, like animal viruses, the virus appears to undergo a conformational change when associating with the vector that is necessary for effective transmission. Thus, this virus overturns the notion that plant viruses are just "dumb tin cans" that get dragged into the plant cells.

This experiment consisted of: extracting CNV from infected leaves and then purifying the virus by ultracentrifugation. Following virus purification, crystallization was set up, using alpha mannotriose sugars in order to examine sugar binding. However sugar binding examination was unsuccessful. CNV's sensitivity to trypsin was also taken into consideration. As stated earlier, we found that CNV undergoes conformational changes when it is bound to zoospores, and those changes are somehow linked to virus transmission. To get a closer look at the conformation changes that CNV undergoes, cloning of P domain of the virus took place. We successfully cloned the P domain of the virus, and got it to express in bacterial *E. Coli* cells. Further studies of this virus will be conducted in the future.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF to Tomas Smith, Aaron Allen, and Miriam Khalil at the Donald Danforth Plant Science Center, St. Louis.

Faculty Advisor: Rachel Beecham, rvbeecham@yahoo.com

OA #78
Subcategory: Plant Research

The Scientific Process of Improving the Flavor of Tomato

Key'erra Rozier, Fort Valley State University/University of Florida
Co-Author(s): Harry Klee and Denise Tieman, University of Florida

Tomatoes are usually red fruit from plants of *Solanum lycopersicum*, commonly known as tomato plants. When picking a tomato, the appearance and firmness is the number one factor for commercial growers, but consumers always want better flavor. The flavor of a tomato is fairly complicated because of its many ingredients, which basically makes breeding for better flavor very difficult. Plant breeding techniques for high yield varieties has destroyed flavor. As the yield of tomatoes per plant has gone up, sugar, acid, volatile and micronutrient content has gone down. The tomatoes tested (using sensory evaluation) in this study were derived from crosses of Maglia Rosa Cherry (a variety with good flavor) and FL8059 (a variety with poor flavor, but good commercial qualities). Fruit from plants derived from this cross were examined to find the best tasting tomato with good commercial attributes. Important commercial properties were looked at like fruit size, fruit appearance, and yield. The attributes associated with good flavor were identified with high aroma volatiles and high soluble solids. In the future, we plan to continue research on this aspect by testing more commercial varieties to find the best tasting tomato with high yields including sugar, acid, volatile and micronutrient contents.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF DBI REU-Site Program awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #79
Subcategory: Plant Research

Genetic Transformation of Valeria (*Valeriana officinalis L*) through Agrobacterium

Jasmine Scott, Fort Valley State University
Co-Author(s): Adriana Mejía and Seema Dhir, Fort Valley State University

Valeria (*Valeriana officinalis L.*) is a hardy, perennial, flowering plant used as an herbal medicine. The roots contain a compound, Valerian, an excellent remedy for anxiety, nervous tension and insomnia. Tissue culture and molecular engineering have provided rapid methods to develop desirable varieties of cultivated plant species. Transient expression has a wide range of applications in molecular biology. The goal of this work was to establish an optimal transient expression system using Agrobacterium for T-DNA gene delivery into different explants from which the whole plantlets can be regenerated. Leaf explants derived from one-month-old seedlings of in-vitro-grown Valeria plants were infected by *A. tumefaciens* carrying a binary vector that harbors a gusA gene and an nptII gene. The infected leaf explants were incubated for three days before they were subjected to gusA histochemical assay. The transform-ability was determined as the percentage of leaf explants expressing the gusA gene and as the intensity of gusA expression per responsive leaf explant. Parameters tested in this study included - different acetosyringone, Silver Nitrate ($AgNO_3$) and Calcium Chloride ($CaCl_2$) concentrations used during the incubation period, wounding type and the length of the pre-culture period of explants prior to infection, different bacterial density (OD) and duration of immersion periods.

The results based on transient gusA gene expression of explants suggested that one month old leaf explants inoculated for 60 minutes with 0.4 OD and 150 µm acetosyringone, 60 µm $AgNO_3$, and 0.25 µm $CaCl_2$ showed 80-90 % transformation efficiency. Therefore, the investigation of factors that influence T-DNA delivery is an important first step in the utilization of Agrobacterium in the transformation of Valeria tissues.

Funder Acknowledgement(s): This study was supported, in part, by grants from NSF DBI REU-Site Program awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University and HBCU-UP Targeted awarded to Seema Dhir, Assistant Professor, Fort Valley State University.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #80
Subcategory: Plant Research

Identifying Relationships of Soil Characteristics and Genotypes of Setaria Viridis

Derrick Smith, Fort Valley State University/Donald Danforth Plant Science Center, St. Louis
Co-Author(s): Max Feldman, Donald Danforth Plant Science Center

The genetic and experimental tractability of *Setaria viridis* make this plant a useful model system for trait discovery applicable to other evolutionarily related C4 grass species (maize, sorghum, sugarcane, biofuel grasses). Our goal is to identify genetic adaptations that improve plant productivity in response to environmental variables by comparing the performance of natural *Setaria viridis* accessions in response to soil variables associated with their collection site. Chemical attributes including soil pH, electrical conductivity, and elemental composition were determined from the native soil of 73 different *Setaria viridis* natural populations. A moderate, but statistically significant positive correlation between these values and those derived the Soil Survey Geographic Database is observed if the most extreme values are removed. Concurrently, we evaluated the performance of natural *Setaria viridis* accessions in response to elevated soil salinity. Our results illustrate that natural accessions exhibit a broad spectrum of ability to germinate on soils with elevated salinity, however this trait is not correlated with the salt content of soil found in their native habitat.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF HRD #0625289 awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #81
Subcategory: Water

Pilot Scale Mesophilic and Thermophilic Anaerobic Digesters

Victoria Dillard, Howard University
Co-Author(s): Evans O. Omotto, Aron Munywoki, and Caroline Ouma, University of Nairobi

The Nairobi Water and Sewerage Company is looking to advance their anaerobic digestion systems to reduce environmental pollution and transform digester gas into a useable fuel for the wastewater plant. Anaerobic digestion is aimed at the stabilization of organic matter in raw sewage solids, but its ability to produce an alternative source of heat and electricity (biogas) is gaining global importance. This research focuses on the optimal anaerobic digestion conditions that maximize methane (biogas) production in batch pilot scale mesophilic and thermophilic anaerobic digesters. Moreover, a digester design was implemented to accommodate effective heating methods and mixing mechanisms for the reactors. Determination of optimal flow rate of wastewater to the digesters as well as characteristics of feed wastewater (BOD, COD, pH, TS) was undertaken using analytical methods outlined in the Standard Methods for the Examination of Water and Waste Water.

Measurement of biogas production rates in mesophilic and thermophilic anaerobic digesters, maximum gas yield and biogas quality was determined using standard operating procedures. Under specific monitoring parameters and methods (OLR 0.5 L/min, thermostatic heating system, inoculum to substrate ratio of 1:3) the bioreactors produced a final average volume of biogas (corrected to STP) and relative retention times: Mesophilic-2.04 x 10^{-3} m^3 (21 days, 37 ± 1^0 C, pH 6.5 -7.2), Thermophilic-7.42 x $10^{-3}$$m^3$ (10 days, 55 ± 1^0 C, pH 6.5 -7.1). Biogas average production rates were: Mesophilic-1.41 x 10^{-5} m^3/day, Thermophilic- 4.08 x 10^{-4} m^3/day. Average percentage composition of biogas produced by thermophilic digester was: CH_4 66.6 vol. %, CO_2 30.4 vol. % and other gases were assumed 3 vol. %. Thus, the biogas produced was of good quality. Overall, the yield and production rate in the thermophilic reactor far exceeded that of the mesophilic as evident from total volumes of gas collected and hourly production rates. Recommendations for Nairobi Water & Sewerage Company include: an advanced digester design that supports an efficient mixing technique and pH sensor, pretreatment of feed wastewater for removal of harmful toxins, co-digestion of organic wastes to raise BOD content of wastewater, and use of portable gas analyzers. Finally, Department of Chemistry, University of Nairobi, should consider improving its power supply system to eliminate frequent power outages.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Silas Burris, burris.silas@gmail.com

Mathematics and Statistics

OA #82
Subcategory: Computer Science & Information Systems

Analyzing Stock Movement through Data Mining

LaQunia Banks, Southern University at New Orleans
Co-Author(s): Rachid Belmasrour and Joe Omojola, Southern University at New Orleans

Data mining is the process of discovering useful information from a large data repository. This process is used to discover if there are any patterns or relationships in the data. In this research we mined data from 15 stocks for the year 2009 by using a combination of technical indicators to build a mining model. Our model was then applied to current data of the assigned stocks. Technical indicators examined are the 35-, 50-, and 100-day exponential moving averages, and On Balance Volume. Two additional conditions were imposed to investigate if the results obtained from our model could be improved.

Funder Acknowledgement(s): Department of Energy

Faculty Advisor: Joe Omojola, jomojola@suno.edu

OA #83

Subcategory: Computer Science & Information Systems

The Solution to the 3-Variable Frobenius Number Problem

Mayla Boguslav, Columbia University and the Jewish Theological Seminary/Auburn University
Co-Author(s): Overtoun Jenda, Auburn University

Given a set of relatively prime positive integers a1, a2, ..., an, after some point all positive integers are representable as a linear combination of the set with nonnegative coefficients. The last integer that is not so representable is the Frobenius Number, and finding that number is the Frobenius problem or coin problem. While the two-variable solution is widely known, and the general solution is NP-hard, there have been several algorithmic solutions to the three-variable problem. Here we present a formulaic solution for the Frobenius number of all relatively prime triples, and a graphic representation of such. The next step would be to look at the 4-Variable case, looking for patterns and formulas for different cases.

Funder Acknowledgement(s): This work was supported by NSF grant no. 1004933, and was completed during and after the Summer 2012 Research Experience for Undergraduates in Algebra and Discrete Mathematics at Auburn University.

Faculty Advisor: Peter Johnson, johnspd@auburn.edu

OA #84

Subcategory: Computer Science & Information Systems

HIV and Syphilis Simulation Models Using Computational and Mathematics Applications

Ashana Evans, North Carolina A&T State University
Co-Author(s): Dominic Clemence, Faculty Advisor

HIV has been an epidemic in this country for a long time. With the spread of this disease, there have been various studies that have focused on many Americans and how they are affected by sexually transmitted diseases, particularly syphilis. Also in those studies they notice if syphilis elimination factors might have an impact on HIV infected cases. With my research I will be looking at HIV and syphilis models to understand how both diseases correlate with population parameters and other factors.

During this research I will be looking at numerical comparisons to see the variations or similarities they have to theoretical simulations. Also I will be looking at numerical simulations methods to see if they produce similar results. I will be doing computer analysis, using MATlab or software provided by Dr. Clemence. With the analysis, I will have a variation of parameters and see the differences in results. For the algorithm that will help conduct the research and the data collection process, I will use the Non-standard Finite Difference (NSFD) method.

I will also conduct a comparison between the NSFD method and some standard methods. Ultimately, by conducting this research I will get an understanding of cooperating mathematical application with computational software and simulation models. I will use a system of differential equations and model theoretical situations and see if models can produce accurate results. I will understand how computers and math correlate to biological systems.

Funder Acknowledgement(s): Talent-21 Research NSF Program

Faculty Advisor: Candy Carter, candy@ncat.edu

OA #85

Subcategory: Computer Science & Information Systems

Schur Positivity of Differences of Products of Schur Functions

Nadine Jansen, North Carolina A&T State University
Co-Author(s): Jeremy Meza, Carnegie Mellon University
Jerry Emidih, University of California at Riverside

The Schur functions are a basis for the ring of symmetric functions indexed by partitions of nonnegative integers. A symmetric function f is called Schur positive if when expressed as a linear combination of Schur functions each coefficient is nonnegative. We wish to investigate expressions of the form sλc sλ − sμc sμ (1) where λ partitions n and μ partitions n − 1 and the complements λc, μc are taken over by a sufficiently large m × m square. We give a necessary condition that if (1) is Schur positive, then μ is contained in λ. Furthermore, we show how conjugating partitions preserves Schur positivity. We incorporate the Littlewood Richardson rule to show that particular classes of λ of μ are never Schur positive. Lastly, we state our main conjecture that determines whether any given pair of λ and μ are Schur positive or not.

This research is significant because answering these questions provides a means to determine when new representations can be induced. Future work includes finalizing the characterization of Schur positivity.

Funder Acknowledgement(s): NSA, NSF, MSRI

Faculty Advisor: Dr. Tang, tang@ncat.edu

OA #86

Subcategory: Computer Science & Information Systems

A Digital Elevation Model and Energy Expenditure for Climbing Up a Mountain

Vanda Johnson, Savannah State University
Co-Author(s): Juhi Brahmbhatt, Savannah State University

A.E Minetti states in an article that when the slope of the route is about fifteen degrees, the energy required to gain a certain altitude is minimized. Despite this theory, it seems difficult or almost impossible to find the optimal trail up a mountain with the lowest energy expenditure due to various factors: infinitely many starting points, selective directions, individually unique metabolic systems, etc. Nevertheless, we are still interested in finding the better trail up a given mountain.

This research explores two major building blocks: development of digital elevation model (DEM) for Stone Mountain in Georgia, and examination of energy expenditure along the existing/newly created trails. The DEM from a topographical map, which provides the surface information of a given mountain, is achieved through the 3D numerical interpolation method with the help of the intuitive estimation of boundary points from a simple topographical map from a park brochure. The evaluation of existing and new park trails from fixed points to the summit of the produced 3D mountain is also achieved through the formula for biomechanical energy expenditure of the human body. Furthermore, we examine Minetti's theory and compare the results of each park trail by observing the graphs of the trail slant. The resultant data shows that the existing trail is well developed reflecting the Minetti's theory and newly developed trail is also well adopted. This work contributes and extends to the various research fields, including creation of 3D visualized map, virtual analysis of mountain surfaces, evaluation of existing trails, and their applications.

Funder Acknowledgement(s): There were no funders for this research project.

Faculty Advisor: Hyounkyun Oh, hoh@savannahstate.edu

OA #87

Subcategory: Computer Science & Information Systems

Comparison of Performance of Technical Indicators

Goodnews Tangban, Southern University at New Orleans
Co-Author(s): Joe Omojola and Rachid Belmasrour, Southern University at New Orleans

A technical indicator is a mathematical calculation derived from price and/or volume of equities. Technical indicators are used to forecast probable price changes of equities. The objective of this research is to compare the performance of technical indicators on stocks to determine which indicator will give investors the best probability for success. In this research, the technical indicators used are the 9-day Exponential moving averages (XMA) crossing over the 15-day exponential moving average, the 4-day XMA crossing over the 20-day XMA Exponential moving average convergence divergence (XMACD) 12.26.9, 14.5.3 stochastics. In addition, two conditions were imposed as follows: (1) 30-day moving average crossing over 50-day moving average and (2) Relative Strength crossover of its 15-day XMA. Analysis was performed over 15 stocks. Results of statistical analysis indicated that both the 4-day XMA crossing over the 20-day XMA, and the XMACD (12.26.9) proved to be effective.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Joe Omojola, Jomojola@suno.edu

OA #88

Subcategory: Electrical Engineering

Error Correcting Codes

Boubacar Abdou Tchoussou, North Carolina A&T State University
Co-Author(s): Marshall Cohen, Bipin Mainali, and Shannon Jordan, Morgan State University

Nowadays, with a very high usage of telecommunications (cellphones, satellites, radar, Internet, etc.), millions of bits are transmitted every second. What is the probability that every bit that is sent will be received correctly? Is there any way to detect and correct a bit error before reception? The purpose of this research was to compute the probabilities of correct reception of any sent message or data, and detect and correct any possible error that might happen during the transmission of the message or data. For instance if 01 is sent, the received message might be 00 01 10 or 11. So if a word of n bits is sent, 2n words might be received. By using many mathematical tools such as combinatorics, fields, vector spaces, partitions, matrices, Hamming distance and weight, we created codes that can detect and correct any faulty bit in a message. Any word (of k bits) to be sent, will be converted to a codeword (of n bits) by multiplying it to a generator matrix G. To check for errors, the received word Z will be multiplied by the parity check matrix P. If Z*P=0 and different code words are far away from each other, then Z=C and the probability that Z is correct is extremely high. If Z*P=0, then the word is incorrect. To correct the error, it suffices to find the position of the word in the parity check matrix and change the bit of the word that corresponds to that position. Our study indicates that any linear code (n, k) satisfying (2r-1, 2r-r-1) where r = n-k, is a perfect code. A perfect code is a linear code that gives an accurate correction.

Funder Acknowledgement(s): This research was conducted during the 2013 Summer Program In Research and Learning program at the University of Maryland, College Park and was supported by NSA and NSF.

Faculty Advisor: Marshall Cohen, marshall.cohen@morgan.edu

OA #89
Subcategory: Materials Science

Mathematical Modeling of Telomere Dynamics in Budding Yeast Cells

Joshua Recore, Winston-Salem State University/University of North Carolina at Chapel Hill
Co-Author(s): Greg Forest, Paula Vasquez, Caitlin Hult, Kerry Bloom, Jolien Verdaasdonk, and Kelly Brannigan, University of North Carolina at Chapel Hill
Dianne Kennedy, Elizabeth City State University

This work includes the study of chromosomal DNA in budding yeast cells during interphase. Understanding the behavior of DNA in the cell nucleus is important because we are creating a baseline for up and coming experiment data for telomeres and how they relate to DNA damage. This summer we focused our research on capturing and modeling the dynamics of centromeres and telomeres. Centromeres and telomeres are the attachment sites of the chromosomes to the boundary of the cell nucleus. In this paper, we describe mathematical models derived from bead spring models. We use these models to investigate telomere behavior assuming different conditions. The models have shown there are more behind this problem and have helped us to refine mathematical models that can capture the chromosome behavior inside a cell. Although telomere dynamics remain unclear, analysis of bead spring chain models have refined our understanding of these dynamics.

Funder Acknowledgement(s): National Science Foundation, DMR #1122483.

Faculty Advisor: Greg Forest, forest@unc.edu

OA #90
Subcategory: Physics (NOT Nanoscience)

Bilinearization of Partial Differential Equations

Byron Williams, Savannah State University
Co-Author(s): Alrazi Abdeljabbar, Savannah State University

In this research we are going to use the Hirota Operator to transform nonlinear partial differential equations into bilinear forms. There is a wide range of systems which are modeled by non-linear partial differential equations; from economics to the physical sciences, expanding the techniques available to solve non-linear partial differential equations enables us to take advantage of the systems which they model. The first example we are going to discuss is a generalization of the Kadomtsev-Pevitishvili (KP) equation (1). uxxxy+3(uxuy)x+utx+uty-uzz=0; (1) Followed by the (2+1)-dimensional system of nonlinear partial differential equations which can be considered as a generalization of the Boussinesq model (2a) and (2b), ut + α1(t)uxy + α2 (t)(uw)x + α3(t)vx = 0; (2a) vt + β1(t)(wvx+ 2vuy+ uvy)+ β2(t)(uxw y- (uy)2)+ β3(t)vxy + β4(t)uxyy = 0; (2b) where wx=uy. When y = x; the system is reduced to the following variable coefficients Boussinesq model in the long gravity water waves: u t+ α1(t)uxx + α2(u2)x + α3(t)vx = 0; (2a) v t+ 2β1(t)(uv)x+ β2(t)vxx + β3(t) vxx+β4(t)uxxx= 0; (2b) So our work will be a new generalization of the (1+1)-dimensional Boussinesq model. The bilinearization of the Kadomtsev-Pevitishvili equation (1) resulted as follows. (Dx3Dy+DxDt+DyDt-Dz2)(f·f)=0 The bilinearization of the Boussinesq model equations (2a) and (2b). DxDy(f·f)+2gh=0 (Dt+12a(t)DxDy)(g·f)=0 (Dt-12a(t)DxDy)(h·f)=0.

In conclusion we successfully bilinearized both non-linear partial differential equations, which is not a solution to either system, but transforms both systems into a form which can be more readily solved. Future work will consist of exploration of the Inverse Scattering Transform, as well as solutions to each system of non-linear partial differential equation.

Funder Acknowledgement(s): This study was funded by a grant from the National Science Foundation awarded to Alrazi Abdeljabbar, PSLSAMP, Savannah State University.

Faculty Advisor: Alrazi Abdeljabbar, abdeljabbara@savannahstate.edu

OA #91
Subcategory: Pollution/Toxic Substances/Waste

Asymmetric Intraguild Predation Between Toxic and Non-Toxic Phytoplankton

Laura G. Asaro, East Central University
Co-Author(s): Joanna Myers, University of North Carolina

Carlos Vera Recio, University of Puerto Rico, Mayaguez
Alan Wirkus-Camacho, Herberger Young Scholars Academy, Tempe, AZ
Bajoun Song, Montclair State University
Miles Manning, Arizona State University
Yiqiang Zheng, Purdue University

The azaspiracid toxin contaminated the harvest of the mussel, *Mytilus edulis*, off the coast of Ireland in 1995. Investigation showed that the genus *Protoperidinium*, previously thought to be harmless, was to blame for a new condition brought about by the azaspiracid toxin. To address this concern, we use nonlinear ordinary differential equations to study the dynamics of two dinoflagellate species, as well as their common predator. An asymmetric intraguild predation model with a mutual predator is introduced, in which the toxin producing *Protoperidinium* preys on the non-toxic *Heterocapsa*, while both ingest the nutrients available in the system and are preyed upon by a higher predator. The equilibria were found and global and local stability was determined. We then found the mode of co-existence of the system in an equilibrium. After the initial analysis, we considered interventions, such as modifying nutrient flow, to reduce the levels of the azaspiracid toxin and observe their effect on the persistence of the system. Future work includes modifying the system for use in other locations with different species of phytoplankton and predators.

Funder Acknowledgement(s): This project was funded by the Mathematical and Theoretical Biology Institute at Arizona State University by NSF and NSA grants under Carlos Castillo-Chavez, Executive Director and Regent's Professor of the Mathematical, Computational, and Modeling Sciences Center, Arizona State University.

Faculty Advisor: Baojun Song, songb@mail.montclair.edu

OA #92
Subcategory: ***Pollution/Toxic Substances/Waste***

PBPK Modeling of Hazardous Chemicals in Maternal and Fetal Tissues

Jasmine Jackson, North Carolina State University
Co-Author(s): Camille Zerfas, North Dakota State University
Ariel Nikas, Meredith College
Stephen Jordan, College of William and Mary

Toxic chemicals that are found in the environment affect humans and animals. These can be absorbed, inhaled, or otherwise ingested at safe levels by adults. However, chemicals that pregnant women are exposed to also transfer into their fetuses. Unsafe environmental levels of toxic chemicals, like bisphenol- A (BPA), could potentially lead to birth defects, behavioral abnormalities, and diseases. In this project, a mathematical model was developed to determine the levels of chemicals that are absorbed, distributed, metabolized, and eliminated in specific tissues in the body. From this model, the dose that a developing child receives due to a mother's environmental exposure is also examined. For specific chemicals, this may mean that the current acceptable environmental levels must be lowered.

Funder Acknowledgement(s): NSA, NSF

Faculty Advisor: Aprillya Lanz, alanz@nsu.edu

OA #93
Subcategory: Social Sciences/Psychology/Economics

Games on Directed Graphs

Sharise N. Dantzler, North Carolina A&T State University
Co-Author(s): Johnny Gillings Jr., Morehouse College

Given a two player graph game from cyclic to acyclic with terminal positions and unlimited starting positions, how does one win the game? This study focuses on the strategies to win the games on directed graphs. In particular, we work on the cyclic to acyclic graph game with one bridge. This type of analysis refers to Game Theory which can be applied to real life situations such as war and tactical planning. The Grundy Numbers are employed to create a systemized graph game. The Grundy numbers along with Nim Sum then allow us to analyze which positions are winning or losing. Different strategies are discovered to win the game when the number of vertices n is either odd or even. With a one bridge graph game from cyclic to acyclic, when the number of vertices n is odd, there is a unique winning strategy such that one who moves from a nonnegative integer shall win. This winning strategy can be explicitly shown through Nim Sum, which is also known as binary addition. Given a one bridge graph game, when the number of vertices n is even, there are several different graph layouts which can result in a draw, a losing position, or a winning position. So given a particular graph layout, where one can apply the unique winning strategy mentioned above, there is only one winning position in this scenario. In this study we only work with one bridge cyclic to acyclic graph games. Further research can be done on multiples bridges between cyclic and acyclic graphs. For example we can have a cyclic graph with two bridges; one to an acyclic graph and one to another cyclic graph.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF and NSA awarded to Kenneth, Mathematics Professor, University of Maryland.

Faculty Advisor: Liping Lui, llui@ncat.edu

OA #94

Subcategory: Social Sciences/Psychology/Economics

Mathematical Modeling of Chlamydia Epidemics in Hampton Roads, VA

Hope C. Eppes, Norfolk State University

Chlamydia is the most common sexually transmitted disease in the United States. The "silent infection" can lead to serious problems such as pelvic inflammatory disease or PID, and can even lead to infertility in women. Reported cases of Chlamydia are high, and estimated rates that are not reported are even higher. Chlamydia cases and rates are extremely high in women, more specifically among African-American women and women under the age of 25. This project modeled the epidemics of Chlamydia in Hampton Roads, VA, as it has the second highest rate of Chlamydia infection in the United States. A compartmental model was developed to describe the interactions among at-risk individuals, infected individuals, and those who are in treatment or recovered. Because of the demographics of the groups affected by this epidemic, the model also considered social factors that might alleviate the spread of the disease. The basic reproduction number was determined and revealed the condition for the stability of the Chlamydia free equilibrium. Stability analysis and numerical simulations were carried out to study the impact of the social factors to the epidemic.

Funder Acknowledgement(s): Norfolk State University

Faculty Advisor: Aprillya Lanz and Ann Barber, alanz@nsu.edu

OA #95

Subcategory: Social Sciences/Psychology/Economics

Radio Labeling for the Sixth Power of a Path Graph

Reyna Hernandez, California State University, San Bernardino
Co-Author(s): Min-Lin Lo, Edward Mendez, Jesus Mora-Sanchez, and Cynthia Salgado, CSUSB

Radio labeling is a process used to model the problem of efficiently assigning channels to FM radio stations to avoid interference. Let G be a connected graph. For any two vertices u and v, the distance between u and v in G, denoted as d(u,v), is the length of the shortest u-v path in G. The maximum distance between any pair of vertices of G is called the diameter of G, which is denoted by diam(G). A radio-labeling of G is a function f that assigns a label from the set {0, 1, 2, …} to each vertex such that the following holds for any vertices u and v: $|f(u)-f(v)| \geq diam(G)-d(u,v)+1$. The span of f is defined as $\max_{(u,v\in G)} \{|f(u)-f(v)|\}$. The radio number of G is the minimum span among all radio-labelings of G. The 6th power of G is a graph constructed from G by adding edges between vertices of distance six or less apart in G. Through our six weeks of extensive research we believe to have completely identified the structure of all possible cases for P_n^6. In this presentation we will discuss the progress we made towards finding the radio number for 6th power of paths during a 2013 MAA summer research program.

Funder Acknowledgement(s): NSA (grant H98230-13-1-0270) NSF (grant DMS-1156582) and the support of LSAMP.

Faculty Advisor: Belisario Ventura, bventura@csusb.edu

Nanoscience

OA #96

Subcategory: Materials Science

Magnetic Cobalt Carbide Nanoparticles Synthesized via a Polyol Method

Raziel Acosta, University of California San Diego
Co-Author(s): Hyojung Yoon, University of California San Diego

Permanent magnets are an important feature in our current technologies such as in hybrid electric vehicles and wind generators. Developing alternatives to rare earth permanent magnets has become a critical investment due to the high costs of rare earth metals, which are mainly mined outside of the US. It was recently discovered that cobalt carbide nanoparticles produce substantial magnetic properties, even though previous theoretical studies indicated they shouldn't. Our goal is to explore and precisely understand cobalt carbide nanoparticles that have high magnetic properties. In the polyol method, a wet chemical synthesis, the reactants are used in a batch reactor to produce cobalt carbide nanoparticles.

By experimenting with certain reaction parameters, such as the reaction time, temperature, and concentrations of reagents, different phases of Co_3C and Co_2C can be achieved. Even though Co_3C has better magnetic properties than Co_2C, when a mixture of the two is synthesized, even greater magnetic properties can be achieved because the Co_2C phase hinders demagnetizing magnetostatic interactions that occur between neighboring Co_3C phases. By using different characterization techniques such as vibrating sample magnetometery, x-ray diffraction and transmission electron microscopy, the magnetization and coercivity, phase confirmation, and morphology of the product can be obtained, respectively. Using these methods, we will be able to determine the magnetic properties as well as the physical characteristics of our synthesized material. If cobalt carbide composites with significant magnetic properties can be clearly studied, they can rival current rare earth dependent permanent magnets.

Funder Acknowledgement(s): ARPA-E, Department of Energy.

Faculty Advisor: Shirley Meng, shmeng@ucsd.edu

OA #97
Subcategory: Materials Science

Enhancement of Optical Properties of DNA-CTMA-AF455 Films

Larnesia Caulfield, Texas Southern University

Biotronics is the development and implementation of a new class of polymers that possess unique optical and electromagnetic properties that no other known polymer has. They have already demonstrated significant improvements in electronic and optoelectronic device performance. These non-fossil fuel-based photonic and electronic Biopolymer materials, derived from deoxyribonucleic acid (DNA) biowaste and silk, are abundant, inexpensive and green materials that will not deplete our natural resources or harm the environment. They have the potential to compete with, or maybe someday even replace, fossil fuel-based plastics for applications ranging from eyeglasses to the higher technology applications light emitting diodes, transistors and solar cells.

Preliminary in-house research in this area started around 1999 and since then low optical losses of < 0.5dB/cm over a broad wavelength have been achieved, electrical conductivities 3-10 orders of magnitude higher than other polymer materials have also been achieved, and they are tunable. Their microwave losses are also lower than other polymers, making them very attractive for high speed electro-optic devices. Used as cladding layers in nonlinear polymer-based electro optic modulators, a significant reduction in the overall optical insertion loss of these devices has been achieved, dropping from 15 dB to 10dB, or a 3X improvement. The first all-DNA electro-optic modulator, with significantly lower losses than current polymer EO modulators has also been demonstrated and has the potential for operating at significantly lower power. Using another DNA-based Biopolymer for an electron-blocking layer in an organic light emitting diode (OLED), the first red, blue and green Bio-Organic LEDs were demonstrated that were as much as 30X brighter and operated at 10X higher efficiency and 3X longer lifetimes compared with OLED's without the Biopolymer electron-blocking layer.

Using a DNA-based Biopolymer for the gate dielectric layer in an organic field effect transistor (OFET), the first Bio-Organic FET was demonstrated that operated at nearly an order of magnitude lower gate voltage compared with OFETs using the commonly used dielectric polymers for the gate dielectric. Using Biopolymers as host materials, a significant increase the photoluminescence of fluorescent materials by as much as 100 times has been achieved, when compared with other commonly used polymer hosts. This suggests significantly increased device efficiencies, higher outputs, lower operating powers and longer lifetimes. The first organic thin film transistor (OTFT) using a conductive polymer doped Biopolymer for the semiconductor region (Bio-Organic TFT) has been demonstrated with a competitive carrier mobility of other organic semiconductor devices but at 10X lower cost. This new Biotronics technology shows great promise for a number of both photonic and electronic applications, with demonstrated increase in device performance. This opens up a whole new field for bio-engineering, in addition to the current genomic sequencing and clinical diagnosis and treatment applications. Where silicon is today's fundamental building block for inorganic electronics and photonics, Biopolymers hold promise to become tomorrow's fundamental building block for organic photonics and electronics.

Funder Acknowledgement(s): Angela Campbell, MLP; Tobie Cordell, UTC; Bobby Wilson and Xin Wei, Texas Southern University.

Faculty Advisor: Xin Wei, wei_xi@tsu.edu

OA #98
Subcategory: Materials Science

The Investigation of Iron Oxide Nanoparticle as a Novelty for Smart Windows

Andrew Knight, Norfolk State University

Smart windows electronically change the way light is transmitted through a medium such as glass. With steadily rising energy costs in the United States, smart windows are an excellent choice to reduce energy consumption. One smart window technology, suspended particle devices (SPDs) via Fe3O4 (iron oxide) nanoparticles has presented itself as a viable option for future window applications. Also, Fe3O4 SPD windows provide a beautifully colorful surrounding in homes and buildings. However, there are several issues that must be resolved before this technology can be fully implemented. That is, Fe3O4 nanoparticles have a low transmittance (<40%) and particle dispersion is not uniform. Also, at high concentrations of Fe3O4, it is very difficult for the nanoparticles to return to their opaque state after being transparent. In this study, we further investigate Fe3O4 nanoparticles and develop (Silica) SiO2@Fe304@ core-shell nanoparticles. Here, we report that by decreasing the concentration of Fe3O4, the transmittance increases. In addition, we achieved better particle uniformity and aggregation. Through looking at scanning electron microscope images, we successfully created Fe304@SiO2 core-shell nanoparticles. Our next step is to test the core-shell reliability.

Funder Acknowledgement(s): This research was made possible by the SUNFEST REU program funded by the National Science Foundation under grant number 1062672.

Faculty Advisor: Aprillya Lanz, dr.l.lanz@gmail.com

OA #99
Materials Science

The Synthesis of Novel Materials and their Self Assembly

Jasmon Montgomery, University of Arkansas at Pine Bluff/ University of Arkansas at Little Rock
Co-Author(s): Cory Stogsdill and Brian Berry, University of Arkansas at Little Rock

The unique structures of multiwall nanotubes (MWNT), fullerene (C60), and photoactive polymers such as PCBM and P3HT allow such materials to be used in the fabrication of components of various devices in many applications. When P3HT (Poly 3-hexylthiophene-2,5-diyl) and PCBM (Phenyl-C61-butyric acid methyl ester) are combined, they form a photovoltaic active layer at their interface. MWNT and C60 have shown to be conductive when properly aligned. The unique electronic properties of fullerene, PCBM and P3HT allow them to be used as conducting or semiconducting elements in nanoscale sensors, transistors and solar cells.

In this experiment, electrode arrays of nanotubes and polymers were created via a flow coating process in which a glass blade is used to drag a 30µL solution of dispersed polymers across a stationary glass slide. Due to the Maringoni Effect, the dispersed nanotubes and polymers are transported to the air/water interface which aids in creating parallel lines of nanotubes. The distance between these lines as well as their thickness was varied using a LabView user interface to control the flow coating instrument. The thickness of these lines and transmittance was found to depend on both deposition temperature and dwell time. The line spacings tested were 10µm, 25µm, 50µm, 75µm, 100µm, and 200µm. The temperature of the surface ranged from 25°C to 50°C, and the dwell times studied were 2.5, and 5 seconds. Conditions were changed to determine optimal conditions required to maximize transmittance. The results of this research will be presented at the conference after thorough analysis.

Funder Acknowledgement(s): This study was supported, in part, by the National Science Foundation and Arkansas Science and Technology Authority-ASSET II to Brian Berry, University of Arkansas at Little Rock.

Faculty Advisor: Anissa Buckner, bucknera@uapb.edu

OA #100
Subcategory: Nanoscience

Analysis of Surface Plasmons Using Nanowires Incorporated into Nanodevices

Christopher Siefe, University of California, Santa Barbara
Co-Author(s): Jose Navarrete and Martin Moskovits, University of California, Santa Barbara

Surface plasmons are conduction electron resonances in metals at the nanoscale excited by the oscillating electric field of light. These surface plasmons can decay into hot electrons with enough energy to overcome an interface barrier, and are utilized for various applications. In particular, surface plasmon resonance occurs in gold nanoparticles by illumination with the solar spectrum, providing the opportunity to promote hot electrons with sunlight.

This research aims to understand better the fundamental science behind surface plasmons for the benefit of many applications such as solar water-splitting devices and sunlight-driven catalysis. By assembling tin (IV) oxide nanowires decorated with gold nanoparticles into a field effect transistor, we can analyze the current resulting from the surface plasmon decay into hot electrons with respect to the visible light spectrum (400-1200 nm). Our field effect transistor consists of a silicon substrate covered with a thin layer of aluminum oxide, a nanowire, and gold/titanium electrical contacts used for measurement. This allows us to control the conductance of the nanowire by applying a potential across the aluminum oxide, the gate oxide of our field effect transistor. By changing this gate potential we hope to control how the hot electrons produced by surface plasmon resonance in the gold nanoparticles interact with the gold/tin oxide interface barrier. Furthermore, through the use of light filters, we hope to determine the wavelength of visible light at which surface plasmon resonance is greatest. With this research, we hope to understand how the surrounding environment affects the surface plasmon resonance of the gold and apply any newfound knowledge to improve current devices and find new applications for surface plasmons.

Funder Acknowledgement(s): UC LEADS

Faculty Advisor: Martin Moskovits, moskovits@chem.ucsb.edu

Physics

OA #101
Subcategory: Astronomy and Astrophysics

Coronal Heating and the Flare-energy Distributions of M Dwarfs

Ying Feng, Pennsylvania State University

Co-Author(s): Katja Poppenhaeger, Andy D. Goulding, and G. Esra Bulbul, Harvard-Smithsonian Center for Astrophysics

Stochastic flaring is an important mechanism for the coronal heating of the Sun and solar-like stars. The driver for these flares is a magnetic dynamo anchored at the boundary layer between the convective zone and the radiative core. Fully convective M dwarfs have been observed to produce powerful flares as well, but they lack a radiative core and must possess a different dynamo mechanism. How their flaring behavior differs from the solar case is not fully understood yet. We have analyzed X-ray flares of 22 M dwarfs, including both fully and partially convective ones, using archival XMM-Newton data. We extracted flares from the individual X-ray light curves and determined the amount of energy released by each flare in the observed X-ray band. We constructed flare-energy distributions ($dN/dE \propto E^{-\alpha}$) of the targets to investigate the degree to which flares heat stellar coronae. We fitted the slopes of the flare-energy distributions for individual targets and for groups of targets bundled by spectral type. If $\alpha > 2$, the total energy, as extrapolated from the power law, could almost be entirely released by flares in the corona. We find $\alpha = 1.96 \pm 0.08$ for early (≤ M4) M dwarfs and $\alpha = 1.90 \pm 0.09$ for late (>M4) M dwarfs, which suggest that flares produce a considerable amount of the energy in M-dwarf coronae. We find that the slopes of the flare-energy distributions are very similar to that of the Sun ($\alpha \approx 2$), for both partially and fully convective M dwarfs. The dynamo process at work in the fully convective stars of our sample needs to have a flare production efficiency which is very close to the solar case. Further observations will cover ultracool targets near the brown dwarfs boundary to test for which masses this solar analogy is valid.

Funder Acknowledgement(s): This work is supported in part by the NSF REU and DOD ASSURE programs under NSF grant no. 1262851 and by the Smithsonian Institution.

Faculty Advisor: Katja Poppenhaeger, kpoppenhager@cfa.harvard.edu

OA #102

Subcategory: Astronomy and Astrophysics

Merger Hydrodynamics of the Luminous Cluster RXJ1347.5-1145

Christina Kreisch, Washington University in St. Louis
Co-Author(s): Marie Machacek, Scott Randall, and Christine Jones, Harvard-Smithsonian Center for Astrophysics

Galaxy clusters are the largest gravitationally bound systems in the Universe. Understanding their evolution through mergers is critical to understanding the formation of structure and the use of galaxy clusters as cosmological probes. We present deep (186 ks) Chandra X-ray observations of baryonic gas hydrodynamics in the merging galaxy cluster RXJ1347.5-1145, an X-ray luminous cool-core cluster at a redshift of 0.451. From X-ray imaging analyses we find that, although the mean gas distribution in the primary cluster is well fit by a spherical beta model, the X-ray surface brightness distribution shows asymmetries, i.e. cold fronts to the west, southeast, and east of the primary cD galaxy at 6.2'', 6.6'', and 11.6'', respectively. These fronts form a clockwise spiral, characteristic of gas 'sloshing' induced by a merger in the plane of the sky. Spectral analysis reveals temperatures ~25 keV southeast and ~20 keV west of the primary cluster, suggesting shock heating from the merger. Radial surface brightness profiles with an excess of surface brightness ~20'' southeast of the primary cluster locate the perturbing subcluster's gas. We identify 2 edges in X-ray surface brightness forming a 'Mach-cone', coincident with the maximum Sunyaev-Zel'dovich decrement from Mason et al. 2010. We model the density on either side of this shock feature as a power law and find a density ratio across the shock of $1.75_{-0.12}^{+0.13}$. Applying the Rankine-Hugoniot jump conditions, we derive a Mach number of 1.53 ± 0.06, corresponding to a subcluster velocity of 3250_{-230}^{+310} km/s. Radial surface brightness profiles with an excess of surface brightness ~20'' southeast of the primary cluster locate the perturbing subcluster. The Mach cone and excess X-ray emission associated with the subcluster gas are displaced to the south of the subcluster's central cD galaxy, suggesting that the subcluster is approaching the main cluster from the southwest. The displacement of the gas from the minimum of the subcluster's dark-matter-dominated gravitational potential suggests that the gas has undergone ram-pressure stripping. In future work we will compare hydrodynamical simulations of this ongoing merger in RXJ1347 to explore the dynamical origin of the observed gas features and constrain the merger history of this galaxy cluster.

Funder Acknowledgement(s): This work was supported in part by the Smithsonian Institution and NASA CXC grant GO2-13148X.

Faculty Advisor: Marie Machacek, mmachacek@cfa.harvard.edu

OA #103

Subcategory: Astronomy and Astrophysics

Gravitationally Driven Instabilities in Slowly Rotating Neutron Stars

Daniel Monge, University of Wisconsin-Milwaukee

Neutron stars (NSs) are the remnant cores of supernovae (massive stars that have exhausted their fuel supply and have undergone gravitational collapse followed by the subsequent jettison of enormous amounts of matter and energy). The remnant cores are characterized by their extreme density and high rotational speeds, and are supported against further gravitational collapse by quantum degeneracy pressure. This pressure, however, can resist gravitational collapse only until a point and for NSs more massive than approximately 2 solar masses gravitational forces overcome the degeneracy pressure of the neutrons and the NS further collapses into a black hole. Equilibrium-configuration-stars' energies are stationary points; that is, in their equilibrium configuration a star's energy is either a minimum or maximum of the system.

Herein we investigate the stability of these stationary points by subjecting the governing, dynamical equations to radial perturbations about these equilibrium points. Non-rotating NSs have an upper mass limit above which they are unstable to infinitesimal radial perturbations of their fluid (below this limit they are stable to radial perturbations). The centripetal force brought about by rotation raises the mass at which NSs gravitationally collapse due to radial perturbations. However, for non-rotating NSs, the instability to radial perturbations occurs at the maximum mass configuration whereas for rotating NSs it is hypothesized that the instability occurs at a mass slightly lower than its new maximum mass; the difference in these two masses is sought. This goal is accomplished theoretically by developing and solving the general dynamical equations which represent rotating, pulsating NSs. The system is solved analytically as well as numerically depending upon the conditions imposed. It must be noted that the system is solved numerically via implementation of independently developed code on the computer program MATLAB. This method has shown its accuracy in that solutions to a similar system of equations representing the sun have been in close agreement with leading models. Although the research is nearly complete (the governing equations have been developed) no general solution has yet been ascertained. A clear knowledge of stellar instability is paramount to developing accurate models of the universe, as well as understanding the development of black holes and the evolution of binary NS systems.

Key reference: Cox, John. Theory of Stellar Pulsation. Princeton: Princeton University Press, 1980. Print.

Funder Acknowledgement(s): This study was supported, in part, by a program funded by the NSF, the Wisconsin Alliance for Minority Participation (WiscAMP) program.

Faculty Advisor: John Friedman, friedman@uwm.edu

OA #104

Subcategory: Astronomy and Astrophysics

The Cooling of Cas A as a Probe for Symmetry Energy and Nuclear Pasta

Kyleah Murphy, Texas A&M University, Commerce

Co-Author(s): W. G. Newton and Bao-An Li, Department of Physics and Astronomy, Texas A&M-Commerce
K. Murphy, Department of Physics and Astronomy, Texas A&M University-Commerce and Umpqua Community College, Roseburg, OH
J. Hooker, Department of Physics and Astronomy, Texas A&M University (Commerce and College Station)

A key component in the description of dense matter in neutron-rich environments such as neutron star (NS) crusts and cores is the nuclear symmetry energy, which tells us the energy cost of increasing the neutron fraction of the system. First principles calculations from QCD are computationally intractable, and experimenters lack the capability to recreate in the lab the extreme densities and neutron/proton ratios found in NSs. The predictions our theoretical models give for the behavior of the symmetry energy as density increases (parameterized by the slope of the symmetry energy at nuclear saturation density, L) are divergent, and a plethora of equations of state (EOSs) of NS matter exist. Terrestrial constraints currently provide a range $30 < L < 80$ MeV. Since L is strongly correlated with the size and structure of NSs, the hope is that observations can constrain it further, enhancing our understanding of the behavior of fundamental forces in extreme conditions. X-ray observations of the NS in the Cassiopeia (Cas) A supernova remnant suggest a rapid drop by ~2-5.5% (Elshamouty et al. 2013) of the surface temperature in last decade. One explanation is that the onset of neutron superfluidity triggers the necessary enhanced cooling (Page 2011, Shternin 2011). Using standard neutron star cooling equations, we compute the thermal evolution of NS models using consistent crust and core EOSs from the Skyrme nuclear matter models.

These model EOSs can be parameterized by the slope of the symmetry energy, L. Neutron star masses in the range 1.25 - 1.8Msun are considered, and we use a range of masses for light elements in the neutron star envelope $-13 < \log M_{light} < -8$; both these ranges are inferred from model atmosphere fits to observations (Yakovlev et al 2011). Finally, it has been theorized that efficient neutrino cooling mechanisms might operate in the deepest layers of the neutron star crust (Gusakov et al 2004, Leinson 1993) where nuclei are expected to deform into exotic shapes and bubbles termed nuclear 'pasta'; we test the effect of these additional cooling processes on the thermal evolutions we calculate. Comparing our modeled cooling trajectories to the temperature and cooling rate of the Cas A NS, we can infer the following: taking all parameters into account we determine a conservative constraint of L<70 MeV; if the Cas A NS has a mass of 1.4Msun the constraint is even tighter: L<60MeV. If cooling processes are active in the bubble phases of the crust, the restriction is very tight: L<40MeV, suggesting a soft nuclear equation of state and neutron star radii of less than 11km (Newton, Murphy et al 2013). The three scenarios predict future cooling trajectories that can be distinguished by future observational data by X-ray telescopes over the next couple of decades. In particular, we will be able to test whether the bubble cooling processes are really active, which will provide important information about the NS crust.

Funder Acknowledgement(s): This work is supported in part by the National Aeronautics and Space Administration under grant NNX11AC41G issued through the Science Mission Directorate, and the National Science Foundations under Grants PHY-0757839, PHY-1068022 and the REU program under grant PHY-1062613.

Faculty Advisor: William Newton, William.Newton@tamuc.edu

OA #105
Subcategory: Nanoscience

Analysis of Lorentz–Drude and Brendel–Bormann Models for Noble Metals

Daniel Rasic, North Carolina Central University
Co-Author(s): Yongan Tang and Branislav Vlahovic, Department of Mathematics and Physics, North Carolina Central University

There are vast applications of surface plasmons in Biomedicinal, Energetics, Sensing, Environment protection, information technology, etc. The dielectric function is very crucial in understanding the physics of surface plasmon and the simulations for surface plasmon device development. Over the years, the Lorentz–Drude (LD) and Brendel–Bormann (BB) models were constantly modified depending on the need of certain metals and measurements. We analyze each model separately and present advantages to each one. We study the BB model and LD model for dielectric constant noble metals (Ag, Au and Al) in visual and infrared light spectrum. Our interest is seeking the ideal parameters so that the precision and accuracy of our acquired measurements of each metal is maximized. We manipulate the models by changing certain values of dielectric constant and changing the frequency.

Funder Acknowledgement(s): This work was supported in part by NSF HRD-0833184, NASA NNX09AV07A and ARO W911NF-13-1-0165.

Faculty Advisor: Yongan Tang, tangy@nccu.edu

OA #106
Subcategory: Physics (NOT Nanoscience)

Using Lie Algebras to Extract Non-Classical Evolution in Optomechanics

Alberto Acevedo, California State University, San Bernardino/ Brigham Young University
Co-Author(s): Ty Beus, Manuel Berrondo, and Jean-Francois Van Huele, Brigham Young University

The task of finding the time evolution of quantum systems governed by noncommuting, time-dependent Hamiltonians is generally quite complex. Factorization of the evolution operator in terms of the elements of the closed Lie algebra constructed from the Hamiltonian makes it possible to separately resolve the operator ordering issue and the time-dependence. We apply this method to oscillator dynamics and obtain analytic results. We then consider optomechanical systems, consisting of coupled optical and mechanical modes of oscillators to study the transition from coherent to non-classical states. We also show how the same method allows the inclusion of dissipative effects. Solutions for the time evolution of general simple harmonic oscillator systems and optomichanical systems of one optical and one mechanical mode were attained analytically and with a mathematical program created by Ty Beus. When dissipation is considered in the latter systems, we cannot attain an exact solution and approximations must be made. There are a variety of ways to consider dissipative effects in the dynamics of a quantum dynamical system, and it is of interest to find out which is the optimal approach for any given system.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Jean-Fracois Van Huele, vanhuele@physics.byu.edu

OA #107
Subcategory: Physics (NOT Nanoscience)

ClaRA: The CLAS12 Reconstruction and Analysis Framework

Eddie Banuelos-Casillas, California State University, Dominguez Hills
Co-Author(s): John W. Price, California State University, Dominguez Hills
Vardan Gyurjyan, Dennis P. Weygand, and Johann T. Goetz, Thomas Jefferson National Accelerator Facility, Newport News, VA
Sebastian Mancilla, Universidad Técnica Federico Santa María, Valparaíso Region, Chile

Like most modern nuclear physics experiments, the CLAS experiment at the Thomas Jefferson National Accelerator Facility (JLab) needs to deal with extremely high data rates; at CLAS, they can be as high as approximately one terabyte (TB) per day. The upgrade of the accelerator energy, and the upgrade of the CLAS detector necessitated by it, will increase the data rate by approximately a factor of five, making it even more important than ever to implement efficient data reconstruction and analysis techniques. Cloud computing provides an efficient and economically feasible way to handle such a large amount of data. A Beowulf cluster is a common type of setup for such a purpose; it uses many similar computers, all connected to each other, performing a task in unison. At the CSUDH Hadronic Structure Laboratory (HadLab),

we have built a 44-node Beowulf-like computer cluster operating a Linux distribution of Rocks Cluster which is based on CentOS. All of the computers in the HadLab cluster are recycled, mostly from computer labs on campus, to reduce the overall cost of the cluster; two of the HadLab nodes perform administrative functions, while the rest perform the calculations done by the cluster. The software used for this work is the CLAS12 Reconstruction and Analysis framework (ClaRA), a service-oriented architecture in which data processing algorithms filter continuously flowing data. I will present the motivation behind the ClaRA framework, and will discuss the current status of the development project of ClaRA stress test. In addition, I will compare the results from the Hadlab cluster at CSUDH to the supercomputers at Jlab.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF awarded to Helen H. Chun, Director for the Louis Stokes Alliances for Minority Participation, California State University, Dominguez Hills.

Faculty Advisor: John Price, jprice@csudh.edu

OA #108

Subcategory: Physics (NOT Nanoscience)

Stability Analysis of Non-Newtonian Films Inside a Rotating Cylinder

Ravi Shankar, UC Davis/California State University, Chico
Co-Author(s): Sergei Fomin, Nate Loker, and Alberto Mojica, California State University, Chico
Peter Haine, Massachusetts Institute of Technology
Abigail Gartrell, University of Maryland College Park

The fluid dynamics of a thin film inside a horizontal rotating cylinder (rimming flow) is characterized using theoretical techniques. This study has applications in various industries including rotational molding and spin coating of polymer melts. In these industries, the coating must be uniform and smooth. However, in practice, it can prove to be difficult to attain these smooth films. The system has an intrinsic inertial instability, so the smooth coating can be ruptured by even the smallest of disturbances. In previous theoretical studies, the inertial instability was shown to be tempered by the film's surface tension. However, for polymer rimming flow, the surface tension is usually a negligible effect in practice. In this study, a new stability mechanism is shown to result from a more accurate representation of the fluid's rheological properties. Previous studies used a linear approximation for the film's rheological properties (the "Newtonian" fluid model of constant viscosity). However, polymers are commonly known to be both shear-thinning and viscoelastic. To obtain more complete models of polymer rimming flow, we study the linear stability using several quasi-linear constitutive equations that each model more complex rheological behavior than that of the linear Newtonian equation. The Generalized Newtonian Fluid model's variable viscosity coefficient is used to model the polymer's shear-thinning, and the Second Order Viscoelastic Fluid model is used to simulate a weakly elastic memory of deformation history. These constitutive models and the Navier-Stokes equations are solved using perturbation expansions. The nonlinear evolution equation governing the film's thickness variation in time and space is derived for each constitutive model. The linear stability analysis of these equations is carried out. Solutions of the corresponding eigenvalue problems are obtained using analytical approximations and numerical techniques and compared to numerical solution of the nonlinear problem. The stability of the film is determined using these solutions. Shear-thinning is shown to have no effect on the film's stability as predicted by the simpler Newtonian approximation (neutral stability). Thus, for shear-thinning, the Newtonian model is shown to be sufficient for modeling film stability. In contrast, even weak viscoelasticity is shown to stabilize the film, suggesting a mechanism to reduce the film's inertial instability.

Funder Acknowledgement(s): We acknowledge the National Science Foundation for support of this project (DMS Award #0648764).

Faculty Advisor: Sergei Fomin, sfomin@csuchico.edu

OA #109

Subcategory: Physics (NOT Nanoscience)

X-Ray Flares Out of the Milky Way Center and Black Hole Universe

Christopher Wilson, Alabama A&M University
Co-Author(s): Tianxi Zhang, Professor of Physics, Alabama A & M University

When considering the big bang theory many assumptions must be made and problems exist that leave the theory in question. One assumption is the existence of mysterious dark energy, which might be impossible to identify and prove. There is also the problem that our universe is believed to be 13.8 billion years old, according to calculations based on current models. However, the most distant galaxies known are 13.4 billion light years from us. This would leave only 400 million years for the universe to come into existence and develop sufficiently enough for galaxy formation to occur to the state we observe now. Recently, we have investigated the new cosmological model called black hole universe, which describes our universe as belonging to a family of continually evolving, developing and growing black hole universes which could exist without beginning or end. This black hole universe theory explains universal expansion and acceleration without the need for the assumption of dark energy. It has also been used to describe phenomena such as cosmic background radiation, quasars, and gamma ray bursts. This work is an attempt to further the study into the black hole universe model. It will focus on whether the model can accurately predict the observations seen from the center of our own galaxy, in particular the X-ray flare emissions caused by our own massive black hole with about 4 million solar masses, recognized at our galaxy center by discovering that some stars are orbiting around this invisible object four decades ago. Recently, the NASA Chandra and NuSTAR X-ray observations have shown that this object shoots out X-ray flares around once a day with luminosity 150 times increased and total 1039 erg energy emitted out. This is an interesting and puzzling phenomenon, scientists are still not sure of the causes of these X-ray outbursts. Through the use of available measured data and our calculations of X-ray flare emissions including frequency, energy, and flux this theory will be tested. This work is expected to show that the black hole universe model will predict the observations we detect from our galactic center.

Funder Acknowledgement(s): This work is supported in part by NSF HBCU-UP grant number HRD #0928904.

Faculty Advisor: Mostafa Dokhanian, mostafa.dokhanian@aamu.edu

Science and Mathematics Education

OA #110
Subcategory: Education

LEGO Robotics Could Increase Female Interest in STEM

Janice Carter, Southern University at New Orleans
Co-Author(s): Rachid Belmasrour and Illya Tietzel, Southern University at New Orleans

Females are underrepresented in science, technology, engineering and mathematics, also known as STEM. Therefore, there is a need to break down barriers to engage females. Commercial robots sold by toy companies may improve interest, confidence and ability in STEM skills. As self-driven learners, children such as young females can naturally engage in robotics through playing to build and program robots. Thus it is hypothesized that hands-on activities with commercial robots sold by toy companies can improve interest, confidence and ability in STEM skills such as building and programming robots independent of gender and thus also for young females. To test this hypothesis, a LEGO Robot was designed and introduced to 21 young students, ages 4 through 9 years at different summer camps. A series of questions were asked and various activities were performed to see if building and programming robots was dependent of gender. Statistical analysis such as Chi-Square and Z-test was used. Results were as follows: Chi-square analysis (1) Null Hypothesis (H0): Gender is independent of like building robots. The calculated P-value was > 0.1 and the Null hypothesis was not rejected. For analysis (2) H0: Building robot is independent of gender, was rejected at 0.1 level of significance based on P-value <0.1. For analysis (3) H0: Wanted to build robot is independent of gender, was not rejected based on P-value > 0.1. For analysis (4) H0: Took apart robot is independent of gender, was rejected based on P-value <0.1. For the Z-test analysis (1) H0 - No difference between males and females who like to build robots, was not rejected based on Z value of -0.105. For analysis (2) H0 - No difference between males and females who did build robots, was rejected based on Z value of 1.63. For analysis (3) H0 - No difference between males and females who wanted to build robots, was not rejected based on a Z value of 1.01. For analysis (4) H0 - No difference between males and females who took apart robots, was not rejected based on a Z value of -1.54. In conclusion, the findings of the Chi-square and the Z-test were similar with the exception of analysis 4. There is gender independence in like to build and wanted to build robots. It is not understood why there is a difference with the analysis 4 between the Chi-square and the Z-test. Future research is needed to find out why there is gender dependence with building robots.

Funder Acknowledgement(s): This summer research study was made possible by a stipend awarded to Janice Carter and supplies of SUNO SPACE UFOM grant of the Louisiana Space Consortium of I. Tietzel.

Faculty Advisor: Illya Tietzel, Rachid Belmasrour, ITietzel@suno.edu

OA #111
Subcategory: Water

Underwater Communication Using Sinusoidal Waves

William A. Snyper, Savannah State University

The ocean has been a mystery to humans for many years, but through the use of advanced technology, we are able to explore it. Though we can explore it, we are faced with many problems such as establishing a way to communicate underwater. Communication is the biggest concern of any operation which could determine success or failure. The purpose of this research is to study an existing underwater diver communication system and identify its strengths and weaknesses. The system we intend to study utilizes sound waves as a means of communication. There has been countless research into the possibility of this. Many devices used sound waves for underwater communication; one such device is the Neptune Space mask. Our goal is to find a permanent solution to eliminate its weakness. By fully understanding the device, we may be able to create an effective and efficient way of establishing a communication channel for divers that provide clarity of sound and range.

Our goal is to investigate this device by identifying the weakness of the system. Through this research we hope to find ways to eliminate this weakness which may lead to effective and efficient ways of communicating underwater. We will be utilizing the speech communication method that is central to diver to diver communication or diver to station. Most of the underwater communication diver devices use analog transmission to transmit data, but we believe that if the signal is converted to digital, this could provide better quality of the transmitted data. We will also try to find ways to improve the range of this device. In this research we were able to study a current underwater communication diver mask and fully understand its strengths and weaknesses. We focused on finding ways of improving the underwater communication system by trying to improve sound quality and area coverage of the device. Analysis of the collected data from other researchers shows that converting the transmitted signals of the Neptune Space mask from analog to digital could improve the quality of the sound. Also, in order to expand the range we can build a device that utilizes the same functionality of a Tsunami Warning System to amplify our signals. Based on our research and collected data we have gathered from other researchers, we believe that further extensive research needs to be conducted to confirm our theory.

Funder Acknowledgement(s): Savannah State University (SSU); Kuppuswamy Jayaraman, SSU-PSLSAMP Coordinator; Chellu Rama Devi, SSU-PSLSAMP Associate.

Faculty Advisor: George Tessema, tessemag@savannahstate.edu

Social, Behavioral, and Economic Sciences

OA #112
Subcategory: Ecology

Direct Fitness and Parental Care in the Three-Striped Poison-Dart Frog

Paige J. Scott, Virginia State University

Darwin (1871) recognized sexual selection as a primary factor in reproductive success for females and males. Paternal care, where males increase their fitness through offspring post-fertilization care is an important aspect of sexual selection theory. Though it was reported in anurans over a hundred years ago few studies have attempted to quantify male parental investment. To our knowledge, this is the first study to document male and tadpole behavior when males release the tadpoles into a puddle for continued development. We used *Ameerega trivittata* to test the hypothesis that larger males can achieve greater fitness with having more tadpoles than smaller males. Our research was carried out at Brownsburg National Park in the Republic of Suriname, South America. We searched along a 1.5 km section of dirt road perforated with puddles for males to deposit their tadpoles. In finding a male with tadpoles on his back, we would catch them with a net or by hand and place them in a zip-lock bag. Tadpoles were counted using a 10x magnifying glass and the male frog's snout-vent length was measured to the nearest 0.01 mm with digital calipers. The total weight of the males and tadpoles were weighed to the nearest 0.01 of a gram. A single tadpole was gently removed from the male's back so length and weight could be recorded. To find total weight of the tadpoles, the tadpole weight was multiplied by the total number of tadpoles. Total weight was then subtracted from the combined weight of the male and tadpoles to determine male weight. Once done, the tadpole was carefully returned onto the male's back, and the male was released at the site of capture. Behavioral observations of males depositing tadpoles were conducted using binoculars and video recordings from a distance of 4-10 m to minimize disturbance. A total of 24 male frogs and 437 tadpoles were measured.

We found a significant correlation between male size and number of tadpoles carried ($r=0.46$, $p=0.024$). In addition, we recorded a previously undescribed male transport behavior, in which males physically remove tadpoles from their backs by pushing them off with their rear limbs into the puddle. In comparison to other studies on this species, our frogs were relatively smaller and carried fewer tadpoles than populations found in neighboring countries. Future research will focus on examining female choice for male size and a comparison of male tadpole transport and deposition in other closely related species.

Funder Acknowledgement(s): We thank I. Monagan, K. Robinson, and R. Jairam for help in the field. For logistic support and collaboration, we thank R. Jairam and P. Ouboter at the University of Suriname and R. Dragman at STINASUS in Suriname. This study was supported by a grant from NSF/HBCU-UP to Christian d'Orgeix.

Faculty Advisor: Christian D'Orgeix, CDorgeix@vsu.edu

OA #113
Subcategory: Physiology and Health

Sex Differences in the Resting State Brain Activity in Bipolar Disorder

Sara Kimmich, University of California San Diego

The course and expression of bipolar disorder (BD) clearly differs between women and men. Women more often have a seasonal

pattern of mood disturbance, and are more likely to experience rapid cycling than men. Men are more likely to have a comorbid substance use disorder, while women more frequently have comorbid anxiety disorders. Previous studies have observed sex effects in connectivity of the default mode network (DMN) of healthy individuals, but more research is needed to see whether a similar effects holds among BD patients. This study investigates 1) how sex differences in DMN activity among BD I patients compared to individuals without BD, and 2) how sex differences may relate to clinical or cognitive differences in BD. We compared 27 euthymic patients with bipolar I disorder to 28 age and gender comparable healthy participants using functional magnetic resonance image during a period of eyes open rest. Averaged functional activity between the nodes of the DMN (medial prefrontal cortex, posterior cingulate, and bilateral angular gyrus) revealed that BD females tend to have greater co-activity within the default mode network than male BDs, which contrasted with the pattern of greater connectivity among male healthy participants compared to females (p=.01). Negative psychotic symptoms were more pronounced in male than female bipolar participants (p=.07). There was a significant negative correlation of average DMN connectivity with negative symptoms (r(28)= -.44, p=.05). These results suggest subtle sex differences in the inter-relationship of resting brain activity within the DMN that may relate to clinical differences between men and women with bipolar disorder, including severity of negative psychotic symptoms.

Funder Acknowledgement(s): NIMH Grant R01 083968; National Science Foundation; VA San Diego Mental Illness Research, Education and Clinical Center; Louis Stokes Alliances for Minority Participation

Faculty Advisor: Lisa Eyler, lteyler@ucsd.edu

OA #114
Subcategory: Physiology and Health

Estimation of Daytime Sleepiness in Hawai'i College Students

Roberto Ramilo, Kapi'olani Community College
Co-Author(s): Mitch Mikami, Kapi'olani Community College, Honolulu

Daytime sleepiness (DS) is very high in college students. Consequences of DS in young college students range from lower levels of academic performance to higher risks of motor vehicle accidents and poorer health. Unfortunately, the currently accepted quantitative measure of DS is currently time consuming and expensive as it requires the subject to go through a lengthy diagnostic tool conducted in a clinical setting called the Multiple Sleep Latency Test (MSLT). To this day, the only qualitative measurement of DS is estimated using sleep surveys.

The purpose of this research is to develop a novel, reliable and quick quantitative method of estimating DS in college students using pupillometry. Subjects are first subjected to a health questionnaire, and are asked to wear an actigraph watch for three consecutive nights in order to ensure healthy subjects and a regular sleep/wake pattern in addition to an adequate amount of continuous sleep. When coming back to the lab, patients are then subjected to two qualitative sleep surveys: the Epworth Sleepiness Scale (ESS) and the Stanford Sleepiness Scale (SSS) to estimate their DS. In order to verify the outcomes of such qualitative tests, a quantitative measurement of the subject's pupil diameter is performed over a period of 15 minutes. Pupil diameter fluctuations are analyzed using time series analysis tools such as standard deviation, and calculations of relative powers over several frequency bands using a power spectrum density treatment.

Our preliminary results showed a correlation between ESS and SSS qualitative results and the standard deviations of sleepy subjects versus non-sleepy subjects. The subjects characterized by sleep surveys as sleepy had more pupil fluctuations over the 15-minute recording period than their non-sleepy counterparts. On a minute-by-minute analysis, the sleepy subjects' standard deviations increased over time while the non-sleepy subjects' standard deviations decreased. Based on the power spectrum analysis, a shift of relative power was also observed towards higher frequency bands for sleepy subjects. Further research involving more human subjects is necessary to obtain reliable statistical differences and confirm our results. In addition, a complete MSLT treatment should be conducted to confirm the metric used in this research.

Funder Acknowledgement(s): National Science Foundation TCUP grant.

Faculty Advisor: Herve Collin, herve@hawaii.edu

OA #115
Subcategory: Social Sciences/Psychology/Economics

Making a Case for Wingate: Improving Math Cognition and Motivation

Eumala Braithwaite, University of the District of Columbia
Co-Author(s): Sean Coleman, University of the District of Columbia

The disparity in academic achievement between African-American and European American students has been an issue for several decades (NAEP, 2012). Many researchers address this academic achievement disparity or gap by suggesting the use of integrity-based pedagogy to support higher academic achievement for African-American students (Boykin, Coleman, Lilja, Tyler, 2004; Boykin & Noguera, 2011; Coleman, 2013). Integrity-based strategies can be characterized by the use of

cultural assets, critical thinking, and constructive social interactions. To this end, this study hypothesizes that students will improve their academic performance after receiving ongoing integrity-based instruction. Additionally, students will endorse integrity-based learning environments over traditional teaching environments. This investigation represents one of two studies--each study used separate samples at different schools. “The anonymous school in this study will be renamed to Wingate to protect the anonymity.” In this study, 54 third through sixth grade students from low socio-economic backgrounds within the Washington, DC Metropolitan area participated. Students were tested in mathematics computation, conceptual understanding, and application using a pretest/posttest design, testing in fall and spring respectively. A paired samples T-test analysis was performed to examine significant differences in students’ pretest and posttest math performance.

Results show that students significantly increased for computation ($t=3.36$, $p. >.01$). Descriptive statistics reveal that students improved in conceptual understanding (pretest $m=3.04$, posttest $m=3.77$) and practical application (pretest $m=3.25$, posttest $m=4.13$). Students completed a Motivation and Climate Inventory. A paired samples T-test analyses was performed to evaluate significant differences in students’ positive perceptions of classroom climate compared to in-school and after-school learning environments. Students’ positive learning perceptions of their after-school climate were significantly higher than those of their classroom climate ($t=4.07$, $p>.01$). Integrity-based strategies may provide insight to how we can enhance cognition and learning as well as moti-vation to learn. Thus, the implementation of these strategies facilitate enhanced student cognitive abilities as well as affective connections to positive school environments. Future research should consider studying larger samples as well additional subject areas.

Funder Acknowledgement(s): Thank you to the MARC U*Star Honors Program at the University of the District of Columbia. Thank you to the Capstone Institute at Howard University as a research collaborator.

Faculty Advisor: Sean Coleman, scoleman@udc.edu

OA #116
Subcategory: Social Sciences/Psychology/Economics

Sex, Stress, and Inflammation in a Murine Model of Ulcerative Colitis

Derell Hampton, Tuskegee University
Co-Author(s): Ira Tigner, Destina Campbell, Jonathan McNeilly, Kara Cromwell, Darielle Freeman, Tim Purdie Jr., DeJuana Grant, Frank Chestnut, Oresea Mitchell, and Denevia Hicks, Tuskegee University

Purpose: To determine the significance of IL-10 knock-out (KO) mice and wild-type (WT) mice on the measures of sexual stress. Background: Perhaps one of the most compelling sources of stress is the desire of animals to procreate. The sex/mating ritual is an aggressive, sometimes violent act, that causes stress in mice, as characterized by a number of behavioral and physical symptoms. IL-10 is an interleukin that inhibits inflammatory cytokine production by macrophages in the body. IL-10 KO mice are unable to cope with stressors, are hypersensitive to inflammation and may exhibit altered responses to sex-related stressors.

Methods: Six week (young) to 6 month-old (old) male and female 129 SvEv WT mice were reared in shoebox cages. Half of the animals had previously been used in mating pairs and the other half were naïve (virgin) mice. We then introduced the singly housed mice to singly-housed mice of the other sex. The experimental design included mice that were confined so that the other mouse of the other sex could see, smell and touch but not copulate with the mouse and included cage pairs that were freely able to mate (WT controls).

Results: Mice were calm and resting before being introduced to the mouse of the opposite sex. After the introduction, the mating pairs were observed for one hour. Data collected included number of attempts at mating, number of copulations, and stress responses. Mice were then assessed for behavioral and physical changes, comparing treated mice to WT controls. Conclusion: When it comes to procreating, the old male mice were more proactive than the young male mice.

Funder Acknowledgement(s): NSF (HBCU-UP #8RD-0938273 and IBS-REU #0852049). NIH (MARC #5T34GM087254 & RCMI #2G12RR03059 programs); the College of Veterinary Medicine, Nursing, and Allied Health, Tuskegee University and the George Washington Carver Agricultural Experimental Station, Tuskegee University.

Faculty Advisor: Deloris Alexander, dalexander@mytu.tuskegee.edu

OA #117
Subcategory: Social Sciences/Psychology/Economics

Understanding the Impact of Epigenomics on the Practice of Psychology

Steven Jones, University of the District of Columbia
Co-Author(s): Benson Cooke, University of District of the Columbia

Epi-Genomic research can potentially be used to augment the professional practice of psychology in determining the most effective behavioral treatment interventions for mental illness including but not limited to: Clinical Depression, Post Traumatic Stress Disorder, and Anxiety Disorders. The goal of this research is to examine the relationships between genomic contributors, environmental factors and phenotypes for mental illness among African-American clients. Using a Meta-analysis to examine the current data surrounding environmental factors, events and trauma that potentially trigger gene expression. This research will also examine the influence of cultural factors, proactive treatment and therapeutic healing for those who have suffered generational trauma. The impact of multicultural interventions will be examined within the context of deterministic and reductionist science. Understanding the influences of resilience triggered by salient cultural interventions will also be examined. Additionally, this presentation will examine the influence between social and psychological environments on gene expression as well as any behavioral and therapeutic interventions with African-American clients that promotes generational healing.

The presenter will provide a step-by-step understanding of how multicultural strategies can influence and inform gene expression, via cultural sensitivity and competence in the development of healing methodologies for treatment with African-American clients. Finally, this presentation will examine how pro-social environments can effect gene expression generationally. We expect to begin a dialogue with the community on the impact genomics has on future psychological research. We expect to further our continued vigilance when it comes to human subject protections.

Funder Acknowledgement(s): UDC Marc U Star Honors Program

Faculty Advisor: Benson Cooke, bcooke@udc.edu

OA #118

Subcategory: Social Sciences/Psychology/Economics

Using Integrity-based Strategies to Improve Math Cognition and Motivation

Tiffany Long, University of the District of Columbia
Co-Author(s): Sean Coleman, University of the District of Columbia

The National Assessment of Education Progress (NAEP) reports that there is a pervasive academic achievement gap between European Americans and African-American students (NAEP, 2012). Several researchers (Boykin, Coleman, Lilja, Tyler, 2004; Boykin & Noguera, 2011; Coleman, 2013) suggest that the academic achievement gap can be closed by using transactional pedagogical practices to enhance academic achievement, subsequently, the capacity for cognition and learning. The study hypothesizes that integrity-based teaching strategies (i.e., cultural assets, critical thinking, and constructive social interactions) will lead to enhanced affective and cognitive math outcomes. This study represents one of two studies--each study used separate samples at different schools. This study consisted of 44 African-American third through sixth graders from low socio-economic backgrounds within the Washington, DC Metropolitan area. A within group experimental research design was used to explore pretest to posttest gains in mathematics for students that participated in an after school program for two semesters. The math foci included computation, conceptual understanding, and application. Students completed Motivation and Climate Inventory regarding their preference for in-school and after-school learning environments. A paired samples T-test analysis was performed to examine significant differences in students' pretest and posttest math performances.

The results show that students' mathematics learning significantly increased for computation and conceptual understanding (computation $t=4.37$, $p>.01$: conceptual $t=2.83$, $p>.01$). Descriptive statistics show that students improved in practical application, however, the results were not significant (pretest $m=3.11$, posttest $m=3.46$). Paired samples T-test analyses were performed to evaluate significant differences in students' perceptions of climate in their classroom and after-school learning environments. Students' positive learning perceptions of their after-school climate were significantly higher than those of their classroom climate ($t=5.01$, $p>.01$). The use of integrity-based strategies, indeed, provides insight into how we can enhance cognition, learning, and motivation to learn. Subsequently, these strategies may be key to closing academic achievement gaps. Future research should consider using larger samples and more content areas.

Funder Acknowledgement(s): Thank you MARC U*Star Honors Program at the University of the District of Columbia. Thank you Capstone Institute at Howard University as a research collaborator.

Faculty Advisor: Sean Coleman, scoleman@udc.edu

Technology and Engineering

OA #119

Subcategory: Biomedical Engineering

A New Wireless Wearable Device for Improved Gait Rehabilitation of Elderly

Abdelhakim Ahmim, University of the District of Columbia
Co-Author(s): Sasan Haghani and Neelesh Kumar, University of the District of Columbia

The elderly population of the world has steadily been growing over the past decade. This has resulted in an increase in the number of people suffering from musculoskeletal disorders, which affect the mobility of individuals. Stroke and other neural disorders such as cerebral palsy and Parkinson's disease also affect the normal gait of an individual. In musculoskeletal rehabilitation, the knowledge of the dynamic status of a patient's gait is necessary to improve and quantify the rehabilitation process. However, available commercial gait rehabilitation devices like GaitRite and ZeroG have very limited information about the gait of the patients. In this project we developed a wearable gait sensor system to monitor the gait and postural stance of a patient. The system consists of a MEMs sensor, a 3-axis accelerometer and an angular rotation gyro sensor. Two accelerometer modules were placed on the shoulders and the gyro sensor module was attached to head using a flexible head band. A 3-axis accelerometer records the tilt in degrees of shoulders in x, y and z directions. The gyro sensor gives the angular orientation of the body. Combined values of these sensors provide data about the postural symmetry and stability of the patient. The gait data was wirelessly transmitted to a base station using ZigBee Commun-ications and inserted in a SQL database. A graphical application programming interface was developed to display the data. The system was tested in real time and the data was successfully captured and displayed. The designed system can be used to capture both normal and abnormal gait data in various positions to make a gait database, quantify gait status and also help to design improved rehabilitation programs.

Funder Acknowledgement(s): This research was supported in part by the grant NSF/HBCU-UP-HRD-0928444.

Faculty Advisor: Sasan Haghani, shagani@udc.edu

OA #120
Subcategory: Cell and Molecular Biology

Characterization of a Human Neuroblastoma Spheroid Model for Drug Discovery

Dayrin Mendez, University of Georgia
Co-Author(s): William Kisaalita, University of Georgia

It is widely recognized that conventional flat-surface cell culture platforms are not as physiologically relevant as three-dimensional (3D) cultures. Human cells are naturally found in a 3D environment, hence, adapting to a 3D model that is more *in vivo* like has the potential to improve clinical research as well as provide a High Throughput Screening (HTS) platform for drug discovery. Specifically, SH-SY5Y Neuroblastoma cell line has become a prominent cell model for studying and developing drugs against neurodegenerative diseases like Parkinson's because it exhibits many characteristics of dopaminergic neurons. Designing a 3D model of SH-SY5Y will increase the relevance of such studies. The present study focused on establishing a relationship between the spatial and temporal dimensions of 3D cultures, specifically, the effect of time on tissue size and associated complex functionality such as calcium dynamics. Both 2D and 3D cultures were stained with calcium specific Fluo-4 AM at different time intervals of up to 15 days, and it was found that the calcium oscillation frequency is lower in 3D than 2D cultures which is similar to what is observed *in vivo*. The Anti-CA9 antibody (carbonic anhydrase IX, hypoxic marker) was used to find the size at which hypoxia occurs since hypoxia can lead to phenotypic and functional changes within the micro tissue. The extent of differentiation of neuroblasts into mature neurons was monitored using the neuron specific enolase (NSE) antibody in order to better understand the effect of 3D cultures on their development. These findings lead to the characterization of human neuroblastoma spheres that enhance the drug discovery process for neurodegenerative diseases.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF (0304340) and a UGA Engineering Grants awarded to William Kisaalita, Director of Cellular-Biology Engineering Laboratory, University of Georgia.

Faculty Advisor: William Kisaalita, williamk@engr.uga.edu

OA #121
Subcategory: Civil/Mechanical/Manufacturing Engineering

Enhancing Sustainability with High-Performance Green Bridges

Tyrone Hansboro, Jr., Morgan State University
Co-Author(s): Kyle Edmonds and Emani Evans, Morgan State University

As the push for efficient, effective and environmentally-friendly construction grows, the use of prefabricated bridge elements and systems (PBES) is one increasingly popular structural design and construction alternative that will help reduce material waste, increase construction work zone safety, reduce pollution to our surrounding environment, and aid in minimizing costs for newly erected structures. For buildings, Leadership in Energy and Environmental Design (LEED) criteria is well-defined, but there is currently no formalized criteria established by the U.S. Green Building Council LEED criteria for bridges. To address this shortcoming, the work herein showcases the development of LEED criteria to yield high-performance green bridges (HPGB) with PBES as one construction approach that can aid in enhancing sustainability of bridges. The LEED criteria described for HPGB is based on four major categories: construction, materials, sustainability, and energy efficiency. Similar to LEED criteria for buildings, the LEED criteria for HPGB is based on a points or rating system. The expected outcome of the work proposed may lead to a new generation of HPGBs that utilize innovative, environmentally-friendly materials and construction methodologies that would meet various prerequisites and credits to be classified as either bronze, silver, gold or platinum LEED certified bridges.

Funder Acknowledgement(s): This study was supported by a grant from NSF awarded to Monique Head, Assistant Professor, Department of Civil Engineering, Morgan State University.

Faculty Advisor: Monique Head, monique.head@morgan.edu

OA #122

Subcategory: Civil/Mechanical/Manufacturing Engineering

Design and Fabrication of a Bumblebee Ornithopter

Deyzi Ixtabalan, Arizona State University
Co-Author(s): Michael Thompson, John Burnett, Dwight Hanson, Ruby Gomez, and Daniel Lopez, Arizona State University

Dynamic flapping micro air vehicles categorically fall into two categories: (1) flapping wings requiring constant forward velocity flight like birds, and (2) wings that flap like insects. The two categories are based upon whether or not an animal is vertebrae (backbone) or invertebrae (without backbone). A bumble bee is considered an insect where their wings are considered more like a flexible blade such as a helicopter rather than an airplane.

The research focuses on designing and fabricating a bumblebee ornithopter. The ornithopter model was designed through SolidWorks and fabricated using 3D printing replicating a bumblebee for its aerodynamic attributes. When the force is equal to the weight of the ornithopter, the model is said to be in equilibrium (hovering). When the force is greater than the weight, the model is said to be producing lift. The ornithopter prototype has a six winding brushless motor with a maximum capacity of 8500 kilovolts to overcome equilibrium flight. The bumblebee ornithopter can maintain its equilibrium by the abdomen which relocates the aerodynamic centroid. The weight of the ornithopter was kept under 100 grams to meet the predicted aerodynamic efficiency. The bumblebee ornithopter design is complete and expecting wind tunnel flight test to optimize performance.

Funder Acknowledgement(s): Western Alliance to Expand Student Opportunities

Faculty Advisor: Armando Rodriguez, aar@asu.edu

OA #123

Subcategory: Civil/Mechanical/Manufacturing Engineering

Sustainability through Soap: Small-Scale Solutions for Large-Scale Problems

Kendra R. Jones, Howard University
Co-Author(s): Awambeng Mofor and Michael Ekonde Sone, University of Buea, Cameroon

Most global, rural populations are regularly confronted with the need for cleanliness and the inability to afford soap. To guarantee long-term community cleanliness, without imposing insupportable financial strain, it is necessary to enable local communities to use readily available ingredients for the local production of soap. The objective of this project was to develop a small-scale soap production machine adapted to the needs of low-income rural communities and to increase their self-sustainability. Specifically, we designed a compact machine capable of producing soap from raw materials. This machine is able to hold, measure, dispense, heat, mix, pour, and form the raw materials into 7x7x7cm cake blocks. It makes a proportionate number of soap squares when set amounts of raw materials enter the holding containers. The containers can hold between 8 and 15 liters of raw materials that subsequently produce approximately 23 to 44 blocks of soap. This machine is capable of operating with or without an electrical power source. As constant electricity is still a major issue for many rural communities, ensuring the machine is fully functional in the absence of electricity is necessary. Therefore, the machine is designed to be fully functional using only hand cranks and pulley systems. This significantly impacts rural communities because it potentially eliminates the need for community electricity and allows for a source of sustainable income. With its simple yet efficient design, the machine could also be used for similar tasks requiring mixing, molding, and/or heating of materials (e.g., making mud bricks for use in local construction). The machine has many implications that would greatly improve the quality of life for impoverished communities around the world, and provide opportunities for increased independence and entrepreneurship.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Wayne Patterson, wpatterson@howard.edu

OA #124

Subcategory: Civil/Mechanical/Manufacturing Engineering

Effect of Doping YSZ with Gd2ZrO7 on YSZ Thermal Barrier Coating Properties

Breanna Lewis, Southern University and A&M College
Co-Author(s): Omotola Coker, Stephen Akwaboa, and Patrick F. Mensah, Southern University and A&M College

Thermal barrier coatings (TBCs) are commonly used as insulating materials to improve the upper limit temperatures and efficiencies of gas turbines. This study is a part of ongoing research to investigate the effects of high temperature thermal cycling performance and thermo-physical properties at elevated

temperatures of potential YSZ doped with GZ double layered TBC coatings. In this investigation, the effect of using varying composition of GZ in double layer TBC in reducing the thermo-physical properties of the composite materials was analyzed. Samples were made of multilayered with Gadolinium particles 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 MCoCrAlY+Hf, 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. Since the specimen was multilayered, the first layer of the top coat was made of three different compositions of YSZ and GZ (30-70% respectively). The bottom layer of all coatings was 100% YSZ. 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 increasing the amounts of GZ found in the YSZ top layer of the thermal barrier coatings, we were able to observe a significant decrease in the levels of the thermo-physical 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 TBCs operating at higher temperatures.

Funder Acknowledgement(s): This work was supported by Louisiana Board of Regents NASA-EPSCoR (2009-12) award number NNS09AP72A, and NSF HBCU-RISE HRD 1036588 award for post-doctoral research support; HBCU-UP ACE 1043316 award is acknowledged for undergraduate student support.. The APS coatings are provided by Material Solutions International, TX. Undergraduate student support is provided by the HBCU-UP ACE Program.

Faculty Advisor: Patrick Mensah, Patrick_Mensah@subr.edu

OA #125
Subcategory: Civil/Mechanical/Manufacturing Engineering

Using Film Boiling to Thermally Decompose Organic Molecules

Adam Lowery, Cornell University
Co-Author(s): Wei-Chih Kuo and C. Thomas Avedisian, Sibley School of Mechanical and Aerospace Engineering, Cornell University

The research presented describes a new approach to decompose organic liquids by a relatively simple process that involves film boiling. This is a specialized multiphase heat transfer mode that arises when heat transfer from a submerged solid to a subcooled liquid promotes boiling on the surface of the solid to such an extent that the departing bubbles coalesce and form a continuous film over the solid. The solid temperature increases substantially as a result due to the insulating effect of the vapor film, and the vapor temperature is thereby limited theoretically only by the melting point of the material. The high gas temperatures in the film may be sufficient to decompose the organic gases flowing within it. In this way the vapor film constitutes a sort of "chemical reactor" that essentially builds itself by adjusting the control variable of surface temperature. The concept is illustrated with a model compound - diethyl carbonate (DEC) - that is known to decompose into ethanol, ethylene and carbon dioxide. In the experiments, film boiling is established by resistively heating a thin-walled horizontal comprised of a nickel alloy, Inconel. When sufficiently heated, boiling is established on the tube surface which eventually transitions to the film boiling regime. The gases that flow (under the action of buoyancy in our concept) are collected in the bubbles that form at the top of the tube and percolate through the liquid pool where they are analyzed after they reach the top of the tube and burst open. The exhaust gases are analyzed using gas chromatography, while the liquid pool is periodically sampled and analyzed by GC/MS means.

The experimental results show evidence of converting DEC to carbon dioxide, ethylene and ethanol which is quite consistent with the expectation of unimolecular decomposition of DEC. Furthermore, formation of a very thin carbonaceous layer was also found on the tube surface. The experimental design allows condensable products (ethanol in this case) to reflux into the DEC pool. Preferential evaporation of ethanol in the vapor film offered an environment for its decomposition apart from DEC to various hydrocarbons and organic compounds. The results include measurements of the product gas flow rates of the individual product species with average tube temperature, and high resolution digital images of the film boiling process. The concept as presented in this study illustrates the promise that such a simple concept as film boiling may have on affecting chemical change of a wide range of condensed organic liquids.

Funder Acknowledgement(s): The work of Adam Lowery was supported by the Cornell University Louis Stokes Alliance for Minority Participation, a NSF supported program under Grant No. 06-552. Partial support was also provided by the NSF Grant No. 1336657.

Faculty Advisor: Thomas Avedisian, cta2@cornell.edu

OA #126
Subcategory: Civil/Mechanical/Manufacturing Engineering

Extra-lightweight UAV Composites Structures via Additive Manufacturing

Marquese Pollard, Savannah State University/Florida State University

Co-Author(s): Jerry Horne, Florida Agricultural and Mechanical University
Charles Young and Richard Liang, Florida State University

Unmanned aerial vehicles (UAV) that hold the ability to be piloted autonomously or via remote control and perform crucial tactical missions have become of increased interest to police and military personnel over the past half-decade. While most UAVs are manufactured via mold fabrication, this method limits the options for a customized design for the growing customers' bases in a timely manner due to time consumption of the fabrication process. This research includes the designing of a UAV via computer-aided design, which will include the fuselage and wings. The design is based on a previously fabricated UAV at the Air Force Research Labortory. However, instead of the entire aircraft possessing a uniform solid finish, it will initially possess a scaffold structure to reduce material usage and weight. Once the CAD model is printed via additive manufacturing, the model will undergo a process where carbon fibers are applied to the structure.

The goal is to reduce the overall weight of the aircraft with the scaffolds while still enabling it to retain its structural and aerodynamic integrity. It is intended for this method to allow countless number of customized designs to be additively manufactured and produce equivalent flight characteristics while meeting cost and time requirements.

Funder Acknowledgement(s): I would like to thank the Air Force Research Laboratory for funding my research at Florida State University's High Performance Materials Institute this summer.

Faculty Advisor: Richard Liang, liang@eng.fsu.edu

OA #127
Subcategory: Computer Engineering

A FPGA-based Algorithm for Message Authentication Hybrid Encryption Scheme

Jonnetta M. Bratcher, Howard University
Co-Author(s): Bunji Ringnyu and Yusinyu Nsami, University of Buea, Cameroon

The importance of this research is highlighted by the need to authenticate messages from various senders. This paper presents a new hybrid scheme which could be used for message authentication, integrity and non-repudiation. The research method includes a multi-level structure and uses the RSA, convolutional codes and wavelet techniques. At the first level, a public-key RSA signature converts the original plaintext into a ciphertext. Iterated subband coding splits the ciphertext into different levels of decomposition. At subsequent levels of decomposition, the ciphertext from the preceding level serves as input data for encryption using convolutional codes. The research findings produced a new algorithm using the Virtex-5 FPGA parameters with 8-bit key lengths by applying the RSA algorithm to each key length. The security level of the new algorithm is high due to the propagation of the cryptographic complexity on all decomposition levels. Future research should implement the RSA algorithm to the 64-bit key length to accommodate larger messages.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Micheal Ekonde Sone, gate_ling@yahoo.com

OA #128
Subcategory: Computer Engineering

Autonomous Robot: Prototype – AVBeta

Brandon Megna, Virginia State University
Co-Author(s): J. Hosler, NASA Goddard Space Flight Center
E. Sheybani and S. Garcia-Otero, Virginia State University

An autonomous vehicle is a self-piloted vehicle that does not require an operator to navigate and accomplish its tasks. Many companies and organizations are spending a lot of time and money developing autonomous vehicles for numerous applications. The AVBeta is a prototype Autonomous Vehicle using parts from seven remote controlled robots. This prototype, upon testing and approval from NASA-Goddard Space Flight Center (GSFC), will be mass produced and sent into space as a multi-unit satellite with the ability to disassemble, gather intelligence of location, reassemble, and send information packets directly to GSFC in an attempt to avoid interception of highly classified data. The AVBeta houses four rangefinder sensors, one multi-purpose WIFI digital camera, four brushing motors, two rechargeable battery packs, WIFI up/down links, multiple customize computer chips, and weather-strip safety measures. This paper presents a self-sustaining autonomous vehicle that when sent into space will be able to repair, charge, and recall itself based on FPGA/VHDL programming. It will have the ability to maneuver effectively and efficiently, avoid obstacles, and create 3D mapping and imaging to be sent via WIFI in the form of information packets to be recreated by NASA ground control securely and safely. AVBeta is able to maintain a speed of 2.5 MPH for a minimum of 2.5 hours. Most satellites, once launched into space, must be able to repair themselves as sending astronauts into space is not cost effective.

Funder Acknowledgement(s): Eisenhower Fellowship

Faculty Advisor: S. Garcia, sgarcia-otero@vsu.edu

OA #129

Subcategory: Computer Engineering

Accessibility Devices for Deaf and Hard-Of-Hearing Individuals

Alexandr Opalka, Rochester Institute of Technology
Co-Author(s): Wade Kellard, Ryan Hait-Cambell, and Jordan Stemper, Rochester Institute of Technology

This team utilizes a LEAP Motion Controller (LEAP) as a sensor which allows for 3-dimensional detection of gestures and hand motions. The focus of our project is in the research and development of a stand alone device which utilizes the LEAP technology and prove its capability to provide real time translation for deaf and hard of hearing individuals who utilize sign language as a means of communication with hearing individuals. The ability to provide real time translation capability for the deaf and hard of hearing would be invaluable in today's world where laws such as the American Disabilities Act mandate access for individuals with disabilities. Deaf individuals currently rely on interpreters but do not have access to them everywhere. Having such a device would allow access to better communication for individuals that currently utilize interpreting services. The stand alone device will be comprised of a mix of various hardware and software which when put together create a device that allows for seamless translation of sign language to text or voice. We are utilizing the Leap Motion API which is provided free to all the developers in Leap Motion's developer program to create the software portion of this device. The software utilizes this exciting new technology to capture various data from a hand as the user signs and then compares that data with algorithms that were developed to determine various hand shapes and hand orientations.

The team will provide the current status of the project along with a demo of the software and how we plan on getting the deaf community to accept our technology. In our presentation we will discuss how our application and stand alone device differs from the current technology and research. The outcome of our device will be dependent on all of the components being implemented in an efficient way. Also we will have to verify the operation of our device in real life conditions and environments. Our current software has the capability to recognize finger spelling and number recognition, and we are also working on an application that allows hearing individuals to learn sign language using the research we are currently doing.

Funder Acknowledgement(s): This study was supported, in part, by Saunders College of Business (Saunders Summer Startup Program), Rochester Institute of Technology/National Technical Institute for the Deaf, and a grant from NSF (Access Computing Summer Research Internship) awarded to Stephen Jacobs, Associate Professor, Interactive Games and Media, Rochester Institute of Technology.

Faculty Advisor: Stephen Jacobs, itprofjacobs@gmail.com

OA #130

Subcategory: Computer Science & Information Systems

Development of Optimal Data Fusion of 2D Laser Scanner and Camera for Rear Vehicle Navigation

Camille Carter, Howard University
Co-Author(s): Patrick Buah, Howard University

Three dimensional scanning collects data on surrounding objects and textures (e.g. shapes, distance) to fabricate a 3D model of the scanned environment. The manner in which this data is fused varies upon the apparatus and application. 3D scanning methods, similar to the principles of triangulation, are most commonly used in robotic navigation and localization[1]. Istanbul Teknik Universitesi (ITU) is currently developing an autonomous vehicle, with hopes that it can perform tasks unmanned. The frontal navigation of this vehicle consists of two standalone 3D scanners that collect and fuse data. Such scanners are highly accurate, but expensive. Because rear vehicle navigation is not as pertinent, rear navigation utilized 2D scanners and a camera to create more cost-effective 3D scanner. Triangulation employs a detector and 2D scanner to discern the location of an object and fabricates a 3D model of the real world. Positioning the laser relative to the camera is vital to the accuracy of this model. The goal of this project was to create a 3D scan of the rear environment while focusing on detecting the width of a gap. Experiments were tested on the autonomous vehicle created at Mechatronics Laboratory at ITU by combining a camera and a laser to detect the width of an opening at the rear. This detection ability would improve rear-functions such as backing up or parallel parking. We hypothesized that by positioning LMS laser on a self-adjusting rig and a stationary rear-facing camera, this vehicle could detect the edges of a gap and return data on the two closest edge points. Once the vehicle is able to determine the necessary angle, the rig will have the capacity to adjust its angle to measure the real-world dimensions of the points. Using this value, real-world distance between two edges and their true gap distance can be ascertained. Additionally we have developed a method of extracting and analyzing both sets of raw data that would be relevant for a vehicle's master code. However this master code has yet to be implemented. As Turkey ranks among the top countries with high road-related fatalities[2], the implementation of autonomous cars with gap-detection capabilities could potentially decrease dangers due to human error on the road.

[1]Tungadi, Fredy, Kleeman, Lindsay. Discovering and restoring changes in object positions using an autonomous robot with laser rangefinders, Robotics and Autonomous Systems 59 (6) (2011) 428:443

[2]Khazan, Olga. 'A Surprising Map of Countries That Have the Most Traffic Deaths.' Weblog post. Washington Post. N.p., 18 Jan. 2013. Web. 03 Oct. 2013.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Lorraine Fleming, lfleming@howard.edu

OA #131
Subcategory: Computer Science & Information Systems

Bandwidth Optimization via DNS Automation

Daniel Flanigan, Tennessee State University
Co-Author(s): Sachin Shetty, Tamara Rogers, and S. Keith Hargrove, Tennessee State University

DNS servers provide the means for routing information to and from internet sources. These routes can include email exchange, site requests, and more commonly, download or get requests. While most DNS records are updated regularly and provide an optimized destination route, open DNS servers can provide an alternate routing path. Several factors can influence the route path that will ultimately result in lower bandwidth for web requests. This project proposes to assess the impact of geographical location of Internet users on the overall bandwidth for web requests experimentally. The experiment setup involves the modeling of web requests from Internet users from geographically disparate locations. The PlanetLab testbed was used to model the web request. PlanetLab is an experimental testbed for computer networking research and is composed of 1090 nodes at 507 sites worldwide. In our project, we identified 23 nodes which were hosted at university sites spread across the continental US and Canada. A list of 12 open DNS servers was used to automate get requests. Test files of 100kb in size were chosen as download targets for each test location. For each server, the active DNS server was modified and the test file downloaded. This process was repeated for all representative DNS servers and test locations. Results indicate route path efficiency regardless of geographic location and suggest DNS records to be a limiting factor in bandwidth optimization.

Funder Acknowledgement(s): This study was funded by the NSF Targeted Infusion Award awarded to Tamara Rogers and Sachin Shetty, College of Engineering, Tennessee State University.

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

OA #132
Subcategory: Computer Science & Information Systems

Development of Accessible Communication Devices for the Deaf

Ryan Hait-Campbell, Rochester Institute of Technology
Co-Author(s): Wade Kellard, Alexandr Opalka, Jordan Stemper, Michelle Giterman, and Stephen Jacobs, Rochester Institute of Technology

Persons with diverse access and communication needs include individuals who are deaf and hard-of-hearing. Our presentation will focus on the identification of accommodations required for persons with substantial access needs. Since deaf and hard-of-hearing Individuals can't always communicate effectively, due to lack of efficient communication technology and establishments that do not always provide instant communication support, there is a constant demand for effective access technology. Our solution is building our own software that utilizes several different hardware components for persons with communication needs. In order to develop this system, it is necessary to identify what is required to make such a device fully functional and accessible. Considering how large the scope of this project is, there are many different challenges we will face in the next few years. The top few are user experience, efficient translation speed and building it to be adaptable to people's various ways of signing. There are numerous components that lend themselves to the final product design and these components involve voice to text and text to voice, facial recognition, and hand shape recognition software. The team I work for has established a company that will focus on researching upcoming motion capture technology and engineering them for the deaf and hard of hearing community.

This presentation, which will include a brief demonstration, will describe what is necessary to provide this technology to a diverse groups of users, current development progress, and examples of how this technology will be implemented in the world today. The process of researching and developing this technology is ongoing. In order for our device(s) to be fully accessible, it must be accepted in the deaf and hard-of-hearing community. Based on current progress, we have successfully developed a software that recognizes the entire American Sign Language (ASL) alphabet and have determined what components will be necessary to implement this software. The outcome of this research project will create a variety of products that can benefit anyone who uses ASL as their primary or secondary language and faces communication barriers.

Funder Acknowledgement(s): This study was supported, in part, by Saunders College of Business (Saunders Summer Startup Program), Rochester Institute of Technology/National Technical Institute for the Deaf, and a grant from NSF (Access Computing Summer Research Internship) awarded to Stephen Jacobs, Associate Professor, Interactive Games and Media, Rochester Institute of Technology.

Faculty Advisor: Stephen Jacobs, sxjics@rit.edu

OA #133
Subcategory: Computer Science & Information Systems

Accessible Communication Devices for Deaf and Hard-of-Hearing Individuals

Wade Kellard, Rochester Institute of Technology
Co-Author(s): Alexandr Opalka, Ryan Hait-Cambell, and Jordan Stemper, Rochester Institute of Technology

Persons with diverse access and communication needs include individuals who are deaf and hard-of-hearing. Our presentation will focus on the identification of accommodations required for persons with substantial access needs. Since deaf and hard-of-hearing individuals can't always communicate effectively, due to lack of efficient communication technology and establishments that do not always provide instant communication support, there is a constant demand for effective access technology. Our solution is building our own software that utilizes motion sensing hardware components for persons with communication needs. In order to develop this system, it is necessary to identify what is required to make such a device fully functional and accessible. Ultimately, the challenge is to make communication easy and comfortable with a product design that incorporates all of the necessary tools and resources to meet accessibility requirements.

Other challenges include: How do we identify the necessary components to efficiently improve accessibility? How do we advance the current communication process, yet keep it efficient? How do we assemble and distribute this product to all of our potential users? Our team has created a company that seeks to utilize this technology into every possible platform with the greatest possible reach. Following specific rules and criteria that our team establishes, as well as adhering to standards of accessibility, we have created and established a company to effectively pursue the development of this revolutionary technology.

This presentation, which will include a brief demonstration, describes what is necessary to provide this technology to a diverse groups of users, current development progress, and examples of how this technology will be implemented in the world today. Documentation of required milestones is being created for team members to follow in the next 4 - 5 years. The process of researching and developing this technology is ongoing. In order for our device(s) to be fully accessible, it must be accepted in the deaf and hard-of-hearing community. Based on current progress, we have successfully developed a software that recognizes the entire American Sign Language (ASL) alphabet and have determined what components will be necessary to implement this software. The outcome of this research project will create a variety of products that can benefit anyone who uses ASL as their primary or secondary language and faces communication barriers.

Funder Acknowledgement(s): This study was supported, in part, by Saunders College of Business (Saunders Summer Startup Program), Rochester Institute of Technology/National Technical Institute for the Deaf, and a grant from NSF (Access Computing Summer Research Internship) awarded to Stephen Jacobs, Associate Professor, Interactive Games and Media, Rochester Institute of Technology.

Faculty Advisor: Stephen Jacobs, Jacobs@gmail.com

OA #134
Subcategory: Electrical Engineering

Using LabVIEW and the CompactRIO to Measure Real-Time Power and Energy

Caleb Davis, Howard University
Co-Author(s): Jade Parker, Howard University

The purpose of this project was to design a system for energy measurement in real-time using the CompactRIO device and LabVIEW programming software. The system takes voltage and current inputs and reads them out for the user. This particular project will be used as the basis for measuring the energy consumption associated with an electrical car built by the students at the Universidad Popular Autónoma del Estado de Puebla. This project consisted of a hardware component, NI LabVIEW 2012 and a software component, the CompactRIO. The CompactRIO consists of a chassis with interchangeable modules. These modules can be DI, DO, AI and AO, which respectively stand for digital input, digital output, analog input and analog output (Larsen 2011). In this project, the modules used were the NI 9225 and the NI 9227. Both are AI input modules. The NI 9225 measured voltage input and the NI 9227 measured current input. The NI 9225 was wired to a plug so that it could be plugged into an outlet and its voltage could be measured. The NI 9227 was wired to a split-core current transformer. The use of the CompactRIO and LabVIEW allowed the creation of a visual interface to view the waveform chart of the measured energy from the source. Upon completion of the programming it was found that there were discrepancies between the data input and what was displayed through the output in LabVIEW. It was concluded that in order to have accurate measurements for different sources the selected source must be isolated to gain access to its output measurements.

After this is done, one can simultaneously measure a source's current and power using LabVIEW to calculate Real-Time energy usage. Although there was a set application for this project, the idea can be easily expanded and modified. The creation of the aforementioned system could serve many practical uses for measuring and evaluating electrical usage and consumption. The ability to observe and record the exact amount of energy used is very important in striving towards energy management. The system could be used commercially or privately in estimating the cost of one's energy consumption, and possibly initiate steps into using energy more efficiently.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Tiffany Lathan, gearup@howard.edu; Casimiro Gómez González, casimiro.gomez@upaep.mx

OA #135
Subcategory: Electrical Engineering

Assessing Resiliency of Mobile Cyber-Physical Systems

Daniel Henke, Tennessee State University
Co-Author(s): Aaron Henderson, Tennessee State University

Mobile Cyber-Physical Systems (CPS) is composed of mobile and integrated physical and computation components with capability to communicate over wireless network. Typical applications include: target tracking, search and rescue, intelligent transportation systems and vehicular networks. Due to the ubiquity of the applications of mobile CPS, it is important to assess the ability of the system to operate under cyber attacks. In this research project, we investigate the resiliency of a swarm of robots to self-organize into a particular formation in presence of cyber attacks on the underlying wireless communication system. The swarm of robots implement a distributed "flocking algorithm" to self-organize themselves into a formation within a specified period of time. But, it's possible that a malicious attacker may launch jamming attacks on the underlying wireless communication systems which may affect the ability of the swarm of robots to achieve their mission outcomes. In this project, we present a systematic approach to assess the durability and stability of the "flocking algorithm" for swarm of robots. The experiments were conducted in a real mobile CPS testbed comprising of 10 Pioneer 3-AT robots, each equipped with dual-core embedded computer and wireless sensors. The jamming attacks were launched from strategically placed software defined radios in the testbed. Experimental results provide insights into the degradation of the communication between the swarm of robots under various attack scenarios.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF RIA grant awarded to Sachin Shetty, Assistant Professor, Electrical and Computer Engineering Department, Tennessee State University.

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

OA #136
Subcategory: Electrical Engineering

Implementation of Wireless Sensor Network for Environmental Monitoring

Ashenafi Lambebo, University of the District of Columbia
Co-Author(s): Sasan Haghani, Abdelhakim Ahmim, and Cassandra Stanford, University of the District of Columbia

The rapid development and miniaturization of sensor devices, and the recent advances in wireless communication and networking technologies, are allowing scientists and engineers to develop networks of small sensors that can be used to continuously monitor the health and stability of the environment we live in. Wireless Sensor Networks (WSNs) consist of a number of spatially distributed sensors with computing, processing and communication capabilities that can continuously sense and transmit data to a base station, where data can be processed and observed in real time.

This project provides a detailed study and implementation of a WSN for real time and continuous environment monitoring. A tree-topology WSN consisting of four sensor nodes, two base stations and a sink base station was successfully built and tested using open source and inexpensive hardware to measure various environmental factors such as air quality and temperature. The sensor nodes consisted of Carbon Monoxide sensor, a Carbon Dioxide sensor, a Methane sensor, a temperature sensor, a GPS module and a Zigbee wireless transmitter packaged together. The GPS module was added to give information about the location of the sensors. The base stations consisted of an Arduino Uno micro-controller and a ZigBee receiver that can collect data from the various sensors and submit to a sink base station where data can be stored and processed. A website was developed where the captured data can be continuously monitored and displayed in real time.

Funder Acknowledgement(s): This research was supported in part by the grant NSF/HBCU-UP-HRD-0928444.

Faculty Advisor: Sasan Haghani, shagani@udc.edu

OA #137
Subcategory: Electrical Engineering

The Analysis of the Efficiency of Framed ALOHA With a Varying Number of Users

Darrell Smith, Howard University

In recent years there have been many advances in data transmission on cellular. The basis of all these advances comes from the ALHOA protocol. ALHOA is a type of media access control used for data transmission between devices over a network. This paper and experiment will focus on Framed ALHOA. Framed ALHOA works with a number of users competing for data transmission in a fixed number of slots with other users. In the experiment a program was created to simulate Framed ALHOA; however, the program allowed the number of users to vary while the number of slots being competed for was fixed.

The purpose of this program was to analyze the efficiency of Framed ALHOA with a varying number of users and fixed number of slots. Research results indicated that as the number of users increased, the efficiency of the transmission fell drastically requiring more frames for all users to have a successful single transmission of data. In conclusion, it was learned when dealing with a large number of users the number of slots should be increased. Future research should include the stabilization and speed of ALHOA while still maintaining low use of bandwidth and network space.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Inez Moore, ineznmoore@gmail.com

OA #138
Subcategory: Environmental Engineering

Solutions for Wastewater Treatment in Poor Rural Mining Communities

Ahnna Beruk, Howard University
Co-Author(s): Ariel Ward, Howard University

The quality of communal drinking water is a principal factor in the overall health and development of a community. Limited availability of potable water in rural communities has been an issue of great significance. Many low cost methods have been implemented to improve the accessibility and quality of water for residents. However, the water supply of populations supplemented by the mining industry is overly exposed to heavy metal contaminants. While many of the traditional methods are sufficient for providing biological and chemical treatment of wastewater, several of these systems do not adequately remove certain pollutants, including nitrogen, phosphorus, and toxic heavy metals. Service learning is applied in this research project, which employs the engineering design process to develop a sustainable water filter that utilizes nanotechnology.

Recently, magnetic nano-sized metal oxides have gained notoriety because of their ability to remove heavy metals from water with the use of a simple magnetic field. The proposed filter, entitled the “Clean Water Tree,” provides a simplified water treatment process that does not require electricity, incorporates readily available resources, and is suitable for inhabitants of rural areas. The filter couples the magnetic particles with a decentralized household treatment system to create a solution that will harvest the many benefits of nano-sized metal oxides, such as regeneration. Future research is required to examine the implementation feasibility of this filter, which aims to reduce costs incurred during advanced water treatment and increase the accessibility of clean water to communities with deficient resources.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Lorraine Fleming, Lfleming@howard.edu

OA #139
Subcategory: Environmental Engineering

Fate of the Pathogen *Ascaris* in a Mesophilic Anaerobic Digester

Ileana Wald, University of South Florida
Co-Author(s): Nathan D. Manser, Matthew E. Verbyla, and James R. Mihelcic, University of South Florida

Global meat consumption has grown significantly over the past few decades, which has led to an increase in concentrated livestock waste streams. These waste streams contain pathogens but also resources that can provide energy and nutrients (i.e., phosphorus and nitrogen). Past research has shown that capture and treatment of the livestock waste by means of anaerobic digestion is an effective way to recover the energy associated with organic carbon and nutrients, while related research has focused on identifying the optimal conditions needed for the inactivation of pathogens such as variations in temperature, organic loading rate or solids retention time of the reactor.

The purpose of this study was to understand how the operating conditions of anaerobic digestion systems affect the inactivation of resistant pathogens without sacrificing biogas and biosolids production. We hypothesized that viable eggs of *Ascaris suum* will survive in a well-functioning discretely fed mesophilic (35°C) anaerobic reactor for 14 to 30 days as observed in similar studies at this temperature. The experiment included a 1.5 liter bench-scale reactor (SRT = 21days) digesting swine manure and a 1 liter phosphate buffered saline control reactor, both of which were operated at 35°C. *Ascaris suum* eggs were used as the model microorganism and nylon mesh bags with 30-micron pore sizes were used to house the eggs while exposing them to the conditions inside the anaerobic reactor and the control. Over the course of the experiment the reactor was monitored for biogas production, ammonia concentration and pH to ensure typical function. In triplicate, *Ascaris suum* viability was determined by microscopic examination of the eggs (n=200 minimum) to identify the current stage of development for each egg. The results showed that 99% inactivation was achieved in the control after 14 days of exposure while the eggs in the anaerobic digester did not reach 99% inactivation until 17 days. These findings and literature suggest that many small-scale mesophilic anaerobic digestion systems are not producing completely pathogen free sludge and that high levels of compounds, such as collagens, may exist in the reactor that may enhance the survival of *Ascaris* eggs. Future research will explore the potential role of collagen in pathogen survivability and the survival of other pathogens such as bacteria and viruses.

Funder Acknowledgement(s): Florida-Georgia Louis Stokes Alliance for Minority Participation

Faculty Advisor: James R. Mihelcic, jm41@usf.edu

OA #140
Subcategory: Materials Science

Comprehensive Characterization of *Areca Catechu* Fibers and Its Utilities

Daril Brown II, Howard University

Growing naturally in Southern Asia and the Tropical Pacific, the *Areca Catechu* is planted throughout Cameroon for its aesthetic beauty. The nut from the palm is chewed commercially throughout the eastern world, specifically in India and the Philippines. Once removed, the husk protecting the nut serves no further use, amounting to a major source of waste. While the fibers from the husk have been the subject of scientific investigation, the data available on their industrial value is very limited. This study characterizes the differences between the inner and outer fibers of the *Areca Catechu* for the purpose of increasing scientific interest in the palm as an alternative natural fiber source for composites used in developing infrastructures.

Due to the palms' close location to developing areas in Cameroon, the palm could be used to lower the cost of building homes and infrastructure in developing regions. Areca palms from the campus of the University of Buea were collected and allowed to dry naturally in the sun. The dried husk was removed from the nut and then chemically treated to remove weaker portions of the fiber. The fibers were chemically treated with sodium hydroxide, which hydrolyzed hemicellulose, a component of plant fibers that does not add to its strength, and removed it from the fiber.

To determine the fibers' mechanical properties, individual fibers were loaded until failure using a tensile testing machine developed in Douala, Cameroon. While exact values for the fibers' ultimate and yield strength could not be determined, findings indicated that the fibers were able to undergo a significant amount of plastic deformation and strain before failure. The palm may be an unexploited and excellent source of renewable and sustainable fibers that could be used in several industries including unwoven fabric and composites. Future research should conduct tensile testing to determine the exact values of fiber strength.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Wayne Patterson, wpatterson@howard.edu

OA #141
Subcategory: Materials Science

Analog Circuit Simulations of Mechanical Behavior in Naval Steels

Zachary Meadows, Alabama State University
Co-Author(s): Alexis C. Lewis, Massachusetts Institute of Technology

The mechanical behavior known as diffusional creep, which occurs in metals under applied stress at high temperature, operates in a fashion very similar to current flowing through a system of resistors. In our metallic system (steel), there are networks termed Grain Boundaries, where different types of boundaries are modeled as resistors which have different resistances. We've found that we can approximate the diffusional creep behavior of steels with certain Grain Boundary networks using analog circuit simulations of series of resistors. In this project, grain boundary network simulations were generated using currently available analog circuit simulation software. This research is important because through these circuit simulations, the behavior of diffusional creep can be predicted. In result, it was shown that creep can be predicted using circuit simulation software. The circuit software produces data that can be used to graph and model diffusional creep, which will begin the foundation of understanding and developing newer, stronger metals. Future research questions will be disclosed between the naval Research Laboratory in Washington, D.C. and my summer mentor, Dr. Alexis C. Lewis.

Funder Acknowledgement(s): American Association of Electrical Engineers and Naval Research Laboratory, Washington, D.C.

Faculty Advisor: Carl Pettis, cpettis@alasu.edu

OA #142
Subcategory: Materials Science

Effect of Interface Strength on the Mechanical Properties of MMCs

Xee Thao, University of Wisconsin-Milwaukee
Co-Author(s): J.B. Ferguson, and Changsoo Kim, University of Wisconsin-Milwaukee

Light-weight metal-matrix composites (MMCs) are considered as one of the most promising structural materials for many fields including aerospace, transportation, construction, and military applications. They are intended to increase the energy efficiency by replacing the traditional heavier structural materials. In these MMCs, various sizes of ceramic particles are often incorporated into the metallic matrix to act as the reinforcement agency enhancing the strength of the composites. The deformation behaviors of these composite materials are influenced by many parameters, but in particular, macroscopic properties strongly depend on the strength of the matrix/reinforcement interface. Currently there is no model to predict the failure stress, failure strain, or strain hardening properties of MMCs.

Therefore, the present work seeks to theoretically understand how the interface strength can affect the overall mechanical properties of composites. Toward this, we combine the analytical and computational thrusts. First, we developed an analytical theory by considering two different types of matrix/reinforcement interface strength; namely, strong bonding and no bonding. Equations predicting the yield stress, failure stress, and strain to failure are proposed for each type of bonding making use of the strain hardening exponent and a newly defined ductility parameter. Application of the model to various experimental studies of weakly bonded MMCs shows that it predicts an upper limit to MMCs with no bonding and a lower limit to MMCs with weak bonding. The model also accurately predicts the tensile properties of strongly bonded MMCs. Next, we employed a finite-element modeling (FEM) computational technique to test the validity of the analytical model. To reliably obtain the macroscopic response of MMCs, we introduce a unit cell approach to link the meso-scale and macro-scale computation. A unit cell is modeled to be a representative volume element of particular composite bulk. The meso-scaled unit cell contains reinforcement particles with given size and distribution geometry. The unit cell was then modified to contain reinforcement particles with different conditions. The calculated results show that the overall macroscopic mechanical properties of MMCs are in good agreement with the analytical predictions.

Funder Acknowledgement(s): This study was supported, in part, by a grant from U.S. Army Research Laboratory under Cooperative Agreement No. W911NF-08-2-0014.

Faculty Advisor: Changsoo Kim, kimcs@uwm.edu

OA #143
Subcategory: Materials Science

Properties of Plastic-Cellulosic Composites Through Simulation Techniques

Cristina Villa, New Mexico State University
Co-Author(s): Arturo del Valle and Delia Valles-Rosales, New Mexico State University

Molecular dynamics simulations permit the study of complex, dynamic processes that occur in biological systems. It is the most detailed molecular simulation method which computes the motions of individual molecules. This technique solves equations of motion for a large number of particles in an isolated cluster or bulk and has become a powerful tool for answering scientific problems as numerical experiments for new materials without synthesizing them. Recently attention has been drawn to the utilization of bio-reinforced composites in several applications due to an increased concern for sustainability. Recent studies in Wood Plastic Composites that use materials other than wood are taking a special emphasis on the utilization of more basic foundations such as Cellulose which is an important component produced by every plant and is the most abundant biological molecule in the world. This study investigates the miscibility and mechanical properties of pairings of cellulose and lignin with several different polymer matrices such as HDPE using molecular dynamics simulation techniques with the Accelrys Materials Studio 6.1 software.

Funder Acknowledgement(s): New Mexico Alliance for Minority Participation

Faculty Advisor: Delia Valles-Rosales, dvalles@ad.nmsu.edu

OA #144
Subcategory: Physics (NOT Nanoscience)

Discovering New Elements Using Gamma-Gamma Time Coincidence

Corbin Jackson, Howard University
Co-Author(s): Nico Orce and R. Lindsay, University of the Western Cape, South Africa

There are many areas for improvement in the country of South Africa including energy production. An underexplored topic that could help advance this country would be the discovery of a new element. Identifying a new element would greatly improve South Africa by potentially discovering a new energy source. The discovery of new elements does not guarantee positive or negative outcomes for the future but may afford many new opportunities in the future. It is hoped that such a significant discovery will contribute to improvement of the country. This experiment used gamma-gamma coincidence testing to discover

new elements by examining Cobalt 60 (Co60) in a variety of controlled settings and configurations. Multiple amplifiers and coaxial cables were connected to Sodium Iodine (NaI) gamma ray detectors to observe the different gamma rays emitted from elements. We placed Cobalt 60 (Co60) and arbitrary elements between the gamma ray detectors. Once the elements were in place, the detectors and modules allowed us to read gamma ray activity using an oscilloscope. Results indicated no significant increases in gamma ray activity when analyzing Cobalt 60 (Co60). A major limitation to gamma-gamma detection is that it relies mainly upon trial-and-error. Because there are countless different elements that can be detected through this method, we never know the exact outcome or when a significant discovery will occur. While this experiment was unable to discover any new elements, we were able to set up difficult modules and equipment to ensure future gamma-gamma testing be conducted easily. Additionally, we began the lengthy process of trial-and-error experiments needed to eliminate elements from future testing. While this work may be tedious, it is entirely necessary for new element discoveries to occur. There are many elements we see every day but still have yet to be discovered. Using this method has helped us tremendously in steps towards major energy improvement for South Africa, and potentially the world.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Silas Burris, burris.silas@gmail.com

OA #145
Subcategory: Plant Research

Programming a Microchip to Operate an Interactive Asian Citrus Psyllid Trap

Daniel Fialkovsky, Hunter College of the City University of New York
Co-Author(s): Mechael Brun-Kestler and Avraham (Abe) Brun-Kestler, Hofstra University

The Asian Citrus Psyllid male calls to his mate via vibrations sent through the tree he is searching. When a male hears the duetting reply of a female psyllid, he moves toward her, whereas a female never moves and only replies to the male. Given the unique vibration patterns the psyllids use to call to their mates and the unique "duetting ritual", one can build a device that calls to the male with the call of a female, thereby luring the psyllid to a trap. A cheap and powerful way of accomplishing the lure is to embed "psyllid recognition software" onto a microchip. We have been working on improving this software and transferring it from a laboratory to a field environment. The "psyllid recognition software" recognizes psyllids by the use of template matching algorithms. Incoming data from a microphone is compared to a template which is a digital representation of a male psyllid call. Once the chip has confirmed a match, the chip will call back with the female's call using a vibrating piezo speaker. The male is then attracted to the source.

Funder Acknowledgement(s): US Department of Agriculture; Citrus Research Development Fund

Faculty Advisor: Richard Mankin, richard.mankin@ars.usda.gov

Undergraduate Abstracts for Poster Presentation

Biological Sciences

1
Subcategory: Biochemistry (NOT Cell and Molecular Biology and Genetics)

Intraspecific Competition Within a Tropical Bird Species

Autumn Chong, University of Hawai'i at Hilo

Food availability can drive competition and dominance aggression among individuals. In the Neotropics fruit, resources are distributed patchily so competition among frugivores can be intense. Even within a single species, there may be competition and dominance hierarchies among different age and sex classes. Many tropical bird species are monomorphic in plumage, but the Cherrie's Tanager (Ramphocelus costaricensis) shows strong sexual dichromatism and presents an opportunity to examine intraspecific competition because sex and age classes can be distinguished by plumage. Initial observations led me to hypothesize that among Cherrie's Tanagers there is a dominance hierarchy at food sources where males displace female-like individuals. To test my hypothesis I set up 12 banana feeding stations throughout the Wilson Botanic Garden of Las Cruces, Costa Rica. Feeding stations were set up near trees for refuge from predators. Each time a Cherrie's Tanager visited the feeding station I recorded its sex class based on plumage. Randomly, I took two 30 minute video footage at the feeding stations. Due to the low quality of the recording, I grouped both female and juveniles as "female-like" because I could not clearly differentiate the plumage between both. For intraspecific interactions I recorded agonistic behaviors, displacement, total time each individual spent at the feeding station and the time until displacement.

My results support Alexander F. Skutch (1954), that Cherrie's Tanagers remain placid most often while feeding at the station in groups unless birds were to close to one another. Individuals spent approximately the same amount of time at the feeding stations and hardly displayed aggressive behaviors between male and female-like individuals. Although I did not color band the birds individually, low aggressive interactions within Cherrie's Tanager may present the role of kin selection to increase inclusive fitness. Therefore, individuals support a relative's off-spring, as a means of passing on genes for the next generation.

Funder Acknowledgement(s): NSF, OTS, Duke University, NAPIRE

Faculty Advisor: Wendy Kuntz, wkuntz@hawaii.edu

2

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

Molecular Analysis of the Centrosomal Protein Cep152 in Mammalian Cells

Yonatan Kebede, University of Minnesota-Twin Cities
Co-Author(s): Ryoko Kuriyama, University of Minnesota-Twin Cities

Discovered and described in the late 19th century, centrosome is a multi- protein complex organelle that is found in most animal cells. This organelle is the major microtubule-organizing center of cells and is consisted of a pair of centrioles surrounded by pericentriolar matrix. In spite of the long history of its discovery, molecular components of the centrosome and how they work together to orchestrate the microtubule organizing activity are not fully understood. With the recent advent of new technology, a number of centrosome proteins have been identified and characterized; yet their localization and role in the centrosome remained elusive. In this study, we analyzed one recently identified centrosomal protein termed Cep152 to identify its detailed localization in the mammalian centrioles/ centrosome. We further demonstrated a possible role of Cep152 in microtubule organization on the centrosome. These results are important to understand the unregulated mechanism of the centrosomal function and microtubule organization in cancer cells.

Funder Acknowledgement(s): I want to dedicate my gratitude to my funding resource McNair Post Baccalaureate Achievement Program of University of Minnesota.

Faculty Advisor: Ryoko Kuriyama, kuriy001@umn.edu

3

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

Electrotonic and Action Potentials in the Venus Flytrap

Colee M. Mitchell, Oakwood University
Co-Author(s): Alexander Volkov, Oakwood University

The Venus flytrap has been studied since the nineteenth century. Scientists were not only intrigued by the rare beauty of this plant, but were also attracted to its mobility. Action potentials do not penetrate to the lower leaf, but we found small electrical potentials in the lower leaf of the Venus flytrap, which resemble graded potentials. We hypothesized that these graded potentials were electrotonic potentials that would be found in the lower leaf. The information gained from this experiment can be used to gain further knowledge about the intracellular and intercellular communications that are within plants. To understand the nature of these electrical potentials in the lower leaf, we have measured their dependence on the distance from the midrib. Amplitude of these electrical potentials decreases exponentially with distance and can be described by this equation: U = a*Exp(-b*Distance) with parameters a = -7.7812 mV, b = 0.5638 cm-1. Based on our analysis of the data that we collected, we concluded that these graded potential were indeed electrotonic potentials. Electro-stimulation of the lower leaf by a square pulse with amplitude of 4.4 V induce propagation of electrotonic potential in the lower and upper leaves and action potential in the trap, which induce the trap closing. Action potential can propagate from mechano-sensitive trigger hairs in the upper leaf to the midrib and does not penetrate to the lower leaf. We plan to further investigate fast electrical communication in the Venus flytrap during environmental changes.

Funder Acknowledgement(s): This study was supported, in part, by the National Science Foundation under Grant No. HRD 811507 and by the U.S. Army Research Office under contract/ grant number W911NF-11-1-0132.

Faculty Advisor: Alexander Volkov, agvolkov@yahoo.com

4

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

***Chlamydia* Major Outer Membrane Protein Induces T-cell Proliferative Responses in Mice**

Aterica Pearson, Southern University, Shreveport/Alabama State University
Co-Author(s): Saurabh Dixit, Shree R. Singh, and Vida Dennis, Alabama State University

Chlamydia trachomatis genital infection is a worldwide public health problem. Overall, 4 million Chlamydia cases were reported to the CDC in 2010. Considerable effort has been expended on developing an efficacious vaccine. The murine model of C. trachomatis genital infection has been extremely useful for identification of protective immune responses and in vaccine development. Although a number of immunogenic antigens have been assessed for their ability to induce protection, the majority of studies have utilized the whole organism and its major outer membrane protein (MOMP) as vaccine candidates. MOMP is the most immune-stimulatory protein identified to date, but it does not induce sterile protection and at the same time it is reported to be immuno-suppressive in nature. To begin to identify the immune-stimulatory regions with T-cell epitopes, we immunized three groups of mice at two-week interval as follows: (i) Group1 (PBS + incomplete Freunds adjuvant (ii) Group 2 (live C. trachomatis) (iii) Group 3 (rMOMP + incomplete Freunds adjuvant). Mice were sacrificed two weeks after the last immunization, and purified T-cells isolated from spleens of immunized mice were restimulated in vitro with Concanavalin A, UV-inactivated C. trachomatis and rMOMP. T-cell samples from mice were analyzed by cytokine ELISA for IFN-γ production and the MTT assay for T-cell proliferation. Our results revealed that rMOMP–stimulated T-cells induced maximum production of IFN-γ and proliferation as compared to the PBS and C. trachomatis immunized groups. Studies are ongoing to identify the specific immune-stimulatory regions of MOMP.

Funder Acknowledgement(s): CNBR

Faculty Advisor: Saurabh Dixit, Shree R. Singh, and Vida Dennis, SDixit@ASU.EDU

5

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

Elucidating a Novel Vitamin C Synthesis Pathway in Caenorhabditis Elegans

Maria Pedraza, University of California, Los Angeles
Co-Author(s): Alexander N. Patananan and Steven G. Clarke, University of California at Los Angeles

Vitamin C is an important antioxidant that neutralizes free radicals in cells, participates in a variety of enzymatic reactions, and protects against human diseases. There are three main vitamers of vitamin C, including dehydroascorbate, D-isoascorbate, and the most common L-ascorbate. Much is known about the important roles ascorbate has in vertebrates, yet little is known about its significance in invertebrates. Caenorhabditis elegans, a commonly used invertebrate model organism, has several enzymes whose homologs in vertebrate organisms require ascorbate. Therefore, we investigated the levels of ascorbate and similar species in C. elegans and explored how these vitamers are biosynthesized. To identify these compounds, we optimized several methods using normal and reverse phase high-performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS). Interestingly, we detected the presence of ascorbate in eggs, L1 larvae, mixed worms, and gravid adults despite C. elegans lacking many of the enzymes plants and animals require for ascorbate biosynthesis. Furthermore, we incubated intact worms with various sugars known to be necessary for ascorbate biosynthesis in other organisms, but none increased the amount of ascorbate in the different life stages, suggesting a novel pathway. The presence of ascorbate in C. elegans is a first for invertebrate organisms, and we are currently elucidating the biochemical pathways for the biosynthesis of this molecule. Finding a novel pathway in C. elegans will broaden our understanding of vitamin C synthesis and its importance to organisms, as well as answering questions about the evolutionary patterns of ascorbate synthesis.

Funder Acknowledgement(s): This study was supported, in part, by a grant from National Institutes of Health awarded to Steven G. Clarke, Professor of Chemistry and Biochemistry, University of California at Los Angeles, Los Angeles, CA 90095.

Faculty Advisor: Steven G. Clarke, clarke@chem.ucla.edu

6

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

Oxidation of DNA by High-Valent Metal-Oxo Porphyrins Mn-TMPyP and Fe-TMPyP

Kaba Tandjigora, Montclair State University
Co-Author(s): Genevieve Pratviel, Laboratoire de Chimie de Coordination, Toulouse, France

The goal of this project is to regulate the reactivity of high-valent metal-oxo porphyrins (Scheme 1) by the controof the axial ligand trans to the oxo group. This work will allow a better understanding of the mechanism of metalloporphyrins oxidation. The chosen substrate was a DNA model. The oxidation products were analyzed by HPLC and LC/ESI-MS. *Meso* -tetrakis (4-*N*-methylpyridiniumyl) porphyrinatomanganese (III) (Mn-TMPyP) and its iron analogue (Fe-TMPyP) mimic the reaction mechanism of natural heme enzymes namely peroxidases and cytochrome P450. Mn- and Fe-TMPyP become a high-valent metal-oxo species (Scheme 2) when activated by peroxide such as $KHSO_5$ and are able to oxidize DNA. Previous work has shown that Mn-TMPyP/ $KHSO_5$ is sensitive to pH; the high-valent metal-oxo species (Mn^V=O) produces variable oxidation products of the DNA duplex model 5'-d(CAGCTG) by electron transfer (ET) and oxygen atom transfer (OAT). At pH 8, the main products observed are those of OAT, whereas at pH 6 the dominant products are obtained from ET. This occurs because at pH 6 the proximal axial ligand of Mn^V=O is a molecule of water whereas at pH 8 it is an anionic hydroxo ligand. It is in analogy with the mechanism of oxidation employed by natural heme enzymes. The regulation of the reactivity of Mn^V=O was tested on a new DNA substrate a short oligonucleotide rich in adenine sequences 5'-dCGAAACG) and its complementary strand 5'-d(CGTTTCG). The tandem of AT base pair sequence provides a good binding site for the porphyrin in the minor groove. The guanine bases been the most oxidized bases of DNA are also good sources where oxidation can be observed. The reactivity of Fe-TMPyP was also studied on this small duplex DNA. Fe-TMPyP as Mn-TMPyP is a powerful oxidizing agent when activated by $KHSO_5$; however, its reactivity towards DNA is unknown. What is known is that it exists as a µ-oxo species (Scheme 3) in basic and neutral medium. The µ-oxo characteristic of Fe-TMPyP should make it insensitive to pH in the pH range used with Mn-TMPyP. We showed that its oxidation products did not vary between pH 6 and pH 8 and that the products in the minor groove were not observed. In order for the products in the minor groove of DNA to be observed, hindrance must be avoided as for Mn^V=O.

The present work has shown that the oxidation reactivity of manganese and iron porphyrins can be directed based on their proximal axial ligand (L- or X-type). The proximal ligand can be controlled by simple modulation of the pH of the reaction in the case of manganese porphyrin or by the nature of the metal (iron porphyrins form iron µ-oxo dimers). The control of metalloporphyrin reactivity may also prove useful in fine chemistry where these compounds are used as oxidation catalysts.

Funder Acknowledgement(s): I would like to thank NSF for this grant that allowed me to do research abroad; also the IREU members at the University of Florida. (NSF-CHM 1156907). Many thanks to my mentor and all the people who helped me this summer at LCC.

Faculty Advisor: Genevieve Pratviel, genevieve.pratviel@lcc-toulouse.fr

7
Subcategory: Cancer Research

Genetic Commonalities in Female-related Cancers

Xiomara Abreu Ramos, University of Puerto Rico at Mayaguez
Co-Author(s): Jessica Adames-Nieves, Clara E. Isaza, Mauricio Cabrera-Ríos, University of Puerto Rico, Mayagüez

How the behavior of women and their customs affect the propensity of a person to acquire cancer in several areas related in the reproductive system of a woman is currently a manner of discussion. This study considers the possible omics relation between cervix, breast and ovarian cancer. Several studies have shown that there is a relationship between these types of cancer. Although each of these cancers presents different symptoms and complications, the analysis of the databases of them together can lead to the finding of potential biomarkers in common. Such simultaneous analysis (also known as meta-analysis) is treated here through Multiple Criteria Optimization (MCO), as proposed by our research group on previous publications. The advantages of using MCO are that (i) it can accommodate experiments with incommensurate units and (ii) it provides an objective analysis (not user dependent). The use of MCO shall result in a manageable number of genes importantly expressed in both types of cancer. It is expected that this meta-analysis study converges to a list of potential genetic biomarkers with an identified role in both types of cancer under study. The information can then be correlated with the sociological explanation discussed previously. Currently our group is identifying the databases to be included in the analysis as well as the sociological evidence offered in the literature. Preliminary results should ensue within the following two months.

Funder Acknowledgement(s): Mauricio Cabrera-Ríos, University of Puerto Rico, Mayagüez

Faculty Advisor: Mauricio Cabrera-Rios, mauricio.cabrera@gmail.com

8
Subcategory: Cancer Research

Investigating MicroRNA Expression Profiles in Triple Negative Breast Cancer

Brianna Arrington, North Carolina A&T State University
Co-Author(s): Armeshia McCoy and Checo Rorie, NC A&T

Breast cancer is a heterogenous 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. Here we investigate the differential expression of miRNAs in TNBCs, luminal subtype, and normal breast cell lines. We cell cultured the breast cell lines, pelleted the cells, and then sent them to Beckman Coulter (Morrisville, NC) for RNA extraction and hybridization to the Agilent Human miRNAs Microarray 8x15K Release 14.0 slides (Agilent). Once we received the data, we used Microsoft Excel software to compare the mean expression levels of miRNA in our cell lines. We are currently analyzing the data in PARTEK microarray data analysis software and have verified our Excel results. We reveal that there are a number of miRNAs that are overexpressed and suppressed in TNBCs as compared to normal breast cells. We believe that these miRNAs could potentially be used as bio-markers for TNBC and eventually used as drug therapy targets.

Funder Acknowledgement(s): NIH-NIGMS: 5P20MD000546-07; NSF TALENT-21 Program #1036299

Faculty Advisor: Checo Rorie, cjrorie@ncat.edu

9

Subcategory: Cancer Research

The Role of Kaiso and miR-31 in Metastasis Inhibition and the Proliferation

Darius Brown, Tuskegee University
Co-Author(s): Honghe Wang and Clayton Yates, Tuskegee University

Prostate Cancer (PC) is the second leading carcinoma resulting in male mortality due to fluctuations in hormone equilibrium which can result from various epigenetic and genetic factors. This is due to the socioeconomic challenges that cause higher exposure to the genetic mutations due to demography. As a disease PC is highly curable with early diagnosis and tumor removal; however, if allowed to persist in a long period of latency it can result in both micro/macrometastasis to neighboring organs. We are currently aware that tumor stage is related to the expression of Kaiso and its regulation of miRNAs. Our preliminary data shows that the level of Kaiso expression is higher in more malignant tumors.

The purpose of our study is to investigate the role that Kaiso, BTB zinc finger protein, and miR-31 plays in the progression of PC in the areas of metastasis, cellular proliferation, and messenger RNA targeting. As a means of quantifying the effect of modulating miR-31 on PC-3 cells, we worked with a miRNA oligo (mimic) to model miR-31 activity both in in vitro and in vivo subcutaneous injections in nude mice. We concluded that the properties of PC-3 cells are related to miR-31 expression and that through Kaiso knockdown; these cells decrease in proliferation and loss of both migration and invasiveness. As a control we allowed PC-3 cells that were not epigenetically altered by miR-31 activity in order to assess the standard tumor size. The results obtained from a tumor xenograph indicate that miR-31 has the ability to be used in future studies as a tumor suppressor, which can lead to the discovery of more anti-carcinogenic capabilities of miRNAs.

Funder Acknowledgement(s): The National Institute of Health under the grant MARC U-Star Grant Number: MARC-5T34GM08.

Faculty Advisor: Honghe Wang, wangh@mytu.tuskegee.edu

10

Subcategory: Cancer Research

Inter-differentiation of Immune Regulatory Cells in Prostate Cancer

Ashley Breanna Cainion, Tuskegee University
Co-Author(s): Michael R. Shurin, Yang Ma, and Galina V. Shurin, University of Pittsburgh

Cancer is the second leading cause of deaths worldwide and prostate cancer is the leading causes of cancer related deaths among men in developed countries. The treatment of tumors using the body's own immune system has long been a goal of both immunologists and oncologists. Given the complex interactions between the effector and regulatory cells in the tumor microenvironment, it seemed reasonable that understanding the pathways responsible for both induction and suppression of antitumor immunity is a crucial step in designing the potent and feasible approaches to cancer immunotherapy. Conventional dendritic cells (cDCs) are responsible for induction of antitumor immunity and tumor eradication, but in the tumor microenvironment cDCs can be polarized into so-called regulatory DCs (regDCs), which efficiently support tumor progression.Our previous studies identified regDCs in melanoma and lung carcinoma, but their presence and role in prostate cancer is unknown. Here we tested whether regDCs can be induced by prostate cancer-derived factors and assessed the potential origin of these immunosuppressive cells in animal models. First, by co-incubating bone marrow-derived CD11chighCD11bneg cDCs with murine prostate cancer cell lines RM-1 we revealed that RM-1 cells may induce formation of CD11clowCD11bhigh regDCs that actively suppress proliferation of pre-activated syngeneic T cells, suggesting that prostate cancer can polarize cDCs into regDCs. Second, we confirmed this phenomenon in the ex vivo model using in vivo generated cDC isolated from mice by FACS cell sorting and co-incubated with RM-1 and TRAMP-C2 cell lines. Third, we tested a new hypothesis that regDCs might be also differentiate from myeloid -derived suppressor cells (MDSCs), a population of immature myeloid cells identified in many types of cancer. The results revealed the differential effect of two tested prostate cell lines on cell sorted CD11b+GR-1+ MDSC differentiation into regDCs. Therefore, our data provide the first evidence that immuno-suppressive protumorigenic regDCs can be induced by prostate cancer-derived factors and can be originated from both cDCs and MDSCs in vitro and in vivo. Our future studies will focus on factors and mechanisms responsible for this new phenomenon.

Funder Acknowledgement(s): This work was supported by the Department of Defense grant #PC080566.

Faculty Advisor: Timothy Turner, turner@mytu.tuskegee.edu

11

Subcategory: Cancer Research

Impact of Racial and Sexual Factors on Human Papillomavirus Infection Cases

Brittany Demmings, Tuskegee University
Co-Author(s): Michelle Moses Chambers, Nuzhat Rahman Siddiqui, Suguna Badiga, and Chandrika J. Piyathilake, University of Alabama at Birmingham

High-risk human papillomaviruses (HR-HPVs) is the causative factor for pre-cancerous lesions of the cervix and invasive cervical cancer (ICC). According to the Journal of American Medical Association, approximately twenty five million women are already infected with HPVs, and every year there is an estimated 5.5 million new cases of HPVs. Many risky sexual behaviors have been studied in relation with HR-HPV infections; including, age at first intercourse, lifetime number of sexual partners, use of douche and contraceptives, parity and history of other STDs.

The purpose of our study was to evaluate the prevalence of HR-HPV infections in relation to sexual behavior-associated factors such as age at first intercourse, parity, lifetime number of sexual partners, use of vaginal douche, history of STDs and use of contraceptives in child-bearing age African American (AA) and Caucasian American (CA) women well characterized for not only HPV status but also for demographic and lifestyle factors. 1709 women, referred by health departments in Alabama, who were enrolled in two R01 studies funded by National Cancer Institute (R01 CA102489 and R01 CA R01 CA105448, PI: Piyathilake). Information on demographic, lifestyle factors, and factors related to sexual behavior were obtained from interviewer administered validated risk factor questionnaires and also DNA was extracted from cervical cells using a PCR-based method. The data were put into two different statistical analyses showing that AA Women were more likely to be infected with HR-HPV than CA women. Younger AA women were more likely to be HR-HPVs positive. The plausible reasons for these observations could be as follows: lower socio-economic status related factors such as lower exposure to sex education, lack of HPV knowledge, lower immune response due to poor nutritional status and lower likelihood of clearance of HR-HPV. In conclusion, the racial differences observed in our study suggest the need for race-specific sex education in order to reduce the racial disparities in ICC risk.

Funder Acknowledgement(s): Minority Health and Health Disparities Research

Faculty Advisor: Roberta Troy, rmtroy@mytu.tuskegee.edu

12

Subcategory: Cancer Research

Identifying Target Genes of Tumor Suppressor Ikaros in Leukemia Cells

Nathalie Fuentes, Iowa State University/Pennsylvania State University College of Medicine
Co-Author(s): Chunhua Song and Sinisa Dovat, Pennsylvania State University College of Medicine

Leukemia is a type of bone marrow cancer characterized by an abnormal increase of white blood cells. Studies indicate that mutations and genetic inactivation in the Ikaros gene play an important role in triggering acute lymphoblastic leukemia. The Ikaros family of zinc finger transcription factors is important regulators of immune system development. Loss or mutation of Ikaros results in dramatic decreases in T cells, B cells, NK, and lymphoid-derived dendritic cells. Our research is focused on the tumor suppression genes such as Ikaros that acts as a transcription factor, binding DNA to regulate gene expression.

We hypothesized that the tumor suppressor such as Ikaros exerts its inhibitory function on tumor by suppressing its target gene expression. To validate our hypothesis, we used Chromatin Immunoprecipitation (ChIP) assay combined with real-time PCR (qPCR), called qChIP, to identify the genes whose expression is directly regulated by Ikaros. Using this technique we calculate the difference in Ikaros binding to the promoter region of the target genes versus nonspecific binding (control). In addition, we cloned the promoter region of these genes into luciferase report vectors for in vitro luciferase transcription assays. HEK293T cells were transiently transfected with the indicated promoter reporter constructs and pcDNA3.1-Ikaros or pcDNA3.1 vector. Luciferase activities were expressed as -fold change relative to values obtained from pGL4.74[hRluc/TK] vector only control cells.

The results showed that the increased binding of Ikaros to MYC, and two other novel target genes are 4.4, 3.9 and 8.5, respectively as compared to control. These results specify that Ikaros binds to the promoter regions of these genes. Our data indicated that Ikaros binds to the promoter region of MYC, and two other novel target genes by ChIP-qPCR assay. Also, Ikaros suppresses the promoter activity of MYC and other two novel genes by luciferase report assay. C-MYC and other two novel genes are Ikaros target genes and it may exert its tumor suppression function by inhibition of their expression. Therefore, Ikaros dramatically inhibits the luciferase activity when it is co-expressed with the above constructs in HEK293 cells. Taken together, our results suggested that one of the mechanisms by which Ikaros exerts its tumor suppression function is by inhibition of expression of its target genes.

Funder Acknowledgement(s): Four Diamonds Foundation Grant, Penn State Hershey; NIDDK Short term Education Program; Research Experiences for Undergraduates (REU).

Faculty Advisor: Sinisa Dovat, sdovat@hmc.psu.edu

13
Subcategory: Cancer Research

High Through-Put Drug Screening for Metastatic Cancer

Damaris W. Gachungi, Lawson State Community College/ Tuskegee University
Co-Author(s): Balu Karanam and Clayton Yates, Tuskegee University

Prostate cancer is the second leading cause of cancer death in American men. It is the cancer that forms in the tissues of the prostate. Prostate cancer usually occurs in older men and it is rarely diagnosed in men below the age of 40 but common in men aged 65 and older. In 2013, an estimated 238,590 new cases will be diagnosed and 29,720 men are expected to die from the disease. During the early stages, when the Gleason scores are low, the disease can be curable by radiation or surgery. In the mid and late stages, it is more than likely the disease has metastisized to other parts of the body beyond the prostate. At this stage, hormonal therapy is a possible treatment but doctors do not consider the disease curable at these stages. Docetaxel, the first-line treatment for Prostate cancer, which prolongs survival up to 18 months, is also available but after time the cells become resistant.

The purpose of our project was to identify a drug to overcome chemo resistance in aggressive prostate cancer cells and also to determine which drug concentration of BSCY-1, BSCY-2, BSCY-3, or BSCY-4 is most effective. These four drug compounds were extracted and isolated from the same plant of which we know the structure but cannot disclose the plant name due to Patton laws. The Cell Culture Method and cell viability assay (MTT) were used in our project to achieve to our results. BSCY-1, BSCY-2, BSCY-3 and BSCY-4 were all able to kill the prostate cancer cells at very low concentrations in vitro.

According to previous research conducted such data is rarely seen. We chose to go further with BSCY-3 because it is known from previous research that it is not toxic. BSCY-3 proved to have no effect on the drug activity while combined with Docetaxel. A formulation, which would be safer in animals for animal testing and that is water soluble was mixed with BSCY-3 to determine if the activity was the same as it was in the cells. The formulation alone killed the cells without the presence of a drug, so other formulations will be tested in the future in order to continue with animal testing.

Funder Acknowledgement(s): This study was supported by the IBS-REU DBI-1263207 grant.

Faculty Advisor: Calvin Briggs, cbriggs@lawsonstate.edu

14
Subcategory: Cancer Research

ATP Production and Caspase Activation in SKOV3 Irradiated Colon Cancer Cell

Jacobi Graham, Talladega College

Colon cancer effects 1 out of every 20 people and it is the third leading cause of cancer-related deaths. If diagnosed with the disease, radiation therapy is a type of therapy used for treatment. Radiation therapy promotes apoptosis. Apoptosis is a cell suicide program. Apoptosis can be induced by two major pathways: an intrinsic (mitochondrial) pathway and an extrinsic (death receptor-mediated) pathway. The induction of either pathway can lead to the activation of caspases. Caspases are a unique family of cysteine proteases that execute apoptosis. The basis of this research study was to examine the apoptotic effects on the production of ATP and caspase activity in SKOV3 colon cancer cells treated with radiation. The ATP Lite Assay was used to determine the production of ATP. The results demonstrated a decrease in ATP production as the amount of radiation increased. Caspase -Glo 3/7, 8, and 9 assays showed that as the concentration of radiation increased the amount of caspase activity increased as well.

The results provide evidence that the production of ATP and caspase activity is effected by different doses of radiation that induce apoptosis in SKOV3 colon cancer cells. Future research would investigate other caspases in the biochemical pathways leading to apoptosis in colon cancer cells as well as other methods of experimentation of caspases 3/7, 8, and 9. The research findings suggest that caspases may have a significant role in the induction of apoptosis in irradiated SKOV3 colon cancer cells. Caspases 3/7, 8, and 9 may be markers for disease progression in the activation of apoptosis in colon cancer cells.

Funder Acknowledgement(s): Talladega College Ronald E. McNair Program

Faculty Advisor: Alison Brown, akbrown@talladega.edu

15
Subcategory: Cancer Research

Validation Study of Multiple Criteria Optimization-Cancer MircroData Arrays

Juan I. Irizarry Nieves, University of Puerto Rico at Mayaguez
Co-Author(s): Mauricio Cabrera and Clara Isaza, University of Puerto Rico at Mayaguez
Pedro Santiago, Ponce School of Medicine and Health Sciences

Microarray experiments can produce large quantities of genetic information at a time. The large amount of information comes from different microarray types and with different scales making the combined information difficult to extract. This becomes a multiple criteria optimization problem (MCO) that our group proposed to handle with a data envelopment meta analysis (DEM-A) in order to find which genes have the highest alteration in expression. DEM-A was applied to colon and cervical cancer microarray databases. An extensive literature search was performed for the ten genes identified as possible biomarkers or cancer related. This study was performed with available online medical and genetic. The data was then sifted out to retain the most relevant and organized onto a table. DEA was applied to lung cancer microarray databases and two genes were identified as possible candidates for cancer relation, RAGE and ADH1. Four lung cancer cell lines (DMS114, H187, H520 and H1975) were utilized in western blots to verify for expression of RAGE and ADH1. Out of the 10 possible genes 8 were identified as having a direct relation to cancer. Two of the genes that did not have direct relations to cancer were found to possibly have an indirect relationship to cancer. Twelve distinct cancers, among these breast, gastric, prostate, pancreatic and colorectal, were found related to the genes studied, breast and colorectal appearing most abundantly within the literature study. Two genes were found to be on chromosome X and two on chromosome 8. Four genes were found on chromosomes regions known to stimulate cancer if deleted. Results obtained from the western blots of ADH1 and RAGE were preliminary, and warrant further trials. The accuracy of the method in acquiring cancer related genes from large microarray databases warrants MCO as a possible future tool for the identification of possible biomarkers. Accuracy was demonstrated through the consistency of the validated genes in their relation to cancer. Our group of Applied Optimization at UPRM is currently supported by the NSF under Grant HRD (CREST program), as well as the NIH MARC Grant Bioinformatics Programs at Minority Institutions.

Funder Acknowledgement(s): National Science Foundation (NSF) Grant HRD 0833112 (CREST program); National Institutes of Health (NIH) MARC Grant; Bioinformatics Programs at Minority Institutions

Faculty Advisor: Mauricio Cabrera, mauricio.cabrera@gmail.com

16
Subcategory: Cancer Research

NASA Space Radiation Cancer Risk Software Analysis

Roslyn Jones, Virginia State University
Co-Author(s): Sheila A. Thibeault, Martha Clowdsley, and Steve Blattnig, NASA Langley Research Center, Hampton VA

Astronaut safety is a crucial factor in space travel. There are many factors that must be taken into consideration when sending humans into space. One of these factors includes radiation. In space, astronauts must be shielded from galactic cosmic rays (GCRs) and solar particle events (SPEs). NASA has set limits on how much radiation an astronaut is able to be exposed to, which are contingent upon age and gender. Sending at least one astronaut who has been a part of a previous mission with a crew of individuals who have not yet had this experience would be preferable; however, usually these astronauts may have reached the limit or are guaranteed to reach the limit if they go into space again. In order to better protect them from these elements, analysis of various materials is required in order to determine the best one to use for shielding. Several aspects of the shielding materials should be considered, including the Risk of Exposure Induced Death (REID), which can be estimated in the NASA Space Cancer Risk (NSCR) 2012 online program.
The NSCR 2012 computer software program is an online program created at NASA Johnson Space Center that allows users to input different parameters and it outputs the proba-bility of cancer risk, leukemia risk, and more. This program outputs risk according to age and specific body parts. In order to simplify the process, the program is being run according to specific ages of astronauts, lengths of missions, thickness of shielding materials, and more. Certain outputs, Effective Dose, Median REID, and 95% Confidence Intervals are being manually imported into an Excel spreadsheet to improve and accelerate the analysis process. After being inserted into a spreadsheet, they are then plotted into graphs for more convenient analysis. Viewing and analyzing these data to find a material that will efficiently protect astronauts from radiation will prevent or eliminate possible health risks that could occur from space travel over long periods of time.

Funder Acknowledgement(s): NASA Langley Research Center, Hampton, VA

Faculty Advisor: Ali Ansari, aansari@vsu.edu

17
Subcategory: Cancer Research

Smooth Muscle Gamma Actin Structure in Prostate Epithelia

Georgina Kolcun, Texas A&M University

Prostate cancer is one of the most plaguing of cancers to American men. Our study aims to understand the expression of smooth muscle gamma actin (SMGA) in the physiology of prostate epithelia so that an innovative, more specialized approach may be developed contributing to the treatment of prostate cancer. It is important to focus on SMGA due to its increased expression in the prostate epithelia during cancer progression. Previous research indicates that SMGA protein is present in the prostate epithelia, but as of yet it has not been detected by traditional methods. The goal of this study is to determine the discrepancy between SMGA protein found in the prostate epithelia from that found in the prostate smooth muscle.

In order to prove SMGA protein is in fact present in prostate epithelia, we subjected lysates derived from a prostate cancer cell line, PC-3, to Western blot analysis, immunoprecipitation, and mass spectroscopy. We used monoclonal muscle actin isoform-specific antibody, HUC1-1, to determine that these isoforms were present in lysate samples. As experimental controls, actin purified from chicken gizzard smooth muscle cells was run in parallel to the lysate on the same gel. We next used HUC1-1 in immunoprecipitation experiments to precipitate actin from the lysate. We found that its band matched to the control of purified actin which migrated at 43 kDa on the gel system. The band from the precipitated actin was then cut from the gel and subjected to mass spectroscopy analysis for sequencing. These experiments identified multiple peptides that are diagnostic of SMGA. However, we did not detect the amino terminal segment of the prostate specific SMGA molecule. Future studies include sequencing the amino acids at the N-terminus using Edman degradation and comparing the sequenced protein to that of SMGA found in mature smooth muscle. If successful, we will synthesize an antibody specific to prostate epithelia SMGA to examine its expression in cancerous prostate.

Funder Acknowledgement(s): This study was supported by stipends from LSAMP awarded to Georgina Kolcun, Texas A&M University, College Station, TX, 2011-2013.

Faculty Advisor: Warren E. Zimmer, wezimmer@medicine.tamhsc.edu

18

Subcategory: Cancer Research

Phenotypic Characterization of an Allelic Variant of Mtor

Solomon Lynch, University of the District of Columbia
Co-Author(s): Joy Gary, DVM, University of Michigan
Beverly Mock, NIH NCI LCBG

The PI3K/Akt/mTOR pathway is a growth and survival pathway that is often dysregulated in cancer. An allelic variant of Mtor (C1977T) was discovered in BALB/cAnPt mice, which makes these mice more susceptible to the development of plasmacytomas when injected with pristane. This allelic variant results in a single amino acid substitution (R628C) that is predicted to be damaging to the protein. In order to study the effect that the amino acid substitution R628C has on the signaling of the mTOR pathway and the transcriptome, mice were created with the BALB/c allele of Mtor on a B6;129 background through homologous recombination. Mouse embryonic fibroblasts (MEFs) were isolated from mice that were knock in (KI) and wild type (WT) for the Mtor allele and were assessed for phosphorylation of downstream targets. MEFs from these mice were then immortalized with SV40 Large T antigen and proliferation was compared between the WT and KI. To explore differences in the transcriptome associated with this allele of Mtor, we compared the mRNA expression by micro-array in bone marrow and B220+ splenocytes (B cells) of WT and KI mice that were or were not treated with pristane. Network enrichment analysis of the genes differentially expressed in bone marrow from pristane-treated animals revealed that top functionally enriched networks included DNA replication and repair. Specifically, multiple genes in the Fanconi anemia pathway, (FancC, FancD2, FancG, and Brca1) were down regulated in the bone marrow of pristane-treated mice. Evaluation of the DNA damage response in KI and WT MEFs is ongoing. Bone marrow and spleen from pristine and non-pristane treated mice were also evaluated for phosphorylation of downstream targets of mTOR.

Funder Acknowledgement(s): MARC U*STAR, NIH NCI CCR CRI.

Faculty Advisor: Kumar and Freddie Dixon, fdixon@udc.edu

19

Subcategory: Cancer Research

Prostate Cancer Knowledge, Myths, and Misconceptions Among Haitian Men

Olivia M. Moline, Florida A&M University
Co-Author(s): Folakemi Odedina, Ezekiel Ojewale, and Shannon Pressey, University of Florida

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, the purpose of this study was to assess 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 Orlando and Miami (FL), and was by self-administered survey. A total of 95 men were recruited during two health forums and at a church. T-shirts or a laptop bag were provided as incentives for participation in the study. Descriptive analysis and simple regression was employed to analyze the data. Prostate cancer knowledge was found to be low among the participants. In addition, prostate cancer myths and misconceptions were also low.

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. (Keywords: Prostate cancer; Haitian-American men; myths and misconceptions; knowledge.)

Funder Acknowledgement(s): Folakemi Odedina

Faculty Advisor: Edna Cofield, Edna.cofield@famu.edu

20

Subcategory: Cancer Research

The Effect of E-cadherin in Prostate Cancer Cells

Kimberly Myers, Tuskegee University
Co-Author(s): Bo Ma and Alan Wells, University of Pittsburgh School of Medicine, Department of Pathology
Clayton Yates, Tuskegee University, Department of Biology

Prostate cancer cell progression to invasion and metastasis directly drives the morbidity and mortality of this disease. This shift to aggressiveness has been linked to the upregulation of growth factor receptors signaling. One in particular is the epidermal growth factor receptor (EGFR), which binds a variety of ligands produced in the prostate and metastatic tissues. It has been shown that expression of EGFR correlates with disease relapse and progression to androgen-independence in human prostate cancer. It is thought that this autocrine signaling drives a switch in these cells to activate their mesenchymal phenotype involved in migration, proliferation, and indicated by the loss of cell-to-cell adhesion molecules such as E-cadherin. It is hypothesized that miRNA200c, a part major component of the MAPK pathway, is down regulated resulting in a decline in tumor progression. The mechanism is not well understood in regards to what occurs once the cancer cells become metastatic and gain access to the secondary organ sites, cells convert from motile mesenchymal cells to polarized epithelial cells.

To support these findings, experiments were conducted to determine the impact of E-cadherin expression in EGFR knockdown DU145 prostate cancer cells. To establish an efficacy in the EGFR knockdown method, siRNA was applied. Western blot results showed EGFR was successfully knocked down with 2, 8, 15 pM siRNA treatments. However, considering the knockdown efficiency and specification, 8 pM was selected in the subsequent experiments. A correlation between the level of E-cadherin re-expression and cell confluence was detected in this project. In addition, the level of E-cadherin re-expression was induced at different durations (0, 6, 24, 48 hours) and assayed. ERK activity in PC3 cells was evaluated after EGF stimulation before and after MET. Consequently, findings suggest that miRNA200c down regulation result in an increase in EGFR expression and enhance E-cadherin production in experimental cells lines.

Funder Acknowledgement(s): This work was supported by the Department of Defense grant #PC080566; SURP.

Faculty Advisor: Richard Whittington, whittingtonr@mytu.tuskegee.edu

21

Subcategory: Cancer Research

Characterization of SPT-1 Open and Alternate Reading Frames in Cancer Cells

Tamra Neblett, Spelman College
Co-Author(s): Chenel Johnson, Takiyah Thomas, and Tokunbo Yerokun, Spelman College

The human serine palmitoyltransferase, long chain base subunit 1, SPTLC1, is located at 9q22.2, where over 1,00 genes have been annotated. In mice, SPTLC1 gene knockout is embryonic lethal, while in cultured cells, SiRNA mediated gene inhibition results in distortion of cell morphology and death. It is hypothesized that the SPTLC1 gene product may play a key role in regulating cellular behavior in development and disease state. Recent but tenuous association of mutations in the gene to the role of altered enzyme activity in cell behavior is complicated by disease association to human disorders including inflammation, hereditary sensory neuropathy type 1, atherosclerotic cardio-myopathy and cancer, independent of altered enzyme activity. Hence there is increasing research interest in a signaling role for SPTLC1 in addition to emerging evidence of its stress responsiveness and capacity to modulate stress response signaling. Morphological and immunoprecipitation studies assessing the phenotypic consequence of aberrant SPTLC1 expression in cells

responding to environmental stress stimuli suggest it can engage in crosstalk with protein regulators of the cellular processes of growth and death. Sequence specific primers were used in the present study to characterize genomic and reverse transcribed cDNA from a set of human cancer cell lines with regards to transcriptional expression of the open and an alternate open reading frame for human SPTLC1. A 150 base pair fragment was differentially amplified from the samples examined. When coupled with DNA sequence analysis, the copy number variations observed in this study provides new insight into molecular expression of SPTLC1 in human cancer cell lines that will help in validating a functional role for SPTLC1 in stress response signaling.

Funder Acknowledgement(s): Spelman College Office of the Dean for Research and Title III

Faculty Advisor: Tokunbo Yerokun, tyerokun@spelman.edu

22
Subcategory: Cancer Research

Explication of Branched Chain Amino-Acid Transaminase 1 in Triple Negative

Richard North, III, Texas Southern University
Co-Author(s): Kayla Burrell, Carmen Gonzalez, and Delon Poole, Texas Southern University

Breast cancer has proven to be one of the most common malignancies in women of the United States. As the primary tumor begins in the breast itself, it eventually becomes invasive and may progress beyond the breast to the regional lymph nodes or metastasize to other organ systems in the body, leading to low patient survival. Often, metastatic tumors are defined as triple negative (TN); these tumors are negative for estrogen receptor, progesterone receptor and ERBB2). Objective of this study was to identify biomarkers related to TN cancers and validate their reliability. Branched chain amino-acid transaminase 1 (BCAT1) was the biomarker examined as part of this study. BCAT1 was examined using MDA 231 RNA to represent TN and MCF7 cell line RNA to represent other breast cancer types. Analysis of Polymerase Chain Reaction (PCR) products on agarose gel revealed over-expression of RNA in MDA231 TN samples compared to MCF7. Examination of protein levels was done using Immunohistochemistry (IHC) using tissue microarray (TMA) complied using patient samples. At the protein level, BCAT1 expression could not distinguish TN and non-TN clinical samples. In conclusion, BCAT1 would not be a useful biomarker to characterize TN tumors.

Funder Acknowledgement(s): Texas Southern University's Summer Undergraduate Research Program (SURP)

Faculty Advisor: Audrey Player, playeran@tsu.edu

23
Subcategory: Cancer Research

Mechanism of Salvianolic Acid-B on the Inhibition of Cyclooxygenase-2

Jonathan Smith, University of Arkansas at Pine Bluff
Co-Author(s): Xinbin Gu, Belinda Hauser, Shenye Hu, and Yayin Fang, Howard University College of Dentistry, Washington, DC

Cancer is the second leading cause of death for Americans in the United States for all ages. New alternatives are needed to improve cancer treatment outcomes. Chronic inflammation is a risk factor dealing with cancer and is related to cyclooxygenase-2 (COX-2) protein. COX-2 is an ideal target for development for chemopreventative agents in cancer prevention because it is overexpressed at sites of inflammation and many cancers. Second-generation anti-inflammatory drugs offer some promise in improving cancer treatments and the prevention of cancer; however, cardiovascular risks are prevalent. Salvianolic acid-B (Sal-B) was found to selectively inhibit COX-2 expression and activity. The objective of this project is to determine the Sal-B binding capabilities to the enzyme COX-2. We hypothesize Sal-B may competitively inhibit COX-2 by binding to a hydrophilic side pocket region close to the active COX-2 binding site of arachidonic acid (AA). Computational analysis using the Molecular Operating Environment (MOE) packaging system to determine Sal-B:COX-2 interaction compared to celecoxib. COX Fluorescent Activity Assay kit was used to determine the biochemical process of whether Sal-B is a competitive or noncompetitive inhibitor. MOE system showed the Sal-B had the capability to bind in the same active site as arachidonic acid. MOE results indicated that Sal-B is capable to compete with the binding site of arachidonic acid, which is a substrate for COX-2. Overall, Sal-B has high potential as a chemopreventive agent.

Funder Acknowledgement(s): This project has been funded in whole or in part with Federal funds (UL1TR000101 previously UL1RR031975) from the National Center for Advancing Translational Sciences (NCATS), National Institutes of Health, through Clinical and Translational Science Awards Program (CTSA), a trademark of DHHS, part of the Roadmap Initiative, Re-Engineering the Clinical Research Enterprise.

Faculty Advisor: Xinbin Gu, xgu@howard.edu

24
Subcategory: Cancer Research

The Effects of ELL2 Loss in Murine Prostate on Vascularity or Angiogenesis

Leekira Smith, Tuskegee University
Co-Author(s): Laura Pascal

All tumors rely on an adequate blood supply in order to grow beyond one cubic mm in size. Tumors can secrete signaling molecules, which promote the increased formation of new blood vessels, a process called angiogenesis. Tumors also can encourage normal cells to give off that same signaling resulting in even more blood vessels being produced. When the new blood vessels are produced they feed the growing tumor with oxygen and other nutrients. This makes it possible for cancer cells to spread and grow, and eventually to metastasize. When cancer cells metastasize they spread from one location to the next. Angiogenesis is a process that facilitates the growth and progression of prostate cancer. New blood vessels not only provide nourishment for the tumor but they also act as a mode of transportation to different locations in the body. ELL2 and EAF2 are two proteins, which have been implicated in both angiogenesis as well as prostate cancer. Prostate cancer is the second leading cause of cancer death in American men. Prostate cancer occurs mainly in older men. Nearly two thirds are diagnosed in men sixty-five or older. The effects of the loss of ELL2, eleven-nineteen lysine-rich leukemia protein 2, and EAF2, an ELL associated factor 2, on vascularity in murine prostate were observed in this experiment. In addition, the correlation of EAF2 loss and increased vascularity was examined in human prostate tumor specimens. Scientists believe that cutting off the blood supply or inhibiting the chemical responses used in spreading the tumor will inhibit the growth of the tumor.

Funder Acknowledgement(s): This work was supported by the Department of Defense grant #PC080566.

Faculty Advisor: Timothy Turner, turner@mytu.tuskegee.edu

25

Subcategory: Cancer Research

The Protein Interaction Between Nef and p53 and Their Regulatory Effects

Seth Wolf, Morehouse College

HIV-1 infection accelerates development of cancer, enhancing the frequency of non-AIDS defining cancers by 2-3 fold among HIV patients. However, the molecular mechanism for this process is still unclear. p53 is one of the most important cancer suppressors, it is able to arrest cell growth and to induce apoptosis. HIV-1 Nef, an essential protein for viral pathogenesis is known to transfer to even non-susceptible cells, like tumor cells by HIV infection, and to dysregulate normal cell physiology in the target cell by interacting with p53. Western blot analysis was performed to investigate the stability of endogenous as well as exogenous p53 and Nef. Subcellular localization was examined by immunofluorescence microscopy to test the hypothesis that the transferred Nef could contribute to the observed acceleration of cancer progression by suppressing p53 activity.

The level of endogenous p53 was significantly reduced by the expression of Nef protein in a dose dependent manner. Similarly, Nef was degraded by expression of exogenous p53, indicating that the degradation of the proteins are reciprocal. Furthermore p53 was detected in both the cytoplasm and the nucleus, and Nef was co-localized with the cytoplasmic p53. Nef could play a primal role in expedition of the progression of cancer by manipulating the stability of p53 which has a cardinal function in tumor suppression.

Funder Acknowledgement(s): Funded by a Collaborative Undergraduate HBCU-STP grant PC094536 from the Department of Defense Prostate Cancer Research Program DOD-PCRP to Jamboor K. Vishwanatha.

Faculty Advisor: InWoo Park, ipark1228@gmail.com

26

Subcategory: Cell and Molecular Biology

Role of Glia in Synchronized Activity of Neurons in Culture

Nkoli Agbazue, Delaware State University

Co-Author(s): Murali Temburni, Delaware State University

Synchronous activity is thought to play a role in the establishment of functional neuronal networks in the developing nervous system. Though the specific mechanisms are still unknown, astrocytes have been shown to modulate bursting activity in neuronal networks. To unravel the role of astrocytes in synchronous firing, we aim to culture neurons alone or with astrocytes on multielectrode arrays and record bursting activity. The objective of my experiment is to obtain pure populations of neurons in culture from the optic tectum of E7 chicken embryos. Using the mitotic inhibitor FUdR in the cultures killed astrocytes in four days leaving a pure population of neurons.

Immunofluorescence using astrocyte (GFAP) and neuron specific (betaIII tubulin) confirmed that the cultures contained only neurons. We will next culture pure neurons on MED64 multielectrode arrays in the presence or absence of astrocytes. The data obtained will be analyzed for differences in synchronous bursting properties between neurons growing alone or in the presence of glia.

Funder Acknowledgement(s): NSF

Faculty Advisor: Murali Temburni, mtemburni@desu.edu

27
Subcategory: Cell and Molecular Biology

The Effect of Anti-VEGF Drug on Neural Stem Cells

Jorge Alvarez, University of Arizona/University of Texas Southwestern Medical Center
Co-Author(s): Ondine Cleaver and Jenny Hsieh, University of Texas Southwestern Medical Center

Targeted therapies are sought to help treat neurological diseases associated with the loss of neurons. Understanding the microenvironment where neurons are born is a critical first step. In the adult brain, a direct association between angiogenesis and neurogenesis has been convincingly demonstrated. The subgranular zone (SGZ) within the hippocampus gives rise to new neurons and houses neural stem cells (NSCs). A specialized vascular niche exists in the hippocampus assisting in the proliferation and survival of neural stem/progenitor cells.

Therefore, this vascular niche is likely to be critical to the continuous production of new neurons in the adult brain. Yet, we do not fully understand the dynamic interplay of newly branched blood vessels and NSCs to support the production of new neurons. Thus, by having an intact living niche system, we could directly visualize and better understand the cell-cell interactions governing angiogenic-mediated neurogenesis. To address this problem, we (1) developed a live hippocampal slice culture system and (2) we investigated the fate of NSCs upon blood vessel ablation using an anti-Vascular Endothelial Growth Factor (VEGF) drug.

We hypothesize that VEGF blockage will decrease both brain vasculature and NSC proliferation. Our preliminary findings show that treatment of brain tissue with an anti-VEGF drug resulted in blood vessel suppression (as expected), but the number of NSCs was neither increased nor decreased significantly. However, upon blood vessel ablation, to our surprise, NSCs migrated away from their niche when compared to controls; suggesting blood vessels play a role suppressing the migration activity of NSCs. These findings could one day lead to fully understanding the successful treatment of neurological disorders.

Funder Acknowledgement(s): Minority Access to Research Careers Program, University of Arizona; Summer Undergraduate Research Fellowship at UT Southwestern Medical Center at Dallas.

Faculty Advisor: Ondine Cleaver, ondine.cleaver@utsouthwestern.edu

28
Subcategory: Cell and Molecular Biology

Identifying Oligopeptides for Binding to Pseudomonas Aeruginosa Cells

Brian R. Austin, Syracuse University
Co-Author(s): Ali Adem Bahar and Dacheng Ren, Syracuse University

Specific targeting of bacteria is important for rapid detection and effective control of bacterial pathogens. Around one third of proteins of a bacterial cell are located on the cell surface, providing promising targets for identifying bacterial binding probes. Since this protein content varies for different bacterial strains, we hypothesized that certain short peptides can bind to Pseudomonas aeruginosa cells with high affinity. To identify such specific binding peptides, a Ph.D.™-7 Phage Display Peptide Library was screened in this study. By mixing the phage library with P. aeruginosa cells followed by washing with increasing stringency, several oligopeptides were found specific for Pseudomonas aeruginosa PAO1 (wild type) and PDO300 (mucoid mutant). These oligopeptides and their modified forms were further compared for their specific affinity to P. aerugionsa cell surfaces and antimicrobial activity. Escherichia coli K12 was used as a control strain. The results show that the peptides STVKYID and SFENVFK can bind to PAO1 and PDO300 cells without apparent antimicrobial effects. On the other hand, these oligopeptides did not show any binding to E. coli K12 cells, which means these two oligopeptides can specifically bind to Pseudomonas strains. Furthermore, fluorescently labeled short oligopeptides were found to bind to target cells. To our best knowledge, this is the first study to screen a phage library for binding to whole cells of Pseduomonas strain. The identified peptides have potential for developing novel probes for specific detection and killing of P. aeruginosa cells.

Funder Acknowledgement(s): This study was supported by a grant from NSF-EFRI/REM program.

Faculty Advisor: Dacheng Ren, dren@syr.edu

29
Subcategory: Cell and Molecular Biology

Roles of Ion Transporters in Mucociliary Development and Disease in Xenopus

Grober Baltazar, UCSD/University of California, Berkeley
Co-Author(s): Peter Walentek and Richard Harland, Department of Molecular and Cell Biology at University of California, Berkeley

Mucociliary epithelia consist of mucus-secreting goblet cells, ciliated cells and transmembrane proton/ion transporters that regulate homeostasis and gene expression. Certain respiratory diseases such as cystic fibrosis are caused by the accumulation of thick viscous mucus in the airway epithelium due to recessive mutations of the cystic fibrosis transmembrane conductance regulator gene family (CFTRs). These genes regulate the concentrations of chloride and sodium ions across the airway epithelium, leading to infections of the carriers. Recently, it has been discovered that the ciliated epidermis of Xenopus embryos can be used as a model system to study and understand the mechanisms of mucociliary epithelial homeostasis and development. Thus, the frog is a model organism that can be used for research to find novel therapeutic treatments for diseases such as cystic fibrosis. Transmembrane proton regulators, e.g. ATP4 and ATP6, interact with the Wnt signaling pathway, which is required for development and function of mucociliary epithelia. In this study, we are cloning ion pumps and transporters, namely Duox1, Hvcn1, CFTR7, NHE1, NHE2, NHE3 and NHE4 for the first time in the frog Xenopus laevis. We want to analyze their expression in Xenopus embryos and investigate their potential role in pH homeostasis of the ciliated skin epithelium and/or interactions with the Wnt signaling pathway. The long-term goal of these experiments is to gain a better understanding of proton/ions secretion across ciliated epithelia and mechanisms involved in human airway diseases.

Funder Acknowledgement(s): AMGEN Foundation; MARC U-STAR Award #T34GM087193 from the National Institutes of Health (NIH) and National Institute of General Medical Sciences.

Faculty Advisor: Richard Harland, harland@berkeley.edu

30

Subcategory: Cell and Molecular Biology

Odor Adaptation Defect in a cGMP Protein Dependent Kinase pkg-2 Mutant

Eduardo Bernal, California State University Northridge
Co-Author(s): Neomal Muthumala and Ray Hong, California State University Northridge

The cGMP- dependent protein kinase egl-4, also known as pkg-1, is known to altercate olfactory response over a prolonged period of time. Its closest paralog pkg-2 displays similarities in chemosensory to the odor butanedione, but phenotypically is very different in size and longevity. Two deletion mutation alleles of pkg-2 were isolated, pkg-2(tm3878) and pkg-2(ok966), and were screened against the well known pkg-1(n479) mutant. To further determine the relationship between these genes we analyzed their odor adaptation defect with the odor pentanedione and isoamyl alcohol. In addition, a double mutant egl-4(n479);pkg-2(tm3878) was created in order to determine if these linked genes produced a redundant or overlapping function through loss of the c-GMP protein kinase. A transgenic rescue was constructed by inserting the genomic fragment of egl-4(n479);pkg-2(tm3878) into the single mutants to verify the phenotype was due to the double mutant strain. We hypothesize that the pkg-2 mutant will result in a redundancy in odor adaptation, which is similar or worse than the pkg-1 mutant because they shared similarities to the odor butanedione. It might result stronger odor adaptation phenotype because the pkg-2 is a deletion mutation while pkg-1 is a substitution mutation.

By studying the closely related paralog of pkg-1 we can in the future tests if they share a similar pathway. The chemotaxis assays were done by washing the worms with modified basal buffer to remove OP50. Animals were then soaked with water (mock) and the respective odor (treated pre-exposure) for 30 minutes. The pre-exposure solution concentrations used were 1:10000 (pentanedione and butanedione) 1:5000 (isoamyl alcohol). The odors were diluted in 100% ethanol to make a final odorant concentration of 1%. After 30-45 minutes the plates were scored and calculated as Chemotaxis Index. To measure the longevity of each mutant Fluorodeoxyuridine (FUdR), an inhibitor of DNA synthesis was used as the chemical to stop any eggs laid during the experiment from hatching. L4 worms were picked from plain NGM plates and transferred on to 20 µM FUdR plates. Worms were counted every day and the number of living worms in each plate was recorded until they were all dead. In our findings we discovered that pkg-2(tm3878) allele displayed a stronger butanedione odor adaptation compared to pkg-2(ok966). pkg-2(tm3878) does not have a large body phenotype, in contrast to egl-4(n479). Egl-4(n479);pkg-2(tm3878) body length is between pkg-2(tm3878) and egl-4(n479), but resembles pkg-2(tm3878) in width. The egl-4(n479) and pkg-2(tm3878) alleles show similar butanedione odor adaptation defects. The egl-4(n479);pkg-2(tm3878) double mutant displays an additive effect to only the odor pentanedione. Lastly, we determined that egl-4(n479) has the highest survival rate.

Funder Acknowledgement(s): R.L.H is supported by NIH SCORE SC2GM089602

Faculty Advisor: Ray Hong, ray.hong@csun.edu

31

Subcategory: Cell and Molecular Biology

Effects of Greens With Omega-6/Omega-3 Ratios on Renin-Angiotensin System

Shane Bradner, Tuskegee University/University of Redlands
Co-Author(s): Marcellus Edwards, Tuskegee University

Cardiovascular disease (CVD) is the leading cause of death for men and women in the United States. Hypertension (HTN), a major risk factor for CVD, is prevalent in the rural Black Belt of Alabama (AL) and contributes to the health disparity amongst racial/ethnic groups in the Black Belt. Green leafy vegetables (GLV) known to lower blood pressure (collard greens, purslane, and sweet potato greens) can play a major role in combating HTN. The effect of GLV and omega-6 to omega-3 fatty acid polyunsaturated fatty acid ratios on HTN has been studied yet little is known about the Renin-Angiotensin System (RAS), the system responsible for controlling blood pressure. The recommended ratio of omega-6 to omega-3 fatty acid is 3:1 yet the average American diet has an omega-6 to omega-3 fatty acid ratio of 25:1. There are limited studies on diets commonly consumed in the rural Black Belt of AL and the effect on HTN, we hypothesized there will be an increase in the components of the vasoprotective axis of the RAS in the SHR.

Our objectives were: 1.) to determine the effect of the GLV with omega 6: omega 3 polyunsaturated fatty acid ratios of 25:1 and 1:3 on cardiac hypertrophy in the spontaneously hypertensive rats (SHR), and 2.) to determine the effect of the GLV with omega 6: omega 3 polyunsaturated fatty acid ratios of 25:1 and 1:3 on the cardiac molecular profile of the RAS in the SHR. Systolic blood pressure was significantly lower in the SHR fed CG at week 6. Thus, left ventricles (LV) from all groups at 6 weeks were dissected, weighed and homogenized. Western blot analysis was performed to determine the RAS profile. The 1:3 omega-6: omega-3 fatty acid ratio had a significant reduction in LV to body weight ratio compared to the standardized control (SC) ($p \leq 0.025$). ACE2 expression was significantly reduced in the 1:3 group compared to the SC (1:3 C=0.0129; 1:3 CG=0.0046; 1:3 PL=0.0023; 1:3 SPG=0.0085). These results indicate that intervention diets that prevent HTN also prevent cardiac hypertrophy and suppress chronic RAS activation.

Funder Acknowledgement(s): This study was supported, in part, by the Howard Hughes Faculty Fellowship, awarded to Chastity Bradford, of Tuskegee University, Tuskegee, AL. My participation in the program was supported by funding from the NSF IBS-REU program.

Faculty Advisor: Chastity Bradford, cbradford@mytu.tuskegee.edu

32
Subcategory: Cell and Molecular Biology

Screening Neurotoxicity of Pesticides in Parkinson's Disease in Vitro Model

Nicole M. Brown, Delaware State University
Co-Author(s): Douglas Mullen, Delaware State University

Parkinson's disease (PD) is the most prevalent motor neurodegenerative disease and more than 1% of people age 65 or older suffers from PD. The majority of research in PD is still using genetic mutation models, although more than 95% of PD cases are considered sporadic (1). While a few pesticides have been banned in use due to inducing sporadic PD, numerous pesticides are not properly tested for their potential combinational damage. For example, the neurotoxic effect of pesticide/fungicide, Paraquat has been demonstrated to substantially exacerbate the toxic effect with another fungicide, Maneb in PD models (2). However, most toxicity assessments are based on controlled experiments with a single chemical over a limited range of concentrations. Here we focus on the neurotoxic effects of commonly used pesticides in the U.S. and how toxic they are to dopaminergic neurons in the PD in vitro model. We screen the potential damage of common pesticides individually and evaluate the additive damage of combinations of pesticides. We use N27 rat dopaminergic cell line for testing neurotoxicity. After plating these cells in 96 well plates, we exposed them to pesticides for 24 hours and measured cell viability using MTT assay. The spectrophotometer plate reader measures the optical density (OD), which reflects the amount of cells alive and healthy. The first measurements are measuring the cell viability of single pesticide at varying concentrations, followed by measuring the combinations of two pesticides at specific concentrations (LD_{50}). We found that 24 hours exposure of 4.34μM Atrazine, 0.62μM Diuron and 2.5μM Metolachlor was sufficient to induce 35-45% cell death in the initial screens. We also test our hypothesis that combinations of these pesticides cause synergistic damage to the dopaminergic cell line. This study will give insights about what pesticides may cause dopaminergic cell death, in addition to particular combinations can induce substantially higher neurotoxicity linked to PD. The goals of this study are to raise a warning sign for the exposure of multiple pesticides and to push toward to select safer pesticides and further minimize or limit the use of harmful chemicals. This research can contribute to reduce the prevalence of sporadic PD. Future studies: we test combinations of potential therapeutic compounds such as lithium, curcumin, and other anti-oxidants to protect dopaminergic neurons against pesticides-induced oxidative stress.

References: 1. Conway et al., 1998. Nat Med.; 2. Thiruchelvam et al., 2000. Brain Res.

Funder Acknowledgement(s): I would like to thank the S.M.I.L.E. program of Delaware State University for help funding this research. I would also like to thank the N.S.F. for funding the S.M.I.L.E. program.

Faculty Advisor: Y. Hwan Kim, yhkim@desu.edu

33
Subcategory: Cell and Molecular Biology

Investigating a Role for DdiTLP2 in Cell Growth and Mitochondrial Function

Elisabeth Carrillo, California State University, Monterey Bay/ Ohio State University

Co-Author(s): Yicheng Long and Jane E. Jackman, Ohio State University

The $tRNA^{His}$ guanylyltransferase (Thg1) is an essential gene in eukaryotes that allows proper function of histidine-tRNAs and plays an important role in mitochondrial metabolism. Mis-regulation of Thg1 expression levels contributes to human diseases including diabetes making the study of this essential enzyme beneficial to human health. Thg1-Like-Protiens (TLPs) are orthologs of Thg1 that have yet to have their functions thoroughly understood. *Dictyostelium discoideum* is used as a model organism in which to study Thg1/TLP function because *D.discoideum* encodes four different Thg1/TLP enzymes.

Previous data suggests distinct functions for the four enzymes in vivo. *D.discoideum* TLP2 (DdiTLP2) causes a slow growth phenotype when deleted in *D.discoideum* cells. DdiTLP2 is a non-essential gene in *D.discoideum* so we therefore were able to study its role in vivo in this organism. We grew wild type as well as ΔDdiTLP2 cells and these cells were then used in mitochondrial examinations using a Mito Tracker Green dye to compare relative mitochondrial staining signal between the two. We hypothesized that the ΔDdiTLP2 cells exhibited a slow growth phenotype due to mitochondrial dysfunction because DdiTLP2 is located in the mitochondria. The Mito Tracker Green tests showed higher relative staining signal in the wild type cells compared to the ΔDdiTLP2 cells. We believe this is due to decreased mitochondrial function in the ΔDdiTLP2 cells. These data suggest DdiTLP2 plays a role in cell growth and mitochondrial dysfunction is a factor in the slow growth phenotype seen in the ΔDdiTLP2 cells. Next, overexpression plasmids were constructed to use as tools to study the role of all four TLPs in vivo in *D.discoideum*. Future work will include transforming the ΔDdiTLP2 cells with the overexpression plasmid containing TLP2 to see if the wild type growth rate is restored. The mito $tRNA^{His}$ in the transformed cells will also be sequenced to determine if the proper mitochondrial function is restored in the ΔDdiTLP2 cells.

Funder Acknowledgement(s): This study was supported by a grant from the National Science Foundation awarded to the molecular genetics and biochemistry REU program at Ohio State University and by the McNair Scholars Program at California State University, Monterey Bay.

Faculty Advisor: Aparna Sreenivasan, asreenivasan@csumb.edu

34

Subcategory: Cell and Molecular Biology

Protein Interactions Among Aquilegia MADS-box Transcription Factors

Marylyn Height Creer, Alabama A & M University
Co-Author(s): Lynn D. Holappa And Elena M. Kramer, Harvard University

The MADS-box Domain transcription factors are key to determining the development of plants and are not only important for plant evolution and organ development, but are paramount in studying determining factors in the development of most eukaryotes. The broad goal of this project is to determine the genetic basis of flower organ development in Aquilegia and its evolutionary significance. In studying Arabidopsis, the ABC model for plant development has been described, with the A, B and C gene classes specifying the major floral organs. Aquilegia (columbine) species have also contributed to the evolution of the ABC model and to a novel model system for biological studies in fields such as evolution and ecology. Aquilegia has experienced a recent adaptive radiation and possesses a new type of organ, the staminodia, making it a useful model for recent and ancient evolutionary studies. In our experiments we used miniprep assays to isolate plasmid DNA from E. coli cultures.

We then used the plasmid DNA in restriction enzyme digests and polymerase chain reactions (PCR) for cloning and sequencing. These particular techniques were used to create plasmid DNA constructs for Yeast Two Hybrid (Y2H) analyses and for localization analyses of MADS proteins tagged with fluorescent proteins (FP), such as green fluorescent proteins (GFP), in order to assess protein interactions in yeast and in planta. Our results illustrated successful digests of vectors by restriction enzymes, as well as microscopic images of GFP confirming transient transformation of plasmid AQP1-GFP into Nicotiana benthamiana leaves to observe its subcellular localization.

Future work involves continued use of miniprep assays to develop constructs that can be used to analyze and document findings that provide insight into the development of the floral organs of Aquilegia, particularly the staminodia, and its evolutionary significance.

References: Immink, Richard G.Kaufmann,Kerstin. Angenent, G. “The ABC” of MADS Domain Protein Behaviour and Interactions. *Semin Dev. Biol*: 2010 . Kramer, Elena M. Aquilegia: A New Model for Plant Development, Ecology, and Evolution. Annual Reviews. *Plant Biology*. 2009. Kramer, Elena M. Holappa, Lynn. Gould, Billie. Jaramillo, M. Alejandra. Setnikov Dimitriy. Santiago, Philip M. Elaboration of B Gene Function to Include the Identy of Novel Floral Organs in the Lower Eudicot Aquilegia. *The Plant Cell*. 2010.

Funder Acknowledgement(s): NIH-NIGMS through the Training Program in Molecules, Cells and Organisms (MCO), T32-GM007598; Alabama A&M University (AAMU) NSF HBCU-UP GRANT # HRD-0928904.

Faculty Advisor: Mostafa Dokhanian, mdokhanian@aamu.edu

35
Subcategory: Cell and Molecular Biology

Fisetin as a Quadruplex DNA Ligand: A Step Toward Alternate Cancer Therapy

Donald Davis, Tougaloo College
Co-Author(s): Bidisha Sengupta, Tougaloo College

Fisetin (3,3',4',7-tetrahydroxyflavone) is a bioactive plant flavonoid of immense importance as a potentially useful therapeutic drug, for various free radical mediated as well as other diseases. 3-hydroxy flavone (3HF) and 7-hydroxy flavones (7HF) are synthetic compounds which are the chromophores of fisetin. We have exploited dual luminescence property of fisetin along with 3-HF and 7HF to examine its interactions with relevant macromolecular targets, namely double stranded (from calf thymus, CT), and quadruplex (QD, G4) DNA. In the presence of CT DNA dramatic changes are observed in the intrinsic fluorescence behaviour of fisetin, 3HF and 7HF. Spectroscopic data suggest that fisetin binds intercalatively between the base pairs, whereas 3HF is a groove binder of DNA. 7HF bind differently in CT and QD DNA. Dramatic changes in differential absorbance spectra of G-quartet DNA with and without fisetin and 3HF were observed, suggesting the stability of quadruplex structures with plant flavonoids. Absorption, melting, fluorescence and CD spectroscopy, combined with molecular modeling approaches were used for the present study.

Funder Acknowledgement(s): Professor P. K. Sengupta, Saha Institute of Nuclear Physics, India is acknowledged for the time resolved studies. BSG is thankful to the travel award by AAAS WIRC @ MSIs which is funded by NSF, for allowing her to initiate the international collaboration, as is presented in the present study. BSG also likes to acknowledge the financial support from NIH/ NCMHHD/RIMI grant # 1P20MD002725, Epscor seed grant MS- EPS-0903787 and research support from HBCU-UP Grant, NSF ID: 0811638 at Tougaloo College. We are grateful to Professor Randy Wadkins of Ole Miss for the computational chemistry studies.

Faculty Advisor: Bidisha Sengupta, bsengupta@tougaloo.edu

36
Subcategory: Cell and Molecular Biology

Elucidating a Mitochondrial Protective Transcriptional Network

Kevin De Jesús, University of Puerto Rico-Humacao/Sloan-Kettering Institute
Co-Author(s): Mark Pellegrino and Cole Haynes, Cell Biology Program, Memorial Sloan-Kettering Cancer Center, New York, NY

The mitochondrial unfolded protein response (UPRmt) is a pathway that is activated during times of mitochondrial dysfunction and is regulated by the transcription factor ATFS-1 (Activating Transcription Factor associated with Stress-1). During periods of mitochondrial dysfunction, mitochondrial import efficiency is decreased allowing ATFS-1 to traffic to the nucleus via its nuclear localization signal (NLS). Nuclear ATFS-1 then activates a cytoprotective transcriptional response that alleviates the mitochondrial dysfunction. Our objective was to identify other candidate transcription factors that act as regulators of UPRmt gene expression. Previous work identified seven transcription factors that are either induced during mitochondrial dysfunction or have been found to physically interact with ATFS-1 in vitro. An initial RNA interference (RNAi) screening was performed against these transcription factors in the clk-1(qm150) background, a mitochondrial stress mutant background that results in activation of the UPRmt. From these candidates, ZIP-5 was identified as a transcription factor required for UPRmt activation. RNAi against zip-5 resulted in reduced levels of the UPRmt reporter transgene hsp-60::GFP in the clk-1(qm150) mutant background. Interestingly, loss of function of ZIP-5 also suppresses the slowed growth phenotype, which is characteristic of mitochondrial stress animals. We hypo -thesize that ZIP-5 may act as a negative regulator of electron transport chain gene expression (ETC genes), which would allow zip-5 loss of function mitochondrial stressed animals to grow at a faster rate due to increased respiration rates. To verify this hypothesis, we used a respiration assay to measure oxygen consumption and quantitative RT-PCR to measure changes in mitochondrial- and nuclear-encoded electron transport chain gene expression in zip-5 mutant animals compared to wild-type. Thus, our observations provide preliminary evidence that ZIP---5 is a component of a mitochondrial protective transcriptional network, acting as negative regulator of Mitochondrial biogenesis.

Funder Acknowledgement(s): NSF, NIH

Faculty Advisor: Cole Haynes, haynesc@mskcc.org

37
Subcategory: Cell and Molecular Biology

An Omega-6 to Omega-3 Fatty Acid Ratio of 1:3 Alters Angiotensin Converting

Jamel Dobbs, Tuskegee University
Co-Author(s): Shane Bradner, Melissa Johnson, Ralphenia Pace, and Chastity Bradford, Tuskegee University

Contribution Cardiovascular disease (CVD) is the leading cause of death among Americans. A major risk factor for CVD is hypertension (HTN). More African Americans suffer from HTN compared to any other ethnic group, and these numbers are even higher in the rural Black Belt of AL. HTN is a multifactorial disease. The environment, gender, and genetics are all contributing factors to the health disparity. In the some rural

areas fast food is consumed more than raw and organic foods due to poor access to good quality foods and socioeconomic status. Typically, Americans consume omega-6 to omega -3 polyunsaturated fatty acids (PUFA) in a ratio of 25:1 that contributes to HTN. The renin angiotensin system (RAS) is responsible for regulating blood pressure, and it is composed of a protective and hypertensive axis. The hypertensive axis is composed of Angiotensin II/Angiotensin Type 1 Receptor/ Angiotensin Converting Enzyme 1 (ACE). The protective axis is composed of Angiotensin 1-7/Angiotensin Type 2 Receptor/ Angiotensin Converting Enzyme 2 (ACE2). There must be a homeostatic balance between the two axes. Recent studies suggest that there is a correlation between omega-3 fatty acid consumption and HTN progression. Our lab has shown: 1) that a change in the ratio of omega -6 to omega -3 from 25:1 to 1:3 significantly reduced LV:BW ratio compared to the standardized control ($p \leq 0.025$); 2) and SHR with a 1:3 omega -6 to omega-3 have an altered RAS profile. Our objective is to determine the ratio between ACE2 and ACE1 expression in the left ventricle of SHR fed a diet with a 1:3 omega-6 to omega -3 PUFA. Adult male SHR were obtained at 6 weeks of age. The LV from all groups were dissected, weighed, and homogenized. Bradford assays and western blot analyses were performed to determine ACE1 expression. Our results indicate that intervention diets that prevent HTN also prevent cardiac hypertrophy and suppress chronic RAS activation. We will continue to assess the impact on the enzymatic ratio and activity. We predict that African Americans should decrease the omega-6 to omega-3 ratios for cardioprotection.

Funder Acknowledgement(s): This study was supported, in part by Marcia Martinez, Director for the MARCU STAR Program Tuskegee University 5T34SM089254-04, RCMI G12MD007585-23, and College of Agriculture at Tuskegee University.

Faculty Advisor: Chastity Bradford, cbradford@mytu.tuskegee.edu

38
Subcategory: Cell and Molecular Biology

A Candidate-Based Approach to Elucidate the Mechanism of KaiC Localization

Abel Duarte, California State University, Monterey Bay
Co-Author(s): Susan Cohen and Susan S. Golden, University of California, San Diego

The cyanobacterium Synechoccocus elongatus exhibits the most robust circadian clock in prokaryotes. The main circadian oscillator proteins KaiA, KaiB, and KaiC accumulate rhythmically over a 24 hour period and have been linked to global gene expression and cellular division. KaiA directly interacts with KaiC to coordinate its autophosphorylation activity whereas KaiB is involved in the dephosphorylation of KaiC. Protein-protein interaction and localization studies of these core oscillators (KaiA, KaiB, and KaiC) reveal polar sequestration of KaiC to the bacterial pole. The specific mechanism of KaiC localization and its biological function is still poorly understood. By studying KaiC, this study aims to unravel the localization mechanism. To test factors involved in the localization of KaiC, we utilized a reporter assay coupled with CFP-KaiC protein fusion to image foci localization. Thirteen E.coli strains where selected with knockouts of polar proteins to observe their impact on KaiC localization. These knockout strains were selected based on protein homology with S. elongatus. Most knockout strains displayed KaiC polar localization; however, two strains showed KaiC diffuse localization. These results suggest that the polar proteins in the knockout strains may play a role in KaiC localization. Future work is directed at using transposon mutagenesis as a tool to identify players involved in KaiC localization.

Funder Acknowledgement(s): Funding for this research experience was provided by the McNair's Scholars program at California State University, Monterey Bay. I would like to also thank the Golden Lab for their help and support at the University of California, San Diego.

Faculty Advisor: Aparna Sreenivasan, asreenivasan@csumb.edu

39
Subcategory: Cell and Molecular Biology

Tick Borne Pathogens in White Tailed Deer

Shanan Emmanuel, University of the Virgin Islands
Co-Author(s): Tasha Corneille, University of the Virgin Islands

Ticks are among the notorious hematophagous vectors known to carry deadly zoonoses. Research has shown that the deer in the US are host to two prominent species of ticks, Ixodes scapularis and Amblyomma americanum. These ticks are vectors of bacteria including Ehrlichia and Rickettsia. These bacterial diseases threaten both wild and domestic animals, and are capable of being spread to humans.

The goal of this study was to identify ticks on the invasive Odocoileus virginanus (white-tailed deer) found in the Virgin Islands National Park (VINP) and to determine whether these ticks are infected with Ehrlichia. We hypothesized that Ixodes scapularis and Amblyomma americium were present on the deer of the VINP and host Ehrlichia.

Ticks were collected from two deer found dead from the VINP and preserved in ethanol. Ticks (n=40) were chosen randomly and observed according to their distinguishing features to identify their species. All 40 ticks were triturated then heated overnight at 55˚C. DNA was extracted from the lysates using the Qiagen DNeasy Blood and Tissue Kit, then stored at -20˚C. Universal oligonucleotide primers that targeted ixodid 12S mitochondrial rDNA confirmed the recovery of PCR amplifiable DNA. Tick DNA extracts (n=18) were chosen at random then screened for Ehrlichia with two rounds of PCR, a primary and nested round of amplification. DNA agarose gels (1.5%) were used to visualize PCR results.

Ticks collected from the deer ranged from larvae, nymph and adults (partially and fully engorged). Ticks were morphologically identified as either Rhipicephalus microplus (cattle tick) or Anocentor nitens (tropical horse tick). I. scapularis or A. americium were not present on the deer in the study. The 12S mitochondrial rDNA amplicons confirmed the recovery of amplifiable DNA for all DNA extracts. DNA agarose gels did not reveal amplified DNA following primary PCR for Ehrlichia. Nested PCR resulted in a band of the expected size, which indicated the presence of Ehlichia canis in at least one sample. In summary, While I. scapularis and A. americanum were not present on the deer surveyed in this study there are ticks on the deer that resemble Anocentor nitens. Moreover, Ehrlichia rDNA PCR indicates the deer ticks may be vectors of Ehrlichia. To further broaden on the investigation, preserved tick specimens will be exported for confirmation of species. Furthermore, screenings for other tick-borne pathogens including Rickettsia and Anaplasma will be performed. This research will expand awareness on the species of ticks present in the territory and the pathogens they may possess. It will also enable persons in authority to take action where further importation or control of O. virginianus is concerned.

Funder Acknowledgement(s): This research was funded by Grant Number: HBCU-1137427.

Faculty Advisor: Jennilee B. Robinson, jrobins@uvi.edu

40

Subcategory: Cell and Molecular Biology

Bioinformatic Analysis of Presenilin-2

Olivia Franklin, Winston-Salem State University

Hypothesis: Presenilin 1 and 2 are genes commonly associated with Alzheimer's disease; the proteins are part of the γ-secretase complex responsible for regulating the production and cleavage of amyloid-β peptides that compose plaques. Mutations within the presenilin genes are shown to cause an accumulation of these plaques within the brain. Two isoforms of the human presenilin-2 gene are predicted from sequence data. Isoform-1 contains 448 amino acids and isoform-2 has 447 amino acids. Presenilin-2 is made up of 12 exons; the alternative splice differencing the two isoforms is expressed by the removal of a glutamic acid, E, in exon 10. Exon 10 is within a large hydrophilic loop, present in both presenilin 1 and 2; this loop is one of the least conservative segments between the genes. Analysis of DNA and amino acid sequences in the hydrophilic loop of other species suggests that the alternative splice site is strictly mammalian. We investigated potential effects this alternative splice will have on the presenilin-2 structure and how this change could lead to a change in function.

Methods and controls: This experiment used the NCBI database to gather DNA and protein sequences for presenilin-2 and its interacting proteins, for multiple organisms in order for bioinformatic analysis of the proteins large hydrophilic loop. Phylogenetic trees were made using CLUSTAL Multiple Sequence Alignment from the San Diego Supercomputer Center comparing the presenilin sequences as well as interacting protein sequences; the presenilin sequences were submitted to the I-Tasser database for 3D modeling, and kinase prediction was done using the NetPhos 1 and 2 to determine changes in phosphorylation sites.

Results and discussion of findings: The phylogenetic tree of the interacting proteins showed no evidence of human or mammalian changes. 3D models of the intracellular loop of each isoform shows changes in orientation of the loop. NetPhos analysis of the changes in likelihood of phosphorylation in presenilin-2 between isoform 1 and 2 shows that the neighboring serine may have a significant increase on its phosphorylation with the alternative splice within isoform 2. Further analysis of the kinase CamKII shows that there is no significant impact on its likelihood of phosphorylating the loop.

Conclusions, future research, and key references: Bioinformatic analysis was done on the presenilin-2 gene to determine if the alternative splice present in exon 10 had a significant effect on the structure and/or function of the protein. The interacting proteins all mapped out as expected, without evidence of a human accelerated form or alternative isoform. The missing E in the sequence changes the likelihood that the neighboring serine will be phosphorylated, 40.7% with the EE in isoform 1, and 13.9% with the single E within isoform 2. Between the two, the probability that CamKII phosphorylates the adjacent S increased from 57% to 53% meaning that even though the chance that serine is phosphorylated is increased 27%, the overall probability that the change is due to CamKII is not significantly increased . The 3D models suggest that there is a change in the shape of the intracellular domain of presenilin-2. Further research into other changes this alternative splice has on the function of presenilin-2 is ongoing.

References: 1. Krane, D. E., & Raymer, M. L. (2003) *Fundamental Concepts of Bioinformatics*.
2. Konopka, G., Bomar, J. M., et al. (2009) *Natur*e, 462(7270), 213-217.
3. Fisher, S. E., Vargha-Khadem, F., et al. (1998) Nature genetics, 18(2), 168-170.
4. De Strooper, B., Iwatsubo, T., et al. (2012) *Cold Spring Harbor Perspectives in Medicine*, 2(1).
5. Wakabayashi, T., & De Strooper, B. (2008) *Physiology*, 23(4), 194-204.

6. Levy-Lahad, E., Poorkaj, P., et al. (1996) *Genomics*, 34(2), 198-204.
7. Kim, S. D., & Kim, J. (2008). *Cell Stress and Chaperones*, 13(4), 401-412.
8. Thompson J.D., Higgins D.G., et al. (1994) *Nucleic Acids Res.* 22:4673-4680.
9. Yang Zhang. (2008) *BMC Bioinformatics*, vol 9, 40.
10. Blom, N., Gammeltoft, S., et al. (1999) *Journal of Molecular Biology*: 294(5): 1351-1362.

Funder Acknowledgement(s): Funding from the Nation Science Foundation, HBCU-UP: Winston-Salem State University

Faculty Advisor: Daniel WIlliams, williamsdb@wssu.edu

41
Subcategory: Cell and Molecular Biology

Immunocytochemistry to Investigate the Expression of MHC II in CPEK Cells

Emanuel Garcia, Universidad del Este/University of Illinois Urbana-Champaign
Co-Author(s): Cassandra L. Wolsic, Benjamin E. Lucas, and Sidonie N. Lavergne, University of Illinois Urbana- Champaign

Drug hypersensitivity is a severe immune-mediated reaction to a medicine, which can affect different several organ systems (individually or simultaneously) that affects 0.1-10% of the overall human patient population. Their incidence in veterinary medicine has not been established yet, but drug hypersensitivity reactions appear very similar in animals. The importance of studying drug hypersensitivity is that its pathogenesis is not well understood, especially not in veterinary medicine. For unknown reasons, delayed drug hypersensitivity often targets the skin, and certain antibiotics (e.g. beta-lactams and sulfonamides) are more commonly associated with drug allergy. Danger signals such as drug- and disease-induced inflammation, are thought to be part of the pathogenesis of drug hypersensitivity. One of the objectives is to determine the effect of allergenic antibiotics on MHC-II levels (an important immune/inflammation marker) in dog skin keratinocytes.

The aim of this study was to develop an immunocytochemistry protocol to investigate MHC II expression in an immortalized cell line of dog skin keratinocytes (CPEK cells). Using blood leukocytes as positive controls, fluorescent staining protocol was developed to detect MHC II on dog cells. However, CPEK cells did not seem to express any significant amount of MHC II. Further work using more sensitive techniques will be warranted to confirm these findings.

Funder Acknowledgement(s): This project was funded by the RISE program (Grant number 5R25GM066250), the UIUC SROP, and Dr. Lavergne's start-up fund.

Faculty Advisor: Sidonie Lavergne, slavergn@illinois.edu

42
Subcategory: Cell and Molecular Biology

A Light Microscope Study of Eye Development in Daphnia Magna

Cedith Giddings, Augsburg College
Co-Author(s): Matthew Beckman, Augsburg College

Daphnia magna is a freshwater micro-crustacean that is a well-established model organism in biological research. Daphnia eye development is distinct in that two pigmented spots within the eye field fuse to form a cyclopean eye. At the present time it is not well understood how cyclopean eye development occurs. An understanding of the mechanism of normal cyclopean development may aid in understanding altered development that is seen in human mid-line defects which range in severity from a single central incisor (tooth) to cyclopia (Solomon, et. al. J Med Genet 2012;49:473-479). This research focused on defining the time-course of this unique developmental phenomenon in Daphnia. Specifically, a developmental timeline was created to establish the precise state of eye development at defined embryonic stages. Daphnia embryos were cultured and microscopic images of embryos were analyzed with Image J which permitted for measurement of the distance between the two eye spots as they migrated medially to form the cyclopean eye. Developing embryos were also stained with fluorescent lectins in an attempt to find a marker for migrating cells. As a control in all lectin experiments, age-matched embryos were treated identically, but without the inclusion of fluorescent lectins. A lectin was not identified which reliably stained eye structures in Daphnia. However, embryos were successfully stained with methylene blue to aid in visualizing eye spot migration. The data demonstrate a linear relationship between developing eye spot diameter and both age and body length. In summary, these studies provide a method for staining and quantifying eye development in Daphnia.

Funder Acknowledgement(s): LSAMP /Augsburg College Undergraduate Research Office.

Faculty Advisor: Matthew Beckman, giddings@augsburg.edu

43
Subcategory: Cell and Molecular Biology

Investigation of Intracellular Vesicular Transport Using Molecular Dynamics

Julie Hess, Syracuse University
Co-Author(s): Shikha Nangia, Syracuse University

Transport of molecular cargo in and out of a cell and between cell organelles is a quintessential process in living systems. Transport across any membrane bound entity (cell or cell organelle) takes place via the invagination of the membrane leading to vesicle formation through a highly orchestrated process by a family of specialized proteins, called coat proteins. In the intracellular transport of cargo from endoplasmic reticulum (ER) to the Golgi apparatus (GA), a specific set of coat proteins called COPII are involved. Although, progress has been made in identifying and the COPII components, but there is limited understanding of the transport mechanism and the molecular level basis of the cargo vesicle formation. Our goal is to employ multiscale molecular modeling approach to provide the mechanism and dynamics of the invagination process and the vesicle formation. Typically a molecular simulation of this magnitude is computationally expensive, but in order to circumvent that cost, we have developed a coarse grained model for the proteins and the lipids that constitute part of the membrane. Using a cubic box of 20 nm size, we have been able to simulate vesicle with COPII coats of about 14 nm diameter. Our current work involves studying the sites of protein attachment, membrane budding, curvature formation and timescale of the vesicle formation. The results from this work will lead to studying extracellular transport of cargo uptake from outside the cell, which is critical in drug delivery to cells through targeted specific nanocarriers.

Funder Acknowledgement(s): This research is sponsored by the Research Experience and Mentoring (REM) program, which is funded by the Office of Emerging Frontiers in Research and Innovation (EFRI 1137186) of the National Science Foundation (NSF), 2013.

Faculty Advisor: Shikha Nangia, snangia@syr.edu

44

Subcategory: Cell and Molecular Biology

Hyperacetylation of Methionine Synthase in Peas

Regina Hodges, Bloomfield College
Co-Author(s): Ceran Messam, Juan Soto, Rafia Muslim, Karla Alvarado, Denisse Martinez, and James Murphy, Bloomfield College

We characterized the gene for Methionine Synthase from peas. We designed oligonucleotides based on the sequence of Methionine Synthase from the pea family. We used these oligonucleotides to perform the Polymerase Chain Reaction on pea cDNA. The PCR products were purified and sequenced. The sequences were analyzed and organized into a contiguous sequence corresponding to the complete cDNA. This will allow us to infer Methionine Synthase's amino acid sequence and then investigate chemical modification of its amino acids, such as acetylation, through mass spectrometry.

Funder Acknowledgement(s): Thank you to Louis Stokes Alliance for Minority Participants (LSAMP).

Faculty Advisor: James P. Murphy, jim_murphy@bloomfield.edu

45

Subcategory: Cell and Molecular Biology

Associations Between Cytochrome P450 Genotypes and Stress in Beef Heifers

Charnesia Jackson, University of Arkansas at Pine Bluff
Co-Author(s): Charles Rosenkrans, University of Arkansas at Fayetteville
Kidud Fleke, Jackson State University

Cytochrome P450s are a superfamily of heme-containing monooxygenases active in the metabolism of endogeneous compounds. Our goal was to determine the frequency of single nucleotide polymorphism (SNP) 994 and 979 in the CYP3A28 gene of crossbred beef heifers. In addition we determined the relationships between genotypes and heifer growth, and stress response. Genomic DNA was evaluated from 71 heifers. Amplification of DNA was through PCR using specific primers for bovine CYP3A28 (P450F: CAACAACATGAATCAGCCAGA; P450R: CCTACATTCCTGTGTGTGCAA). The amplicon was a 565 base segment (based on GenBank accession number Y10214). Genotypes were determined by Restriction Fragment Length Polymorphisms (RFLPs) analysis using the AluI restriction enzyme. The genotyping of the heifers for SNP C994G resulted in 11 as CC, 34 as CG, and 26 as GG which displayed an allelic percentage of 39 for the C allele and 61 for the G allele. For SNP CG979, the genotyping of the heifers resulted in 61 as CC and 19 as CG displaying an allelic percentage of 88 for the C allele and 12 for the G allele.

Preliminary results in SNP C994G suggest an association with heifer plasma HSP concentrations where that concentration of HSP plasma changes over time within the genotype. The pregnancy rates of the heifers with the CC genotype were the highest, and heifers with the genotype CC have the lowest stress level compared to the genotypes CG and GG.

Funder Acknowledgement(s): This study was supported, in part, by National Science Foundation Grant, to Dr. Charles Rosenkrans, Fayetteville, AR.

Faculty Advisor: Anissa Buckner, bucknera@uapb.edu

46
Subcategory: Cell and Molecular Biology

Quantifying the Impedance of Amoeba as a Measure of Growth

Erin Symone Johnson, Spelman College

The development of new technologies and techniques have allowed for improvements in taxonomy and phylogeny. We are now able to analyze organisms at the molecular level to differentiate species rather than solely relying on the differences or similarities in physical or behavioral traits. Spelman College Professor, Dr. Yonas Tekle, and his students recently identified a new species of amoeba, Cochliopodium minus. Molecular analysis was used to distinguish C. minus from other species in the genus Cochliopodium. The goal of this study was to quantify and monitor the growth and motility of C. minus, however this species adheres strongly to its substrate and its growth is difficult to quantitate using common methods such as a hemocytometer. The objective of this project is to test the use of the Electric Cell-Substrate Impedance-Sensing (ECIS) system to automate the analysis of the amoeba population by quantifying the movement and growth of C. minus. The ECIS data allows us to quantify the number of cells covering the electrode, the morphology of the cells, and the nature of the cell attachment. The data generated is impedance change versus time. C. minus was obtained and grown in plastic Petri dishes in spring water with a rice grain to promote bacterial growth. Cells were transferred to the ECIS arrays. As they attach to the substrate electrodes the cells act as insulators, increasing the impedance. The data generated suggests that high frequency impedance is affected more by cell-coverage whereas the low frequency impedance reflects changes in space, either under or between cells, implying cell migration or cell growth. Future work will determine whether these patterns of high and low frequency impedance changes can be used to distinguish C. minus from other amoeba species.

Funder Acknowledgement(s): Investigation was supported by a HBCU-UP Award from the National Science Foundation (Award ID: 0714553).; ASPIRE Program, Spelman College.

Faculty Advisor: Gene McGinnis, gmcginnis@spelman.edu

47
Subcategory: Cell and Molecular Biology

Deut1 Role in Regulating Centriolar Duplication in Multi-Ciliated Cells

Tonee Jones, Morehouse College/Northwestern University
Co-Author(s): Deborah Klos-Dehring

Centrioles and basal bodies, referred to interchangeably, are highly conserved structures in living cells that are essential for cell division, and for cilia and flagella development. These structures are both components of motile and primary cilia, making them important for cellular movement, environmental sensing, and signal transduction. The development of normal functioning multi-ciliated epithelia depends on ciliated cells producing many centrioles. Some cells require 100-200 cilia to function normally. There are two mechanisms of centriole duplication: the acentriolar, and more common, centriolar pathway. An uncharacterized structure called the deuterosome is speculated to drive the acentriolar pathway, resulting in substantial centriole production. Furthermore, despite the tight regulation of these pathways, cancer-promoting aberrations can occur and little is known about the underlying mechanisms of these events. A micro array screening of genes up-regulated in multi-ciliated cells identified a novel protein called Deut1, which was shown to localize to a single puncta in ciliated cells--postulated to be the deuterosome. Xenopus laevis embryos, used as a model to monitor centriole duplication, have the unique ability of facilitating centriole duplication and quickly producing large numbers of basal bodies (100+) on their outer surface, thus facilitating examination via confocal imaging. Over-expression of Deut1 fragments (N-terminal 1-210 and C-terminal, 205-559) was conducted to determine which domain was essential for Deut1 localization to the deuterosome. To determine if Deut1 recruits the components required for deuterosome localization and subsequent facilitation of centriole production, we fused endogenous Deut1 with a CAAX domain to force re-localization of Deut1 to the plasma membrane. We later observed that punctate localization was lost with expression of the 1-210 N-terminal domain of Deut1 and expression of the 205-559 C-terminal domain resulted in localization to the deuterosome. Future experiments will involve co-localizing Deut1 with Polo-like kinase 4 (Plk4), an essential regulator of centriole duplication, to determine if Deut1 is required for Plk4 localization to the deuterosome. These findings lend more insight into how multi-ciliated centriolar pathways are regulated, and their link to irregular centrosome production, which can lead to tumor or cancer progression.

Funder Acknowledgement(s): Funded by Leadership Alliance in conjunction with Summer Research Oppurtunity Program.

Faculty Advisor: Brian Mitchell, brian-mitchell@northwestern.edu

48
Subcategory: Cell and Molecular Biology

BMP Signaling Degradation by way of Kinase Phosphorylation in MAD Linker

Matthew Juarez, California State University, Los Angeles

Co-Author(s): Marlyn Rios, Abigail Aleman, and Fletcher Przybyla, California State University

A fundamental principle in cell and molecular biology is understanding how cells relay extracellular and intracellular signals into processes such as organogenesis. Our research focuses on the Bone Morphogenetic Protein (BMP) signaling pathway. This pathway is considered to be a pivotal cell signaling mechanism due to its extensive roles during embryonic development and adult tissue homeostasis. The clinical importance of these morphogenetic signals is apparent with aberrant signaling being implicated in an array of human diseases such as cancer, and effecting the functionality of cardiovascular, skeletal and kidney systems. Using Drosophila melanogaster as a model organism, the goal of our research was to determine how proline dependent kinases affect the BMP pathway. We conducted as systematic approach using dsRNAi knockdowns to see the effects each kinase in question had on the transduction of BMP signaling. In vitro analysis through western blot and immunostaining assays showed that the BMP cascade undergoes degradation by polyubiquitination when proline dependent kinases phosphorylate the linker region of the transcription factor protein MAD. In vivo studies complemented the findings of in vitro analysis through immunostaining data of pupal wings, and wing imaginal discs. In conclusion, we have identified a kinase that phosphorylates the intracellular protein MAD in the linker region and leads to the degradation and termination of the BMP signaling pathway. Further research is being conducted on tissue determination by inhibition on neighboring phosphorylation sites in MAD linker.

Funder Acknowledgement(s): Support provided by CSU-LSAMP from NSF HRD-1302873 and Office of the Chancellor; A.A. and M.R. are supported by the National Institutes of Health R25-GM061331; M.J. is a 2013 Presidents Commission Scholar (CSUPERB); Research was funded by National Institute of Health; SC3-GM103699-01 and new professor CSULA start up fund (E.E.).

Faculty Advisor: Edward Eivers, eeivers@calstatela.edu

49
Subcategory: Cell and Molecular Biology

High Mobility Group B Knockdown Decreases Heterochromatin Modifications

Rachel Lopez, University of California, Los Angeles
Co-Author(s): Daniel Lee, Emma Monte and Thomas Vondriska, Departments of Anesthesiology, Medicine and Physiology, David Geffen School of Medicine at UCLA

Chromatin is differentially packaged to create accessible and restricted regions, called eu- and heterochromatin respectively. The chromatin structural protein High Mobility Group B (HMGB, a family with three isoforms) regulates transitions between these forms of chromatin through unknown mechanisms. We recently found that HMGB2 protein abundance increases with cardiac hypertrophy in the mouse, a condition that can lead to heart failure, a disease affecting >5 million people in the USA. In isolated cells, HMGB2 knockdown increases the hetero-chromatic post-translational modification (PTM) histone H3 lysine 9 trimethylation (H3K9me3) and decreases the euchromatic PTM H3K4me3; however, the effect HMGB levels have on other chromatin proteins remains unknown. To further characterize HMGB, we knocked down HMGB2 or HMGB3 in neonatal rat ventricular myocytes and mouse 3T3 fibroblasts and measured the abundance of euchromatic (H3K4me3, active RNA Polymerase II) or heterochromatic (H3K9me3, H3K27me3, Linker Histone H1, CTCF) proteins by Western blot. We hypothesize that the nucleus regulates chromatin accessibility through the combined actions of chromatin structural proteins (HMGB, CTCF and H1) and histone PTMs. Therefore, we predicted a decrease in heterochromatin proteins after knockdown of HMGB. HMGB2 and HMGB3 knockdown increased CTCF, potentially reflective of functional compen-sation. As predicted, HMGB2 knockdown increased H3K4me3 and decreased H3K9me3. HMGB3 knockdown increased RNA Polymerase II and decreased H3K9me3 and H3K27me3, as predicted; histone H1 remained unchanged. Thus, HMGB knockdown caused a shift from heterochromatin to euchromatin, implying HMGB normally preserves hetero-chromatin. The increase in CTCF and decrease in H3K9me3 following knockdown of either HMGB2 and HMGB3 suggests HMGBs have similar effects on heterochromatic PTMs. Future studies will explore the universality of HMGB actions by testing other cell types and will explore the changes in chromatin structure and gene expression that result from varied levels of HMGB protein in vivo.

Funder Acknowledgement(s): This work is funded in part by a National Institutes of Health/National Institute of General Medical Sciences training grant (NIH Bridges R25 GM 050067, PI: D.D. Simmons).

Faculty Advisor: Diana Azurdia, dazurdia@college.ucla.edu

50
Subcategory: Cell and Molecular Biology

The Effects Of Neuropeptide Y On Osteoblast And Osteoclast Cells Lines

Kierrariel Mitchell, Dillard University
Co-Author(s): Gerri Wilson, Michelle Tucci, and Ham Benghuzzi, University of Mississippi Medical Center

Neuropeptide Y (NPY) is a 36-amino acid neuropeptide that acts as a neurotransmitter in the brain and in the autonomic nervous system. In the autonomic system it is mainly produced by neurons of the sympathetic nervous system and serves as a strong vasoconstrictor and also causes growth of fat tissue. Recent evidence suggests NPY serves as a neuronal regulator in bone remodeling. Studies of neuropeptide Y (NPY) knock-out mice show reduced bone formation, suggesting NPY directly affects bone cells. The purpose of this study was to evaluate the role of NPY (concentrations 0.1 x 10-9 (low), 0.2 x 10-9 (medium), and 0.5 x 10-9 (high)) on osteoblast and osteoclast cells in vitro for periods of 24, 48 and 72 hours. Our results show that NPY did not have a direct effect on osteoblast cells but showed enhanced nitric oxide production by osteoclast cells. According to our findings, osteoclast cell numbers were decreased as early as 24 hours and remained depressed through 72 hours of culture. Osteoclast cellular nitric oxide levels were elevated after 24 hours and remained elevated for the duration of the study in all three doses of treatment. The concentrations of NPY used in this study were consistent with levels of NPY found in control (0.1 x 10-9) intact female animals and ovariectomized (0.2 x 10-9) rats with evidence of osteoporosis. Our data suggest a direct stimulation of osteoclast cells, which is consistent with evidence in the literature suggesting NPY increased oxidative burst in rat peritoneal macrophages at similar doses. Additional in vivo studies are needed to address the changes in osteoclast nitric oxide production and its relationship to bone remodeling in pathophysiological states of bone loss.

Funder Acknowledgement(s): Abstract was supported by the MS-INBRE Summer Research Program.

Faculty Advisor: Julia Basu-Ray, jbasuray@dillard.edu

51

Subcategory: Cell and Molecular Biology

Fabrication and Characterization of Lactoferrin Fibers

Benjamin Pickard, Fort Valley State/University of Connecticut Health Center
Co-Author(s): Eric James and Lakshmi S. Nair, University of Connecticut Health Center

Lactoferrin is an 80kda iron binding globular protein. It is produced by various exocrine glands and is present in breast milk. Lactoferrin's uniqueness as a skeletal regenerative molecule lies in its ability to modulate the response of various cells involved in musculoskeletal tissue regeneration. Lactoferrin promotes proliferation of osteoblast cells and inhibits osteoclast mediated bone resorption, which makes it a potential candidate for use in bone tissue engineering. Electro spinning is a technique, which uses an electrical charge to ejaculate very fine fibers out of a syringe. The final product is a non-woven fiber mat composed of nanofibers. The purpose of this study was to test feasibility of developing nanofibrous structures from human recombinant lactoferrin by the process of electro spinning. In this study different concentrations of lactoferrin solutions (100,150, 200, 250 mg/ml) were spun along with gelatin (75mg/ml), which was used as a control. The Scanning Electron Microscope (SEM) images demonstrated the feasibility of forming fibers in the nanoscale. Mouse mesenchymal stem cells were cultured in basal media, which contains Alpha Minimum Essential Medium (αMEM) and 1% pen-strep, and basal media with and without 10% serum for 1 to 3 days followed by 3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxymethoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium, (MTT) assay, to evaluate the cell viability. This experiments shows that lactoferrin has anti-apoptotic properties, which may significantly improve the efficacy of cell based therapy for orthopaedic applications.

Funder Acknowledgement(s): This study was supported, in part, by grants from NSF HRD #0625289 awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA and the Department of Health Career Opportunities, Aetna Health Professions Partnership Initiative and NIH- AR061575.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

52

Subcategory: Cell and Molecular Biology

Proliferation of DU145 Prostate Cancer Cells in a Pre-stressed Hepatic Nich

Royan Reddie, Tuskegee University
Co-Author(s): Amanda Clark, Sarah Wheeler, Don Taylor, and Alan Wells, University of Pittsburgh School of Medicine

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 come out of dormancy and start to proliferate, our experimental approach was to determine whether stressing of the hepatic microenvironment prevents MErT in prostate cancer and thus contribute to proliferation. To accomplish this, we have created an in vitro 2D cell culture bioreactor to co-culture hepatocytes with cells from the human prostate cancer cell line, DU145. The co-cultured cells were pre-stressed for 6 hours with lipo-polysaccharide (LPS; 1mg/mL; an anti-tumor agent that naturally arises from the gut microbiome or epidermal growth factor EGF; 20nM a ubiquitous growth factor. The hepatic niche was then imaged on days 2, 4 and 6 in order to determine whether the DU145 cells proliferated or remained quiescent under these treatments. Preliminary results showed that the wells with only hepatocytes and DU145 prostate cancer cells showed an up regulation of E-cadherin. In these wells the cancer cells are epithelial in nature with a decrease in proliferation and a decrease in how invasive they are. The wells that contained hepatocytes, DU145 prostate cancer cells and either LPS or EGF showed a decrease in E-cadherin. The cancer cells are now mesenchymal with an increase in proliferation. The results are currently being gathered and evaluated, and will be presented and implications discussed.

Funder Acknowledgement(s): This work was supported by the Department of Defense grant #PC080566.

Faculty Advisor: Clayton Yates, cyates@mytu.tuskegee.edu

53
Subcategory: Cell and Molecular Biology

Cellular & Molecular Mechanisms Critical Mechanosensory Neurite Termination

Lorrayne Serra, California State University East Bay
Co-Author(s): Joshua Azevedo, Alejandro Escalante Flores, and Maria Gallegos, California State University

To better understand how the brain works, it is necessary to study how neurons control axon and dendrite (neurite) growth. Our lab is interested in the cellular and molecular mechanisms underlying PLM neurite termination. In WT animals, the posterior mechanosensory neuron, PLM, extends a neurite in the anterior direction that terminates at the worm's midsection just posterior to the anterior mechanosensory neuron, ALM. Published results indicate that *sax-1* and *sax-2* both function in the same molecular pathway to promote PLM neurite termination (Gallegos and Bargmann 2004). More recently, our lab demonstrated that loss of F09A5.4, an ortholog of yeast Mob2p, a cofactor to cbk1p (SAX-1 ortholog), also leads to PLM neurite overextension. To establish if *F09A5.4* functions in the *sax-1/sax-2* pathway, we next compared PLM neurite length (visualized by GFP) in *sax-1*, *sax-2* and *F09A5.4* single mutant controls and compared to *sax-1;F09A5.4* and *sax-2;F09A5.4* double mutant strains. Our results suggest that *F09A5.4* indeed functions in the *sax-1/sax-2* pathway consistent with the hypothesis that the pathway in yeast controlling cell shape is conserved but functions in *C. elegans'* neurons to controls neurite length.

In a related project, BDU, an interneuron positioned anterior to ALM, extends a long, posterior process that comes in contact with the PLM neurite tip. More recently, Zhang et al. showed that BDU and PLM form a gap junction at the point of contact (Zhang et al., 2013). Interestingly, our preliminary results indicate that genetic loss of BDU leads to PLM neurite over-extension. To ask if gap junctions play a role in PLM neurite termination, we created *unc-9* single and double mutant strains with *sax-2*. *unc-9* encodes a ubiquitously expressed innexin essential for the formation of most gap junctions in *C. elegans*. The strains have been built and we are in the process of measuring PLM neurite lengths. Detailed results will be presented.

Funder Acknowledgement(s): Funding provided by the department of Biology, California State University East Bay.

Faculty Advisor: Maria Gallegos, maria.gallegos@csueastbay.edu

54
Subcategory: Cell and Molecular Biology

Control of Neurogenesis by Fragile X Proteins

Tyler Wishard, University of California, San Diego/Scripps Research Institute
Co-Author(s): Regina Faulkner and Hollis Cline, Scripps Research Institute

Fragile X Syndrome (FXS) is the most common form of inherited intellectual disability. Loss of function of the fmr1 gene results in lack of Fragile X Mental Retardation Protein (FMRP), an RNA binding protein. Two homologs of FMR1, FXR1 and FXR2 are expressed in brain and may have functional redundancy in RNA binding, but little is known about their role in development. Recent studies suggest that neurogenesis, the generation of neurons from progenitor cells, is aberrant in FXS patients. We investigated whether Fragile X proteins affect neurogenesis, using Xenopus laevis tadpoles which express homologs of fmr1 and fxr1 genes. We knocked down FMR1 and FXR1 with antisense morpholinos and collected in vivo confocal time-lapse images of GFP-expressing radial glial progenitor cells and their progeny over three days. Animals treated with control morpholinos increase in the number of GFP-labeled cells between the first and third days of imaging, but FMR1 or FXR1P knockdown significantly decreased the total number of GFP-labeled cells generated over the imaging period. We identified neurons and glia based on their morphology and found that the average number of neurons and radial glia cells on days 2 and 3 is significantly reduced with FMR1 or FXR1 knockdown compared to controls, suggesting that proliferation and survival of neural progenitor cells is compromised by loss of Fragile X proteins. Interestingly, knockdown of FMRP increased the proportion of neural progeny compared to progenitors, suggesting that loss of FMRP induces rapid differentiation of neurons from progenitors, adding insight into mechanisms of FXS.

Funder Acknowledgement(s): NIH R01NS076006 and T34GM087193 to HTC and TJW, respectively.

Faculty Advisor: Hollis Cline, cline@scripps.edu

55

Subcategory: Cell and Molecular Biology

Lung Fibrosis: How the Matrix Affects Cell Function in Mice

Annechael Wood, University of Minnesota
Co-Author(s): Lindsay Goddin, Angela Panoskaltsis- Mortari, University of Minnesota, Minneapolis

Recent evidence suggests that endoplasmic reticulum stress enhances the development of lung fibrosis in the lungs following Bleomycin injury (Lawson, 2011). Whole lung decellularization of fibrotic lungs would allow investigation of how matrix affects cell function. We first verified that endoplasmic reticulum stress enhances lung fibrosis, with the future goal to examine how the matrix affects cell function. We administered two drugs (Tunicamycin and Bleomycin) with PBS as a control vehicle intratracheally to mice, measured the changes in pulmonary function, and processed and analyzed lung sample histology. For the Tunicamycin injections, control mice were given a 10% DMSO solution, while a 20 ug/mL in 10% DMSO dose was provided intratracheally. After 2 days of recovery, 0.05U/50uL Bleomycin was also administered to the mice, with PBS administered as a vehicle control. The mice lungs were then harvested for histology and analysis. Lungs were frozen in OCT, sectioned, and stained using Hematoxylin and Eosin to visualize the lung structure. Trichrome histological staining technique was also used to differentiate collagen and other matrix fibers. Pulmonary function tests were performed on all mice using a Flexi vent ventilator, with resistances, compliances, and total lung volume measured by manufacturer software. Mice were injected with 0.25ml of Nembutal and intubated. The dynamic resistance(R) and Newtonian Resistance (Rn) was greater in the Bleo/Tunica group than the PBS mice.

This shows that the drugs changed lung function. The compliance and static compliance (Cst) in the Bleo/Tunica mice was lower than in the control, which indicates that, the lungs injected with the Bleo/Tunica are stiffer. The total lung capacity of the Bleo/Tunica mice was much lower than the control mice due to the stiffness of the fibrotic lungs observed in the Bleo/ Tunica mice. High resistance and low total lung volume, and changes in lung histology, verifies that Bleomycin and Tunicamycin caused fibrosis which lead to stiffening of the lungs.

For future research, hydroxyproline assay will be done on all the samples to verify the increase collagen content. Cell culture, RNA analysis and real time PCR will also be performed.

Funder Acknowledgement(s): This study was supported, by a grant from NIH awarded to Angela Panoskaltsis- Mortari, (ABMLI) Department of Pediatrics, University of Minnesota Masonic Cancer Center, University of Minnesota. RO1HL108627 02.

Faculty Advisor: Angela Panoskaltsis-Mortari, panos001@umn.edu

56

Subcategory: Civil/Mechanical/Manufacturing Engineering

Understanding the Biological Mechanisms for Dynamic Sonar Sensing in Greater Horseshoe Bats

Rebecca Anilu Castro, Hampton University
Co-Author(s): Brandon Goodman, Hampton University
Michael Philen, Virginia Polytechnic Institute and State University

The Greater Horseshoe bat (family Rhinolophidoe) is a group of bats with a highly sophisticated biosonar system that allows them to navigate and pursue prey in dense forest habitats. What sets the Greater Horseshoe bats aside from other bats is that it emits its echolocation nasally and diffracts by using a special structure known as its noseleaf. The noseleaf can also move to help to help diffract outgoing ultrasonic waves. The lancet - the top of the noseleaf moves outward to inward while the horsehoe- the bottom of the noseleaf- moves forward to backwards. This allows them to be more precise and accurate while capturing fluttering prey. The noseleaf is a rather small structure with strong attributes. The quite powerful structure of the noseleaf provides an important and interesting platform for scientists and biologists to study. The aim of this research project is to gain a better understanding of the biological mechanisms employed by the Greater Horseshoe bat for echolocation. This will help inform the design and execution of the robotic experiments. Combined with the robotic experiments, this research can help improve acoustic systems and make them more effective to receiving and transmitting information, by changing these systems in size as well as in power and accuracy.

Funder Acknowledgement(s): This study was supported by a grant from NSF (EFRI-REM) under Grant #0938043 awarded to Michael Philen, Associate Professor, Aerospace and Ocean

Engineering Virginia Polytechnic Institute and State University, Blacksburg VA 24061.

Faculty Advisor: Michael Philen, mphilen@vt.edu

57
Subcategory: Ecology

Do Vibrio Bacteria Play a Major Role in Fish Welfare in the Pet Trade?

Mareike Donaji Duffing Romero, Humboldt State University
Co-Author(s): Linda Amaral-Zettler and Victor Schmidt

Ornamental fishes are the third most common pets in the United States and are largely imported from harvest locations and aquaculture facilities in Southeast Asia. Disease along shipment routes is a major obstacle to fish welfare and industry profitability, yet little is known about the microbial communities associated with these fish shipments. The objective of this research is to further understand the behavior of potential bacterial pathogens while transported from one location to another, and the major role they play in microbial communities, the environment, and fish and human health. My research will focus on the genus Vibrio, a known bacterial fish pathogen. The proposed methods are to measure and contrast the diversity of vibrios using next-generation DNA sequencing data. My analyses will determine whether any increases in pathogenicity occur during shipment both inside and outside fish in transit and upon arrival to pet shop aquaria. I hypothesize that due to stressful conditions of fish shipments, more pathogenic Vibrios will be found after transit. The findings of the research will provide clues to fish disease in trade and hopefully influence regulatory measures to control the treatment and handling of ornamental fishes that carry such potential pathogens.

Funder Acknowledgement(s): Partnership Education Program/ NSF

Faculty Advisor: Jacquelyn R. Bolman, jacquelyn.bolman@humboldt.edu

58
Subcategory: Ecology

Pollen Limitation and Reproductive Ecology in Penstemon Digitalis

Kevin Terry Lee, Vassar College

With climate change, populations of pollinators continue to dwindle, in turn altering patterns of pollen circulation. Subsequently, pollen limitation, a term that describes decreased reproductive success due to inadequate quantity or quality of pollen, may occur, which can affect the abundance and viability of fruits and seeds. Flowering plants that outcross, in particular, often exhibit increased pollen limitation because they require pollen from another plant, which is not always guaranteed (Knight et al. 2005). As a mechanism to decrease pollen limitation, some plants have evolved the ability to self, in which flowers can accept pollen from itself or the same plant. While self-compatibility provides reproductive assurance, it can also lead to inbreeding depression as a result of decreased genetic variation and increased expression of deleterious recessives. This experiment predicted that pollen limitation, inbreeding depression, and reproductive assurance of self pollen occurred in a population of Penstemon digitalis Nutt. Ex Sims (Plantaginaceae) at the Louis Calder Center Biological Field Station in Armonk, New York. To detect whether the population of Penstemon digitalis at the Calder Field Station was pollen limited, the reproductive success, measured by larger fruit size (length x width), of a control group of plants with unmanipulated flowers was compared against the success of plants with flowers that were supplemented with pollen. Plants supplemented with self pollen were compared with plants supplemented with cross pollen in order to detect presence of inbreeding depression. Furthermore, we compared the reproductive success of flowers on control plants with flowers on plants with emasculated flowers in order to examine whether self pollen provides reproductive assurance in Penstemon digitalis.

The results revealed that the population of P. digitalis was in fact not pollen limited. In addition, self pollen neither provided reproductive assurance nor contributed to inbreeding depression in the experiment. Additional studies should be conducted using seed count as a measure of reproductive success, as they may provide different conclusions from the ones in our experiment. Future studies should also be conducted to determine whether environmental conditions contributed to the outcome observed.

Funder Acknowledgement(s): This study was supported by the National Science Foundation as part of a Research Experience for Undergraduates program at the Louis Calder Center Biological Field Station (Fordham University) in Armonk, NY.

Faculty Advisor: Steven Franks, franks.steve@gmail.com

59
Subcategory: Ecology

Bison Conservation Genetics Study at Rio Mora Wildlife Refuge, New Mexico

Lisa McBride, New Mexico Highlands University
Co-Author(s): Wacey Cochise, Jesus Rivas, and Sarah Corey-Rivas, New Mexico Highlands University

Bison face a variety of threats to their long-term survival as a species, including the spread of new diseases, low genetic diversity, and the introgression of domestic cattle genes. At Rio Mora Wildlife Refuge, NM, we are studying the genetic diversity and cattle hybrid status of the resident wild bison herd to ensure its conservation significance. Molecular techniques were used to identify individual bison with cattle genetic introgression and unique evolutionary lineages in the bison population. We sampled hairs from fifty-three bison, isolated DNA, and performed PCR to amplify the D-loop region of the mitochondrial genome. The bison gene sequences were then compared to published bison and cattle sequences. Of the thirty-seven D-loop sequences analyzed, three hybrid bison were found with Bos taurus sequences. Two lineages of Bison bison were identified: lineage WRR_1 is common (83% sampled) sharing 100% identity with bison from Fort Niobrara National Wildlife Refuge, Montana's National Bison Range, Yellowstone National Park, and a private herd in Montana. Lineage WRR_2 is rare (8% sampled), and is not shared with any known lineages published. The presence of a lineage from conservation herds including Yellowstone is significant because Rio Mora Wildlife Refuge bison are brucellosis-free and may therefore be an asset to our national bison genetic "portfolio". The unique lineage of bison at Rio Mora Wildlife Refuge discovered in this study is a further indication that the herd is a conservation genetics resource. Our future work includes collecting hair samples from all the individuals in the herd. The study will be expanded to include microsatellite markers, a reliable tool for assessing cattle gene introgression in the nuclear genome and estimating overall levels of genetic diversity in the herd.

Funder Acknowledgement(s): This study was funded in part by a grant from NSF-WASEO; this study was funded in part by a grant from Denver Zoo; this study was funded in part by a grant from LSAMP.

Faculty Advisor: Sarah J. Corey-Rivas, sjcorey@nmhu.edu

60

Subcategory: Ecology

A Survey of Parasites in Fish at Cabo Blanco Absolute Reserve, Costa Rica

Tina Nguyen, Humboldt State University
Co-Author(s): Afua Adjekum, California State University Channel Islands
Darryl D. Lopez, California State University Stanislaus

Twenty fishes belonging to eleven species from nine families were surveyed for ectoparasites and internal parasites. Altogether >26 parasites were encountered comprising >21 nematodes, 3 trematodes, 1 acanthocephalan, and a single ectoparasitic isopod. Parasites were found in 35% of the 20 fish examined. Distribution of parasites among individuals was non-random, showing a clumped dispersion pattern. There was no association between the presence or absence of parasites and fish diet (fish, invertebrates, and zooplankton or algae), habitat (freshwater, intertidal, or deep water), or the presence of food in the gut. The largest fish in our samples were from deep water habitats. Parasite loads showed no simple relationship with fish weight.

Funder Acknowledgement(s): Chancellor's Office of the California State University; NSF grant HRD-0802628 from the LSAMP program of the National Science Foundation.

Faculty Advisor: Milton Lieberman, liebermv@racsa.co.cr

61

Subcategory: Ecology

The Affects of Bimodal Signals on Male and Female Frogs of Wisconsin

Juan Sebastian Orjuela, University of Wisconsin-Milwaukee
Co-Author(s): Gerlinde Höbel, University of Milwaukee-Wisconsin

Anurans (Frogs & Toads) are highly vocal creatures. Most people are familiar with the mating calls male anurans produce during the breeding season. Much less known is the fact that the vocal repertoire of many species includes several additional call types, each probably used in a different behavioral context. The present study was conducted to survey the call types found in different species of Wisconsin frogs, investigate the behavioral contexts associated with different call types, and pinpoint the call features that communicate the different messages associated with each call type. By recording different frog calls under their natural conditions and utilizing the recordings in a series of tests, it provided the study with a broader set of information that was later analyzed and compared. Different call types were presented to both female and male frogs inside the test chamber. The behavioral responses where also documented through video recordings while the tests were being performed. It was hypothesized that when introducing the frog strictly to only audio recordings (monomial signal), its behavioral response towards the given call would cause the frog to take a scattered path towards the source (a speaker/the "mate"). When introducing images of frogs with the audio recordings (bimodal signal), which were believe to induce a change in the behavioral reaction of the frog because it illustrated an imitation of their natural habitat, the frog will then take a narrow and direct path towards the source. Different methods were used in this study to provide the necessary material needed to come to a conclusion or a second hypothesis. ImageJ and Videomux, both computer based programs, were used to take the resulting video recordings, cut them into image stacks, and later compressed them to obtain a picture that exemplified the exact path taken by the frog towards the source of the call. The images were then categories into different folders, which organized the results accordingly; AVM (Male-Audio and Video), AM (Male-Audio), AVF (Female-Audio and Video), AF (Female-Audio). The pictures were then individually analyzed, the paths measured, and the information recorded. Through this process patterns began to be noticed which progressively contributed to the overall final conclusion. Although this sub-study contributes to a greater general study, it was concluded that the use of bimodal signals does affect the behavioral reaction of the frog receiving the call. This could be interpreted to also occur in the frog's natural habitat as well. Visualizing and hearing the call projected by a potential mate increases the chances of an individual frog of finding a mate compared to any surrounding competition that can only hear the call and not see the target itself, the mate. This sub-study contributed to the overall research on the affects of how vibrations and different contributing signals affect the interactional process of anurans in their natural habitat.

Funder Acknowledgement(s): This study was made possible by the WiscAMP program at the University of Wisconsin-Milwaukee. Awarding Juan Sebastian Orjuela a stipend for his assistance and work in the biological sciences department of UW-Milwaukee. Mr. John Baker, faculty advisor and coordinator of the WiscAMP program at the University of Wisconsin-Milwaukee, jlbaker@uwm.edu.

Faculty Advisor: Mr. John Baker, jlbaker@uwm.edu

62
Subcategory: Ecology

Starvation Affects Feeding Preferences of the Sea Urchin Diadema Antillarum

Jarvon Stout, University of the Virgin Islands
Co-Author(s): Jahnelle Rivera and Teresa Turner, University of the Virgin Islands

Sea urchins are important herbivores that eat macroalgae. In the 1980's there was a massive die off of sea urchin Diadema antillarum throughout the Caribbean. This die off led to an increase in macroalgae which led to a decrease in coral cover. This was due to the fact that the algae out-compete the corals. To determine the effects of sea urchins and algae, feeding preferences of urchins need to be known. Thus, we developed methods of testing feeding preferences in a sea water system. We conducted four cafeteria- style experiments. For each experiment we collected approximately 20 urchins, and placed each in individual containers. Algae abundant on the reef in Brewers Bay St. Thomas, U.S. Virgin Islands were used in the experiment. We tested the red alga Acanthophora spicifera and the brown alga Dictyota dichotoma and Sargassum Polyceratium. In the experiments in which Acanthophora and Dictyota were tested, it was found that Acanthophora was preferred (t-test, $p<0.01$).This may explain high Dictyota cover on Caribbean reefs. Our experiments also showed that starvation changes food preferences. In the experiment without starvation of urchins the red alga Acanthophora was eaten more than the brown alga Sargassum polyceratium (t-test, $p < 0.01$), but with 5 days starvation Sargassum was preferred. These results may have been influenced by many factors, such as stress on the urchins, loss of algae during the experiment, variation in algal chemistry, urchin size, and previous diet. In future research, urchins will be raised in a controlled environment to eliminate some of the factors that can further affect our results.

Funder Acknowledgement(s): This research was funded by NSF Grant Number: HBCU-1137472.

Faculty Advisor: Teresa Turner, tturner@uvi.edu

63
Subcategory: Education

Use of a New Robot Design to Engage Students in Robotics

Michael D. Cassel, Southern University at New Orleans
Co-Author(s): Rachid Belmasrour and Illya Tietzel, Southern University at New Orleans

LEGO promotes the interaction of kids with robots through competition. Competitions have shown that kids can build robots. Therefore, it is hypothesized that a LEGO robot can be built for children which engages them in robotics by programming and building. This involvement into the Science, Technology, Engineering, and Mathematics [STEM] areas could lead to more job opportunities. The 9797 LEGO MINDSTORMS Education Base Set was used. Four questions related to building, programming, and experience were asked before and after each experiment. The kids were taught how to build and program.

The willingness for building, programming, and selected programs was recorded. Statistical analysis for the questions of 1) Have you ever played with a robot before?, 2) What do you think the robot can do?, 3) Building willingness, and 4) Programming willingness was used applying two tests for independence. For the Z-Test the question was whether more than half of the population (New Orleans Elementary School Kids) responded to the questions in a certain way. For the Chi-Square test the hypothesis was if there was any independence on gender.

The results were: In regard to question 1) 58% said no; for 2) 90% could give an answer; for 3) 90% said yes; and for 4) 95% said yes. The Z-Test was conducted at 95% confidence level for each question. For 1) only 50% of the population have had experience with a robot before. Pertaining to 2), 3), and 4) there was strong evidence that more than 50 % of the population had a positive answer or a positive attitude, respectively. The Chi-Squares analysis for gender independence showed that for 1) the null hypothesis was rejected based on the fact that the Chi-square value of 7.05 was greater than the critical value of 3.84. For 2), 3), and 4) the null hypothesis was not rejected for gender independence. In conclusion, the results of the Z-Test suggest that children enjoyed building and programming with robots, because more than 50% of the population gave a positive answer or had a positive attitude. Even though 50% had previous experience with robots [1], engagement increased as shown by the results for [2, 3, and 4]. Interestingly, the Chi-Square analysis for gender independence indicates that there is no association between the gender and the attitude or response towards robotics. This rejects the common stereotype that females don't like robotics. Even though males are more exposed to robotics 1) females will engage in robotics if given the opportunity [2, 3, and 4].

Funder Acknowledgement(s): This research was funded by the LaSPACE CSG grant SUNO SPACE UFOM of I. Tietzel.

Faculty Advisor: Illya Tietzel, Rachid Belmasrour, ITietzel@suno.edu

64
Subcategory: Education

Preparing Bridge Students to Conduct Quantitative Research Projects

Lansa Dawano, St. Olaf College

Introducing mathematics into introductory biology courses exposes students to the modern integrated approaches in science. This project illustrates how the two disciplines can be incorporated into introductory science courses to guide students through basic laboratory methods. Our goal was to prepare incoming Summer Bridge St. Olaf students who come from low-income first generation backgrounds to design independent research projects and communicate their quantitative data orally and in writing. We developed four laboratory experiments that introduce typical biological tools and generate quantitative data as well as graphical exercises to enrich student insight and understanding of biological principles. These tightly structured exercises lead directly to quantitative research projects designed and carried out by the Bridge students. This quantitative research approach was implemented in August 2013 and will be assessed through an end-of-course survey.

Funder Acknowledgement(s): Howard Hughes Medical Institute (HHMI), TRiO St. Olaf College McNair Scholars Program.

Faculty Advisor: Kathy Glampe, glampe@stolaf.edu

65
Subcategory: Environmental Engineering

A Robotic Reproduction of the Dynamic Sonar Sensing in Horseshoe Bats

Brandon H. Goodman, Hampton University
Co-Author(s): Rebecca Anilu Castro, Hampton University
Yanquing Fu, Virginia Tech

Greater Horseshoe bats (family Rhinolophidae) are a group of bats with a sophisticated biosonar system that use the noseleaf for environmental sensing, navigation, and hunting. The aim of this research project is to obtain experimental data for understanding the effects of the deformations of the noseleaf during pulse emission on the ultrasonic field. An automated experimental approach was developed to achieve this goal. The experiment was designed in the laboratory such that the acoustic instruments for emitting the pulses and recording the signal, such as ultrasonic loudspeaker, were integrated with high sensitive actuators for orienting the noseleaf, such as linear actuators and pan tilt unit. A cone and tube waveguide was designed to funnel the loudspeaker to the nostrils. By using this experimental system, it will be possible to reproduce the dynamic effect of the noseleaf and characterize it as a basis for inspired dynamic acoustic devices. Future research will focus on the effects of the noseleaf deformations on the acoustic field.

Funder Acknowledgement(s): This study was supported by a grant from NSF (EFRI-REM) under Grant #0938043 awarded to Michael Philen, Associate Professor, Aerospace and Ocean Engineering Virginia Polytechnic Institute and State University, Blacksburg, VA 24061.

Faculty Advisor: Michael Philen, mphilen@vt.edu

66
Subcategory: Genetics

Juvenile Play Behaviors in Celf6 Knockout Mice

Krystal Chandler, Harris-Stowe State University
Co-Author(s): Susan E. Maloney and Joseph D. Dougherty, Washington University School of Medicine, St. Louis, MO

Autism Spectrum Disorder (ASD) is a developmental syndrome characterized by communication deficits, resistance to change, and impaired social interaction. The Autism and Developmental Disabilities Monitoring Network estimated in 2008 about 1 in 88 children have been identified with ASD. ASD is commonly diagnosed by behavior due to the diversity of genetic and environmental determinants associated with the disorder. It has been suspected that the serotonergic system has a role in disorders like ASD. Translational profiling of the serotonergic neurons led to the implication of the Celf6 protein in autism risk.

A disruption of the Celf6 gene in mice resulted in abnormal brain serotonin levels and ASD related behaviors. Celf6 knockout (Celf6 -/-) mice have exhibited decreased ultrasonic vocalizations and resistance to change that is comparable to ASD behaviors in children.

The aim of the current study was to assess the play behaviors of juvenile Celf6-/- mice to determine if they express abnormal social behaviors compared to Celf6 wild-type (Celf6+/+) littermates. We hypothesized that Celf6-/- mice would exhibit decreased social and increased non-social behaviors compared to Celf6+/+ mice. The play interactions of juvenile Celf6-/- subject mice and sex-matched, non-littermate Celf6+/+ stimulus mice were video recorded for thirty minutes. Afterwards, count, duration, and latency of sixteen behaviors across four interaction categories were manually scored. Celf6-/- mice showed a significant difference in non-social behavior by exhibiting more digging events for a longer duration compared to Celf6+/+ mice. Celf6+/+ mice demonstrated a trend towards more allogrooming compared to Celf6-/- mice during the first ten minutes of testing. In conclusion, our results further support the previously documented resistance to change phenotype and suggest a slight social deficit in the knockout mice. An extension of this study will observe a larger sample size to increase the power of the results.

Funder Acknowledgement(s): This study was made possible by NIH-NHGRI award R25HG006687 to the Opportunities in Genomic Research Program at The Genome Institute of Washington University, St. Louis, MO. Supported, in part, by an HBCU-UP grant awarded to Harris-Stowe State University, St. Louis, MO.

Faculty Advisor: Tommie Turner, turnert@hssu.edu

67

Subcategory: Genetics

Targeted Analysis of the Mexican Hypertriglyceridemia Locus on Chromosome 18

Luis Gonzalez, University of California, Los Angeles
Co-Author(s): Alejandra Rodriguez and Paivi Pajukanta, University of California, Los Angeles

Mexican populations are more susceptible to developing dyslipidemias and coronary heart disease (CHD) than European populations. The first Mexican genome-wide association (GWA) study for lipids revealed a new locus associated with high serum triglycerides (TGs) on human chromosome 18. Within this locus, the trait-associated single nucleotide polymorphisms (SNPs) lie within the transmembrane 241 (TMEM241) gene region.

Therefore, the purpose of this study was to identify all regional variants in tight linkage disequilibrium (LD) with the key associated SNPs for future functional studies. We used the PLINK software to determine which SNP variants were in LD with the lead variant in the newly identified TG locus. The UCSC genome browser and RegRNA2.0 databases were utilized to determine whether any of the variants contributed to or altered regulatory elements. This was accomplished by inputting the sequence with the common allele and the sequence with the rare allele and monitoring any abrupt changes. Rs1759126 was amplified by PCR and genotyped in Mexican low TG controls to characterize the regional LD patterns between rs17259126 and other genotyped variants around the TMEM241 gene.

We observed that most variants in LD with the lead SNP result in RNA motif modification due to changes in transcriptional regulatory motifs along with alteration in functional RNA sequences and non-coding RNA (ncRNA) hybridization regions. After identifying the variants with potential regulatory role using tools of bioinformatics, we will conduct functional studies, including building a construct with the most promising variants to test if they affect TMEM241 expression levels. Taken together these bioinformatics analyses and functional studies should help elucidate the molecular mechanisms underlying the genetic association signal of high TG levels in theTMEM241 gene region in Mexicans.

Funder Acknowledgement(s): This study was, in part, funded by a grant from NIH awarded to Luis Gonzalez, University of California, Los Angeles.

Faculty Advisor: Paivi Pajukanta, ppajukanta@mednet.ucla.edu

68

Subcategory: Genetics

Delineating Exc-2, A Gene Responsible for Maintaining the Structure of the Excretory Canals in Caenorhabditis Elegans

Hamid Hussaini, University at Buffalo/University of Kansas
Co-Author(s): Hikmat Al-Hashimi, Kelly Grussendorf, and Matthew Buechner, University of Kansas, Lawrence

Maintenance of the structures of biological unicellular tubes such as glomerular capillaries is vital to carry out fundamental functions such as osmoregulation. Our lab aims to understand the molecular mechanisms underlying formation and preservation of the shape of such tubes found in the model organism Caenorhabditis elegans. We hypothesized that the set of EXC proteins regulates lumen diameter in the excretory canal. Loss of function of the C. elegans protein EXC-2 allows accumulation of large liquid-filled cysts inside the lumen of the single-celled excretory canal cell. The length of these mutant canals varies from about 1/3 to 1/2 the length of canals of wild-type nematodes. In an endeavor to map EXC-2, the results of DNA sequencing have narrowed the location and exc-2 may be identical to the gene ifa-4, which encodes an intermediate filament protein found in all metazoans. We are currently carrying out studies to determine if ifa-4 is in fact exc-2. We are currently performing RNAi studies of the gene ifa-4 to see if it phenocopies exc-2; results show that the progeny of dsRNA-injected worms fail to extend their canals posteriorly. Complementation tests and rescue assays are ongoing to confirm these observations. EXC proteins play a role in the endosomal recycling machinery necessary to maintain cell membrane integrity, and the excretory canal is a good model for investigating anterior-posterior endosomal movement.

We conclude that Intermediate filament protein EXC-2 regulates movement of recycling endosomes and we infer that this protein may perform a similar function to regulate tubule diameter in other organisms. Observation of biological markers used such as labeled Rab-11 and Rab-5 show movement of recycling endosomes and early endosomes, respectively, in wild-type worms, while another marker, Rme-1, paradoxically, shows no locomotion of recycling endosomes. Movement of all three markers is ceased in exc-2 mutant worms. We are using these marker movement studies to examine genetic interactions between exc-2 and other exc genes.

Funder Acknowledgement(s): This REU program (research experience for undergraduates), was funded in part, by a grant from NSF grant (DBI-1156856) awarded to Robert Cohen, Professor Molecular Biosciences & Director of the NSF REU program.

Faculty Advisor: Matthew J Buechner, Buechner@ku.edu

69

Subcategory: Genetics

Occurrence of Circadian Clock Genes in Wild Picocyanobacteria

Myesa Legendre-Fixx, University of Washington
Co-Author(s): Jaclyn Saunders and Lisa Peterson, University of Washington

In the picocyanobacterium Synechococcus, there are three circadian clock genes: KaiA, KaiB, and KaiC, which regulate the organism's diurnal biorhythm. Its sister genus, Prochlorococcus, has only KaiB and KaiC, and therefore can only maintain a rhythm with stimulus from light (Holtzendorff et al., 2008). In this experiment, gene sequences of wild picocyanobacteria from the top five meters of the ocean were surveyed in an attempt to find KaiA genes in wild Prochlorococcus populations. Because there are many more strains in the wild than in a lab, it was expected that a complete KaiA gene would be found in the samples, and KaiB and KaiC would be maintained in a 1:1 genes/genome ratio. By using reference sequences found on the JGI IMG (Joint Genome Institute Integrated Microbial Genomes) website and by BLASTing the GOS database, the KaiC genes/genome ratio in Prochlorococcus strains was determined to be very close to zero. KaiA and KaiB were not found. This genome streamlining most likely occurred in order for the picocyanobacteria to partition more phosphorus towards growth. It was proven that picocyanobacterial strains in the field can differ from strains maintained in a lab. This is a reminder that lab strains are not representative of the whole genus. More insight was given into the evolution of Prochlorococcus and the process of genome streamlining in such a competitive environment. Future research would involve searching for the circadian clock genes in genomes taken from a depth of 150m.

Funder Acknowledgement(s): This research was supported by the NSF grant OCE-1138368 and the NIH HG007153-02 grant.

Faculty Advisor: Lisa Peterson, lisapete@uw.edu

70

Subcategory: Genetics

Patterns of Racial Variation in Allele Frequencies of Asthma-Associated GWA

Twymenia Liggins, University of Arkansas at Pine Bluff
Co-Author(s): Gurjit K. Khurana Hershey and Tesfaye B. Mersha, University of Arkansas at Pine Bluff, Chemistry and Physics Department, Division of Asthma Research, Cincinnati Children's Hospital Medical Center, Department of Pediatrics/University of Cincinnati

The prevalence of asthma substantial differs between races. Although these differences are partially due to life style and socio-economics, genetic factors also contribute. Genome-wide association studies, mostly done in populations of European ancestry, have identified numerous asthma-associated single nucleotide polymorphisms (SNPs). To date, little is known about whether the same variants or genes contribute to asthma-susceptibility in populations of different ancestry. We hypothesize that SNP with a large difference in risk allele frequency between populations is a strong candidate to explain large differences in asthma prevalence between populations. The aim of the study was to explore and compare allele frequency distribution of genetic polymorphisms known to influence asthma based on GWAS data from European ancestry population across ancestral and admixed African American populations using 1000 Genomes Project (http://www.1000genomes.org).

Funder Acknowledgement(s): This work was supported by the NIH K01HL103165 (TBM), U19A170235 (GKKH).

Faculty Advisor: Antoine Rice, ricea@uapb.edu

71

Subcategory: Genetics

We Seek to Develop Wireless Methods for Recording and Stimulating Nerves

Guttu Maskalo, St. Olaf College
Co-Author(s): Erick Marigi, Shane Allen, Chris Stewart

Modern implantable devices require invasive methods of wires and batteries. Wires can inhibit an animal's mobility presenting issues in neuroethological studies, be displaced, or present an increased opportunity for infection. Batteries are large, generate undesirable heat and require surgical replacement. Our aim is to develop a wireless method for recording impulses that uses current traveling through the natural conductive pathway of the body as opposed to radio frequency emission. We propose to do so using passive (battery free) resonance circuit technology. First, we developed a passive probe to record intracellular nerve impulses. We sought to improve the sensitivity of the probe by running trials using earthworms and leeches. Specifically, we looked to record intracellular nerve signals by passing a carrier signal to the probe through various tissues, modulating the carrier at the site of recording, and demodulating the signal with a receiver outside the body. Our experiments have clarified the obstacles that remain, specifically the small amplitude and low power of nerve field potentials. To address these issues we need to amplify the nerve signals prior to entering the probe, which poses a challenge for the passive nature of our device. We have therefore begun examining the use of energy harvesting technology to avoid the use of battery power. If ultimately successful, this technology will not only improve intracellular physiological readings, but may have implications for wireless signal and energy transmission.

Funder Acknowledgement(s): NSF, University of Minnesota, TRIO McNair, St. Olaf College.

Faculty Advisor: Kathy Glampe, glampe@stolaf.edu

72

Subcategory: Genetics

Evaluation of Pediatric Sickle Cell Disease Pulmonary Complications

Dakarai Moton, Dillard University
Co-Author(s): Dakarai Moton, Dillard University, New Orleans Maria Velez and RV, Gardner, Louisiana State University Health Sciences Center

Sickle cell disease affects approximately 300,000 newborn babies worldwide each year. It is a hereditary disorder stemming from a single gene mutation of hemoglobin and is associated with increased rates for pulmonary complications. This study examined pulmonary function test data (forced vital capacity (FVC), forced expiratory volume (FEV1), FEV1/FVC, Vital Capacity, and diffusing lung capacity for carbon monoxide (DLCO)) and patient/parent self-assessment regarding asthma in pediatric sickle cell patients, ages 6 to 18 years, at Children's Hospital of New Orleans.

We also looked at bronchodilator response as an indicator of asthma. Asthma questionnaires which were given as part of routine practice were evaluated to identify those who may have asthma. Questionnaire responses were correlated with the patients' pulmonary function tests to confirm whether the patient suffers from asthma. Medical charts were reviewed for episodes of pneumonia or other pulmonary complications including, Acute Chest Syndrome, chest pain, hemoglobin levels, genotype, sex, and race. Homozygous SS patients comprised 67% of patients, SC 20%, and Sβthalassemia 13%. Almost 75% of patients had PFT evidence of asthma. Of those individuals identified as having indicators of asthma, 72% had not previously received treatment for asthma. Patients requiring >3 hospitalizations or ER visits throughout the year have been previously assessed as having moderately severe to severe sickle cell disease. 76.4% of these patients requiring more hospitalizations had homozygous disease. They also had a significantly lower DLCO than patients with Sβthalassemia ($p=0.02$) or SC disease ($p=0.04$). Patients with a diagnosis of asthma also had an average hospitalization duration of 2.77 days and average number of ER visits of 1.92/year, compared to those without asthma whose average hospital stay duration was 2.5 days and average ER visits of 1.65/year.

We conclude that asthma and other pulmonary disorders are underdiagnosed in sickle cell disease although the disorder can be associated with significant morbidity and possibly lessened quality of life. The difference for average hospitalizations was not significant, but the difference for the average emergency room visits was significant ($p=0.03$). Only 4.8% of the total patient population had experienced acute chest syndrome. In the future, we plan to assess PFT data and overall health post-bronchodilator treatment. The ultimate goal is to identify and treat all individuals with sickle cell and asthma.

Funder Acknowledgement(s): Louisiana State University Health Sciences Center.

Faculty Advisor: Julie Basu-Ray, jbasuray@dillard.edu

73

Subcategory: Genetics

Analysis of Genetic Diversity in the Field Grown and Tissue Culture Raised

Jorge L. Muriel-Mundo, Universidad del Este/Fort Valley State University

Co-Author(s): Seema Dhir, Fort Valley State University

Stevia (Stevia rebuaidana) is widely grown for its sweet leaves as it yields diterpenoid steviol glycosides, which are about 300 times sweeter than sugar. Stevia plant organs contain different amounts of steviol glycosides, which decline in the following order: Leaves, flower, stems, seeds and roots. Some genes and pathways involved in steviol biosynthesis are already elucidated. Researchers increased the Stevia glycoside concentration in plant leaves up to 20% after an extensive breeding and selection program (Brandle and Rosa 1992; Rajasekaran et al. 2008). Such progress needs a boost to combat the challenge of diabetes and coup with the farmer's demand of superior variety and planting material. So molecular techniques could be an important tool for Stevia improvement and for this, isolation of quality DNA is an important prerequisite. Therefore, the present investigation was carried out to compare the commonly available DNA isolation protocols for their efficacy in the isolation of quality DNA to explore the genetic diversity from different conditioned and unconditioned Stevia plants. We evaluated different methods to isolate DNA from the young and old leaves of Stevia plants. The quantity and quality of the DNA extracted was compared using UV-spectrophotometer and agarose gel electrophoresis. The present findings will certainly play a vital role in genetic improvement of Stevia rebaudiana Bert.

Funder Acknowledgement(s): This research was supported by the REU-Site (DBI-1004764) grant awarded to Sarwan K. Dhir at the Fort Valley State University, Fort Valley, GA.

Faculty Advisor: Sarwan K. Dhir, Dhirs0@FSU.EDU

74
Subcategory: Genetics

Ultraclean and Chloroform Yield High Quality DNA from White Mangroves

Abigail S. Rene, University of the Virgin Islands
Co-Author(s): Joshua Hazel, University of the Virgin Islands

Mangroves are an important part of our coastal ecosystem. They help protect coastal areas from tsunami and hurricane damage and serve as habitats for juvenile fish, insects, and small crustaceans. Knowledge of mangrove population diversity would help us determine what activities threaten the population and what conservation and restorative measures would be most effective. To determine the diversity of the mangrove population, DNA samples must be extracted and amplified. Mangroves are specially adapted to harsh environments such as marshy anoxic anaerobic soil and fluctuating salinity of the water bodies in which they grow; they synthesize high amounts of polysaccharides, polyphenols, and other secondary metabolites such as alkaloids and flavonoids which impede DNA extraction (Sunil Kumar Sahu et. al, 2012). This study investigated white mangroves (Laguncularia racemosa) from the U.S Virgin Islands and Jamaica using four protocols: a standard CTAB protocol, a modified CTAB (Xin and Chen, 2012), Master Pure TM Plant DNA purification kit, and UltraClean to determine which protocol would yield the purest DNA sample. Extracted samples were subjected to further cleanup using sodium acetate, proteinase K, and RNase H (ribonuclease H). The extracted DNA was analyzed using a UV spectrophotometer under dilution factors of either 50 or 20. In terms of quality RNase H and chloroform yielded the purest DNA with A260/A280 ratios of 1.86 and 1.77 respectively. Quantitatively, UltraClean and the modified CTAB and yielded DNA concentrations of 116.25 ng/uL and 79 ng/uL respectively. These results indicate that despite the chemicals that impede DNA extraction, high quality genomic DNA can be obtained and used for further genetic studies.

Funder Acknowledgement(s): Funding for this research was provided by the National Science Foundation (NSF) HBCU-UP grant #HRD-0506096.

Faculty Advisor: Alice M. Stanford, astanfo@live.uvi.edu

75
Subcategory: Genetics

Investigating the Role of Aging in Population Dynamics

Alexander Jess Sigala, California State University, Monterey Bay
Co-Author(s): James Tan, Washington and Kerry Kornfeld, Washington University, St. Louis, MO

Disruption of the IGF-1 signaling pathway has been shown to drastically increase longevity and provide resistance to age related diseases such as cancer and Alzheimer's (Kenyon, 2010). In C. elegans, mutations to the IGF-1 homologue daf-2 also produce viable longer lived mutants. In contrast, mutations which disrupt IGF-1, daf-2, and other homologous pathways are not commonly observed in vivo. We hypothesize that longer-lived mutants destabilize population dynamics by causing populations to become more susceptible to extinction events. To test this hypothesis, we developed a computer model which emulates the progression of C. elegans through its life stages. This software has the advantage of displaying quick, precise, and reproducible data on the lifecycle of each individual within the population. We compared our models' predictions to data collected in vitro and found our model to accurately predict periods of growth and decay as well as key demographic data. Preliminary data suggests that in populations where lifespan is doubled, there are longer periods of low population size, thereby increasing the population's susceptibility to extinction. Future research will focus on improving variables within our model and incorporating alleles for short, wild type, and extended life spans to test for the selection of 14 day lived worms.

Funder Acknowledgement(s): Funding for this research was provided through NHGRI: R25HG006687 awarded to the Opportunity in Genomics Research Program at Washington University St. Louis MO.

Faculty Advisor: Aparna Sreenivasan, asreenivasan@csumb.edu

76

Subcategory: Genetics

Mapping of the Sos2 Mutant in Maize

Andrea Valdez, California State University, Monterey Bay
Co-Author(s): Hannah Seberg, Christopher Garner, and Paula McSteen, University of Missouri-Columbia

With the world population exceeding 7 billion, it is important for researchers to develop ways to increase agricultural yield without too much expansion. One way to accomplish this is by engineering current crops to produce more. A model organism for this type of research is maize because unlike other monocots, including rice and wheat that produce spikelets singly, maize produces spikelets in pairs. To understand the evolution of this trait, mutations that effect the production of paired spikelets must be evaluated. The suppressor of sessile spikelet class of mutants, produce fewer kernel rows in the ear and sparse tassels each indicative of having only single spikelets similar to ancestral monocots. The semi-dominant mutant Sos2 exhibits a typical Sos mutant phenotype as well as fewer tassel branches and reduced ear size. Meristems control the production of organs in developing plants, therefore the Sos2 mutant may have defects in both the spikelet pair and inflorescence meristems. To identify the gene responsible for this phenotype, the Sos2 mutant was backcrossed twice to different genetic backgrounds to generate a mapping population. The DNA extracted from these samples was amplified by PCR and the resulting recombination frequencies were then used to map the gene's location. Sos2 mapped between bin 10.1 and 10.2 on chromosome 10. Narrowing of the mapping region will be required to identify the exact gene responsible for the Sos2 phenotype. The identification of genes involved in the Sos pathway is necessary for understanding the evolution and development of the paired spikelet. The discovery of the genes responsible for generating paired spikelets can then be used to create a model for engineering single spikelet monocots, such as rice, to produce paired spikelets potentially doubling yield.

Funder Acknowledgement(s): This work was funded by the NSF Grant #1256373 awarded to Paula McSteen, division of biological sciences, University of Missouri-Columbia.

Faculty Advisor: Sreenivasan, asreenivasan@csumb.edu

77

Subcategory: Microbiology/Immunology/Virology

A Leishmania Major Mutant Defective in Mitochondrial Function

Kierha S. Baker, Dillard University
Co-Author(s): Ruby Broadway and Ben Kelly, Dillard University

Leishmaniasis is a parasitic disease affecting over 12 million individuals worldwide. Protozoan parasites of the genus Leishmania are transmitted to humans by the phlebotomine sandfly vector during feeding. Leishmania major parasites are phagocytosed primarily by macrophages and cause a skin disease called cutaneous leishmaniasis. Threshold levels of LACK, the Leishmania ortholog of the eukaryotic protein, RACK1 (a protein implicated in regulation of translation and cell signaling), are necessary for full virulence in vivo. Although our previous studies suggest LACK has translation-associated functions in L. major, molecular details of LACK's role in parasite virulence have remained unclear. Recently, we identified a novel molecular role for LACK in maintaining expression of the mitochondrial protein cytochrome c oxidase subunit 4 (LmCOX4) at mammalian host temperature (35°C). Under these conditions, the decreased amount of LmCOX4 observed in LACK-deficient L. major mutants correlates with decreased cytochrome c oxidase (complex IV of the electron transport chain) activity and ATP generation compared to wild-type.

Our preliminary results demonstrate that, at 35°C, LACK-deficient L. major have increased levels of reactive oxygen species (ROS) and are more sensitive to hydrogen peroxide than their wild-type counterparts. Our studies, indicating LACK's important role in Leishmania mitochondrial function, redox and virulence, highlight LACK as a potential target for therapies to combat leishmaniasis.

Funder Acknowledgement(s): Ruby Broadway, PhD. and Ben Kelly, PhD., Dillard University

Faculty Advisor: Ruby Broadway, rbroadway@dillard.edu

78

Subcategory: Microbiology/Immunology/Virology

Cloning, Sequencing and Molecular Characterization of Plant GAPDH Genes

Brandi Bethune, Alabama State University
Co-Author(s): Abigail S. Newsome, Mississippi Valley State University
Langston Grant, Edward Water College, Jacksonville, FL

Glyceraldehyde-3-phosphate dehydrogenase (GAPDH) is a critical enzyme that codes for a protein that is catalyzed in the

sixth step of glycolysis, the process of converting glucose into pyruvate to produce energy. GAPDH is found in all cells and is more than just the critical enzyme in glycolsis. In human genome the GAPDH gene is orthologous between species. The gene is expressed in 21 types of cancers and associated with neuronal diseases like Alzheimer disease. GAPDH makes up 10% of the soluble protein in the skeletal muscles of animals, and is active in endocytosis, DNA repair, microtubule building and membrane fusion. GAPDH also takes place in programmed cell death, and viral pathogenesis. The objective of this experiment was to isolate the gene (GAPDH) from the DNA of the plants Spineraci Oleracea and Epipremnum Aureum so that it could be prepared for sequencing and comparison. In this experiment, Polymerase Chain Reaction (PCR) method was used to prepare the gene GAPDH for sequencing so that the gene could be compared to genes of the same type. DNA extracting was used to isolate the genomic DNA of interest. Once the DNA was fully extracted, PCR was used to amplify a portion of the DNA molecule. Agarose Gel Electrophoresis was used to separate the DNA portions by size and also to determine the number of PCR products, the presence of the band, and the strength of the band. Electrophoresis showed plant DNA was amplified in the nested products for both Spineraci Oleracea and Epipremnum Aureum.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the Department of Education awarded to Abigail S. Newsome, Bioinformatics Program, Mississippi Valley State University, Itta Bena, MS 38941.

Faculty Advisor: Elijah Nyairo, enyairo@alasu.edu

79
Subcategory: Microbiology/Immunology/Virology

Staphylococcal Superantigens and Their Correlation with Atopic Dermatitis

Chris Bolden, University of Southern Mississippi
Co-Author(s): Adam Spaulding, Patrick Schleivert, Wilmara Salgado-Pabon, Elizabeth Mueller, and Joseph Merriman, University of Iowa

Staphylococcus aureus is a common commensal bacterium that colonizes 30% of the human population and is also a major opportunistic pathogen responsible for a broad range of diseases and infections worldwide. Their ability to colonize and cause disease are based on a myriad of surface and secreted virulence factors. Surface factors include microbial surface component adhesive matrix molecules (MSCRAMMS) and secreted virulence factors include cytolysins and staphylococcal superantigens. Staphylococcal superantigens have been shown to be associated with a wide range of diseases, and one disease that is under investigation is atopic dermatitis (AD). Atopic dermatitis is believed to exacerbated by staphylococcal superantigens and with this study we aimed to further classify SAgs associated with atopic dermatitis through PCR screening and western blot quantification. We investigated the super-antigen profile of strains from lesional sites compared to non-lesional sites. We hypothesized that lesional strains would encode a higher yield of SAgs compared to non-lesional strains. Fifty strains (25 lesional, 25 non-lesional) were obtained from the National Jewish Institutes of Health and were analyzed for their genetic potential of encoding 12 SAgs and TST-1, SEC, & SEB were quantified. Our results indicate that there is no significant difference between lesional and non-lesional strains in the amount of SAgs encoded suggesting that the paired isolates are the same strain.

Funder Acknowledgement(s): This research was supported by the NSF REU in Microbiology at The University of Iowa through grant number DBI-1262222.

Faculty Advisor: Andre Heath, andre.heath@usm.edu

80
Subcategory: Microbiology/Immunology/Virology

Inhibition of Biofilm Formation by Diallyl Disulfide

Jessica R. Clark, Winston Salem State University
Co-Author(s): Brittany Justice, Martkia Harper, and Stephanie Dance-Barnes, Winston Salem State University

Pseudomonas aeruginosa is a opportunistic human pathogen often found in severely infected patients such as those with cystic fibrosis. These microbes live in adherent communities that enjoy protection against host immune responses and tolerance to various anti-microbial treatments. This communication mechanism, quorum sensing (QS) has been found to play a role in P. aeruginosa biofilm formation and swarming ability, which increases its virulence. QS in bacteria has been shown to occur by two distinct acyl-homoserine lactone based pathways: the rht/rhR pathway and the lasI/lasR pathway. There is a third signaling molecule that is responsible for virulence and inter-species communication, 2-heptyl-3-hydroxy-4(1H)-quinolone. In this study, Ally Disulfide (DADS) is being used as a possible treatment to inhibit the motility and biofilm formation of Pseudomonas aeruginosa. DADS is a lipid soluble compound in garlic that has in previous studies been shown to have antimicrobial capabilities. It is hypothesized that the DADS will interfere with the signaling events and communication involved in biofilm formation, thereby diminishing the virulence of P. aeruginosa. Swarming and attachment are critical in biofilm formation. DADS was shown in both cell surface attachment and swarming motility assays to diminish attachment and swarming motility (QS regulated phenotype) of the P. aeruginosa in a dose dependent manner. P. aeruginosa green bioluminescence is another QS regulated phenotype that was reduced in a dose

dependent manner, indicating further influences of DADS on QS. Additionally, RT-PCR revealed that DADS treatment is correlated with a reduction in expression of this the las gene which is implicated in controlling bioluminescence and biofilm formation. However, las expression increased in P. aeruginosa that was treated with penicillin/streptomycin. This could be an indication that Pen-strep may work through a different inhibitory pathway, or it could also provide insight into QS and resistance to traditional antibiotics that has been linked to biofilm formation. Despite, Pen-strep being effective at inhibiting biofilm formation, this inhibitory influence was short-lived. For periods longer than 24 hours the inhibitory capability was diminished, but not the case with DADS. Lastly, cell viability assays supported that DADS was not toxic to normal eukaryotic cells. To conclude, all of these findings provide evidence that DADS may be a strong safe antimicrobial drug from dietary sources that has a lower toxicity and lacks the risk associated with antibiotic resistance. Moving forward we will continue to elucidate the specific signaling events involved in biofilm formation, and DADS influence on other microbes.

Funder Acknowledgement(s): Study supported by National Science Foundation Award #0927905, Winston Salem State University Summer Undergraduate Research Experience Program.

Faculty Advisor: Stephanie Dance-Barnes, dancest@wssu.edu

81
Subcategory: Microbiology/Immunology/Virology

Detecting Drug Resistance Mutation in Senegalese Children under ART

Diamond Crumby, Howard University

While the provision of highly active antiretroviral treatment (HAART) is important in reducing HIV/AIDS mortality among children, this therapy can also cause resistance, thus reducing the effectiveness of HAART. Consequently, receiving and adhering to HAART treatment is vital in preventing the mutation of HIV-1. Due to the scarcity of higher-level treatments in Sub-Saharan Africa, this research study served to detect drug resistance mutation in the Pol gene of HIV, specifically in the protease and reverse transcriptase enzymes, among four Senegalese children undergoing HAART therapy. The Pol gene was decoded using a sequencer. This showed markers for A, C, T, and G using polyacrylamide gel. Minor discrepancies were corrected with the software Seq Man 2. The corrected files were then compared to Stanford University's HIV Resistance Database HIV-1 subtype B to measure mutations. Four samples were measured for resistance: A3 084, A3 514, and A3 589 were on 1st line treatment, which includes NNRTI (non-nucleoside reverse transcriptase inhibitor) and NRTI (nucleoside reverse transcriptase inhibitor); A3 185 was on 2nd line treatment, which includes NNRTI and NRTI as well as PI (protease inhibitors).

Results indicated that A3 084 showed resistance to NNRTI, which suggests a transition to NRTI. A3 514 showed resistance to both NRTI and NNRTI, which suggests a transition to the 2nd line treatment to include PI. A3 185 showed resistance to NRTI, NNRTI and PI, which indicates the need to seek higher-level treatment that may not be available in sub-Saharan Africa. A3 589 showed no resistance and can continue with the current treatment. It can be assumed that A3 084, A3 514, and A3 185 did not adhere to their therapy since they require a more progressive treatment. In general, if patients follow their therapy correctly, the viral load will remain low. Regardless, if higher line treatment is not available, as for A3 185, this patient and many others in the same situation will develop AIDS.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the NSF.

Faculty Advisor: Ndeye Coumba Toure Kane, diamond.crumby@gmail.com

82
Subcategory: Microbiology/Immunology/Virology

Cell Cycle G2/M Arrest by Inhibition of Protein Kinase D

Myles Davis, Tuskegee University
Co-Author(s): Myles Davis, Tuskegee University
Manuj Tandon and Q. Jane Wang, University of Pittsburgh

Protein Kinase D (PKD), a ubiquitous serine-threonine protein kinase, consists of three members: PKD1, PKD2 and PKD3 and is recognized as a subfamily of the calcium-calmodulin-dependent kinase superfamily. PKD has been implicated in many key cancer related biological functions such as adhesion, survival, migration, cell motility, apoptosis, and cell proliferation. Expression of PKD has been found to be up-regulated in prostate cancer cells. The inhibition of using novel PKD small molecule inhibitors greatly reduced PKD mediated cancer cell proliferation through growth arrest at G2/M phase of cell cycle. Previous work in our lab showed that SD 208, a small molecule inhibitor of PKD induced cell cycle arrest at G2/M phase. This study further investigates the molecular mechanism involved in cell cycle arrest by inhibiting PKD using small molecule inhibitors. To examine the mechanisms of cell cycle arrest in prostate cancer, human prostate cancer cell lines, PC3 and DU145, were treated with increasing time and doses of SD 208. The effects of SD 208 mediated PKD inhibition on cell cycle regulatory proteins were assessed by flow cytometry and western blotting analysis. The G2/M arrest by SD 208 was found associated with marked decline in protein level of cyclin A2 and cyclin B1. We found increased level of pCdc2 as well as protein level of CDK inhibitor Cip1/p21 in time- and dose-dependent manner. These findings suggest that SD 208 induces G2/M arrest through promoting Cdc2/Cyclin B1 phosphorylation and induction of p21 in prostate cancer cells.

Funder Acknowledgement(s): Department of Defense grant #PC080566.

Faculty Advisor: Q. Jane Wang, qjw1@pitt.edu

83
Subcategory: Microbiology/Immunology/Virology

Characterization of the RNA-DNA Hybrid Virus Capsid Protein

Nkolika Egbukichi, Portland State University
Co-Author(s): Ken Stedman, Portland State University

Currently there are three major classes of known viruses: exclusively RNA viruses, which do not require a DNA intermediate in their replication and propagation; DNA viruses, which use DNA dependent processes to perform their genome replication; and so-called retroviruses, which go through both an RNA and a DNA phase with the help of a reverse transcriptase enzyme. Until very recently there was no evidence that there was genetic exchange between these distinct virus classes. However, a single stranded DNA (ssDNA) virus genome, recently found using metagenomics in Boiling Springs Lake in Lassen Volcanic National Park, USA (BSL) contains elements homologous to both ssRNA and ssDNA viruses. This virus has a genome which contains an open reading frame (ORF) for a replication initiation protein (Rep) homologous to that of the Porcine Circovirus (PCV) and other ssDNA replicons. The other ORF of interest encodes a putative capsid protein (CP) that is not at all similar to the PCV CP in sequence. The CP ORF however, is homologous to the CP of viruses from the ssRNA virus family Tombusviridae (TBV). The single-stranded DNA genome of this virus tentatively named BSL RNA-DNA hybrid virus (BSL-RDHV) is about 4.1kb and also contains two additional ORFs with unknown functions. Phylogenetic analysis of the CP and Rep ORFs strongly suggest a chimeric origin from both single-stranded RNA and single-stranded DNA viruses for this novel virus genome.

This study proposes chemical and structural characterization of the BSL-RDHV capsid protein. The main question explored in this research project: What characteristics of the Boiling Springs Lake RNA-DNA hybrid virus CP resemble that of a DNA circovirus and which resemble that of a RNA tombusvirus?

The long-term goal of this research will be to determine the structure of the BSL-RDHV CP and compare it to the known structures of the PCV CP and the TBV CP. The recent assembly of new chimeric virus genomes recovered from various environments encoding tombusvirus-like CP and Rep from ssDNA viruses belonging to three different families suggests that the CPs of these chimeric viruses are likely to display the same structural fold and domain organization as those of TBV CPs. To gain further insight into the structure of the BSL-RDHV CP, the gene will be assembled in an expression vector using the Gibson Assembly® Cloning Method and transformed into competent E. Coli cells. The CP will be purified from cell lysate using column chromatography, and pure protein will be obtained in milligram quantities. Ultimately, the successful expression of the BSL-RDHV CP will allow for crystallization trials aimed at eventual X-ray crystallography and structure determination.

Funder Acknowledgement(s): This research was completed as part of the 2013 Portland State University Ronald E. McNair Postbaccalaureate Achievement Program. Research in the Stedman Lab is supported by the National Science Foundation MCB0702020.

Faculty Advisor: Ken Stedman, Kstedman@pdx.edu

84
Subcategory: Microbiology/Immunology/Virology

Testing Algorithms to Predict Onset of Cerebral Malaria in Murine Model

Mina Ghobrial, University of Georgia

Malaria is an infectious disease caused by the parasite genus, Plasmodium, which kills approximately 2.7 million people each year. 20-50% of all malaria cases develop into cerebral malaria (CM), but much of its pathology is not clearly understood. Plasmodium berghei ANKA induces CM in mice. Behavioral and neurological symptoms of mice experiencing CM are similar to those seen in humans. However, incidences of experimental CM are variable. In some experiments, nearly 100% of mice develop CM, yet in others, only 50% develop CM. Lack of understanding which and when infected mice will develop CM contributes to a weak understanding of the relationship between early pathological changes of CM and the resulting outcome. In our experiments, approximately 4-8 mice are infected with P. berghei ANKA and evaluated daily for symptoms suggesting the likelihood that they will develop CM. On days 4-7 post-infection, the mice were subjected to a battery of behavioral and neurological tests. Each test produced a numerical score that was inserted into a published algorithm designed to predict the chance that a mouse will develop CM. While the experiments are still underway, it appears that the published algorithm does not universally apply to all experimental conditions and mouse strains. However, assessment of an alternate predictive algorithm is being investigated. Creating an effective and reliable algorithm has a plethora of benefits; it can predict CM development in its early stages and the corresponding approximate time of death. Composed of simple tests and inexpensive materials, the protocol for this algorithm can be reproduced easily. This could be helpful to future research concerning CM in murine models.

References for Abstract: B. Oztas, and M. Kucuk. Intracarotid hypothermic saline infusion: a new method for reversible blood/ brain barrier disruption in anesthetized rats. *Neurosci*. Lett. 190 (3):203–206 (1995), May 12.

John CC, Bangirana P, Byarugaba J, Opoka RO, Idro R, Jurek AM, Wu B, Boivin MJ. Cerebral malaria in children is associated with long-term cognitive impairment. *Pediatrics*. 2008;122:e92–99. doi: 10.1542/peds.2007-3709.

Yuri C Martins,1 Guilherme L Werneck,2 Leonardo J Carvalho,1,4 Beatriz PT Silva. Algorithms to predict cerebral malaria in murine models using the SHIRPA protocol. *Malaria Journal* 2010, 9:85 doi:10.1186/1475-2875-9-85.

Funder Acknowledgement(s): This work was funded by National Institute of Health (NIH) grant no. AI50240 to JMM.

Faculty Advisor: Julie Moore, julmoore@uga.edu

85

Subcategory: Microbiology/Immunology/Virology

GcpMB Shares a Common Pathway with Staphylococcus Aureus Virulence Factors

Ashlea Hendrickson, Oakwood University
Co-Author(s): Briana Moncur, Gabriel Spencer, and Marsalis Brown, Oakwood University

Introduction: Staphylococcus aureus infections are a growing concern in the medical community. Infections with S. aureus can range from non-life threatening skin infections, like impetigo, to life threatening conditions such as endocarditis and toxic shock. Recently, there has been an emergence of multi-drug resistant S. aureus called methicillin-resistant Staphylococcus aureus (MRSA). Infections with these strains are potentially lethal. It is imperative that we elucidate the mechanisms of virulence and cellular invasion to identify antibiotic-independent means of treating MRSA infections. We hypothesize that the putative protease GcpMB may be involved with S. aureus virulence and cellular invasion.

Objective/Purpose: The purpose of this study is to identify the regulatory role of GcpMB on S. aureus virulence factors including HtrA, ScpA, TSST-1, enterotoxins, exfoliative toxin and sortase A. It is our central hypothesis that GcpMB shares a common pathway with the various virulence factors of S. aureus and is directly involved in virulence.

Methods: Using standard molecular cloning, protein expression, protein-protein interaction studies and immunoblot analysis, the interaction between rGcpMB and S. aureus virulence factors were analyzed.

Results: Protein interaction studies and immunoblot analysis demonstrate that rGcpMB physically interacts with HtrA and ScpA. Interaction of rGcpMB with other virulence factors were also evaluated. Conclusion: The data from this study suggest that GcpMB may be involved in the production, processing or maturation of important S. aureus virulence factors.

Funder Acknowledgement(s): The National Science Foundation funded S.T.E.M.E.R. program (Grant #: 0811507)/ National Institutes of Health, NIDCR Grant # 3RO1DE019730-04S1.

Faculty Advisor: Elaine Vanterpool, evanterpool@oakwood.edu

86

Subcategory: Microbiology/Immunology/Virology

Human Microbiome Variation in Relation to Diet and Geographic Origin

Devante Holmes, Virginia State University
Co-Author(s): Latoya Wran and Xianfa Xie, Virginia State University
Noela Muma, University of Maryland, College Park, Maryland
Zulekah Bibi, Prince George Community College

Recent studies have shown that microbial communities play a very important role in human health. We would like to investigate if different diets, geographic environments, ethnicities could affect the microbiome in human digestive system. In the pilot study, we collected fecal samples from individuals of different ethnicity, geographic origin, and diets. For each sample, the V1-V3 region of the 16S rRNA gene was PCR amplified and then sequenced using the 454 sequencing technology. The raw data was filtered with quality control and the primers were removed. The microbial diversity within each sample was characterized using Qiime (Quantitative Insights into Microbial Ecology), MetaPhlAn (Metagenomic Phylogenetic Analysis), and RDP (Ribosomal Database Project) analysis. Samples from different individuals show different compositions in their microbiomes. However more samples are needed to elucidate the relative contribution of diet, environment, and ethnicity to the microbiome in human digestive system.

Funder Acknowledgement(s): This study was supported by funding from the NSF HBCU-UP Program.

Faculty Advisor: Xianfa Xie, xxie@vsu.edu

87
Subcategory: Microbiology/Immunology/Virology

Identification of Antifungal Cutaneous Bacteria Isolated from Amphibians

Esther Ibarra, California State University, Bakersfield

Chytridiomycosis, a disease caused by the fungal pathogen Batrachochytrium dendrobatidis (Bd), is causing a major decline in amphibian populations worldwide. In the Southern San Joaquin Valley (California), the North American Bullfrog (Rana catesbeiana) and the California Toad (Bufo boreas halophilus) are thriving despite the presence of this invasive pathogen in their environment. Previous research reveals that cutaneous bacteria in numerous different species, like the salamander (Hemidactylium scutum), for example, secrete antifungal compounds. We hypothesized that cutaneous bacteria found on the frogs and toads produce antifungal compounds that have enabled their survival. Cutaneous bacterial samples were collected from six Rana catesbeiana and six Bufo boreas halophilus individuals from the same urban location. Water samples were also collected to cultivate fungal species from the frogs and toads' environment. A total of 225 bacterial and five fungal isolates were generated. To analyze the antifungal potential of the bacterial samples, challenge assays were performed against the fungal species. It was determined that 61 bacterial isolates inhibited the growth of at least one environmental fungus. Of the 61 isolates that demonstrated antifungal properties 29 were found on the North American Bullfrog and 32 on the California toad. The 61 bacterial isolates and five environmental fungi were identified by PCR amplification and by sequencing a portion of the 16S rRNA and 18S rDNA gene, respectively. The fungi identified represent three classes of Ascomycetes (Dothideomycetes, Eurotiomycetes and Saccaromycetes). From the 61 cutaneous bacterial isolates identified 30% belong to the Bacilli class, 28% to Actinobacteria, 20% to Gammaproteobacteria, 7% to Alphaproteobacteria, 3% to Betaproteobacteria, 3% to Cytophagia and 3% to Sphingobacteria. In addition, the bacterial isolates were Gram stained to help with the identification of each to the species level and to categorize them into the Gram + and Gram – groups.

Our results show that both Gram + and Gram – cutaneous bacteria possess antifungal properties, therefore, supporting our hypothesis. Antifungal compounds produced by cutaneous bacteria may be able to prevent the amphibian population decline. The metabolites produced can contribute to advances in the treatment of fungal pathogens and they can impact amphibian conservation globally.

Funder Acknowledgement(s): Funding for this project was provided, in part, by the National Science Foundation under grant HRD-0331537 (CSU-LSAMP).

Faculty Advisor: Kathleen Szick, kszick-miranda@csub.edu

88
Subcategory: Microbiology/Immunology/Virology

Cutaneous Bacteria from Amphibians Inhibit Growth of Fungal Pathogens

Imelda Ibarra, California State University, Bakersfield

The amphibian population is massively suffering losses due to the fungal pathogen Batrachochytrium dendrobatidis (Bd). Despite Bd being present in environments of the Southern San Joaquin Valley (California), the North American Bullfrog (Rana Catesbeiana) and the California Toad (Bufo boreas halophilus) are thriving. Their success may be attributed to the bacteria found on the surface of their skin. We hypothesized that bacterial isolates, collected from six Rana catesbeiana and six Bufo boreas halophilus, which previously demonstrated antifungal properties against environmental fungi, will inhibit the growth of two known amphibian pathogens, Basidiobolus ranarum (Br) and Batrachochytrium dendrobatidis. Challenge assays were performed with 61 bacterial isolates against Br and Bd to test our hypothesis. A challenge assay against Br consists of a fungal plug in the center of a media plate and two different bacteria streaks along each side of the plug. The isolates were recorded as strong if they showed a clear zone of inhibition or negative if they showed no zone of inhibition. These isolates were compared to known isolates that caused strong and negative growth inhibition. For the challenge assays against Bd, 1ml of liquid from a stock Bd plate containing active zoospores was added to another 1% tryptone media plate and left to dry. Once dry, but not completely dried, two bacterial isolates were streaked on the plate. The results were recorded in the same manner as were the challenge assays against Br. 44 out of the 61 bacterial isolates (72%) showed strong inhibition towards Br and to date three out of 20 (15%) bacterial isolates have shown strong inhibition towards Bd. Based on the results our hypothesis that the 61 bacterial isolates would potentially inhibit the growth of Br and Bd was supported. The bacterial isolates potential to inhibit fungal pathogens growth is important because it can help in amphibian conservation. Future work includes the investigation of the bacterial isolates' inhibition potential against human pathogens and how they can help in combating human fungal diseases.

Funder Acknowledgement(s): This project was supported by the National Science Foundation under grant HRD-0331537 (CSU-LSAMP).

Faculty Advisor: Kathleen Szick, kszick-miranda@csub.edu

89
Subcategory: Microbiology/Immunology/Virology

RNA-Coliphage Qβ Displayed Nano-tags as a Platform for Nanoparticles: A Novel Drugs Cargo

Kelvin Jones, Alabama State University
Co-Author(s): Shanavia Crenshaw, Rana Singleton, and Alain B. Waffo, Alabama State University

There are a growing number of potential therapeutic molecules (biodrugs) presenting some serious challenges: in vivo degradation, indiscriminate distribution and severe toxicity. This shortcoming may be overcome by targeted drug-carrying platforms that protect and ferry the drugs to the target tissues with nanoparticles. We hypothesize that by attaching nanoparticles to the surface of the bacteriophage Qβ which displays a well know number of nano-tags, the chimera phage platform produced will act as a modular carrier system for biodrug scaffolding and delivery. To achieve this goal, nano-tag genes for silica (MSPHPHPRHHHT) and gold (VSGSSPDS) were inserted into the cDNA of Qβ A1 gene separately and displayed on the exterior surface of the phage Qβ. These hybrid phages with nano-tags were designated as pQβSi, pQβAu. The hybrid phage titers were lower than the wild type (108 – 109 pfu). The correct tag gene size was confirmed by RT-PCR from plaques of each phage type. Ouchterlony double diffusion was performed with phages and the corresponding antibodies, which confirmed the presence of the tags on the phage surface. The QβAu phages were analyzed through scanning electron microscopy (SEM) and have confirmed the success of the Qβ phage displaying gold tag. We are currently analyzing other hybrid phages constructed. In addition biophysical properties of phage displaying nano-tags and their nanoparticles counterpart are being studied. To our knowledge this is the first report on RNA coliphage Qβ displaying biologically useful surface tags or peptides. Future work will involve attachment of functionalized or conjugated gold or silica nanoparticles to these hybrid phages to directly use or assess biodrug scaffolding and delivery in an animal model.

Funder Acknowledgement(s): NSF-CREST (HRD-1241701).

Faculty Advisor: Alain Bopda-Waffo, abopdawaffo@alasu.edu

90
Subcategory: Microbiology/Immunology/Virology

Selective Macrolides can Regulate Virulence in Porphyromonas Gingivalis

Briana Moncur, Oakwood University
Co-Author(s): Jeffery Taylor and Elaine Vanterpool, Oakwood University
Hansel Fletcher, Loma Linda University

Porphyromonas gingivalis, a black-pigmented, Gram-negative anaerobe has been implicated in periodontal disease. P. gingivalis has also been linked to other diseases such as cardiovascular disease, bacterial pneumonia, diabetes mellitus, and low birth weight. Like other pathogens, it produces virulence factors that cause destruction in the host. The major virulence factors of P. gingivalis are the gingipains, Rgp and Kgp. The immune response to the presence of P. gingivalis virulence factors in the gingival epithelium can trigger the highly inflammatory environment of periodontitis. The general treatment for periodontitis includes the mechanical removal of biofilm, in conjunction with topical or systemic antibiotics. Patient non-compliance of antimicrobial use can lead to treatment failure due to the inability to achieve the minimal inhibitory concentration in the infected site.

In this study, the impacts of sub-inhibitory concentrations of the antibiotics chloramphenicol, clindamycin, erythromycin, azithromycin, tetracycline and metronidazole on gingipain activity were evaluated. We hypothesize that the sub-inhibiotry concentrations of protein synthesis inhibitor antibiotics, such as the macrolides, can inhibit or decrease the gingipain activities of P. gingivalis. Antibiotic-treated P. gingivalis were compared to the negative control, which were grown in the absence of antibiotics. Growth rates for P. gingivalis were determined spectrophotometrically (optical density at 600 nm [OD600]). The activity of Rgp and Kgp-specific cysteine protease activities were determined by measuring the hydrolysis of BApNA and ALNA substrates using a microplate reader (405 nM). Results: Sub-inhibitory concentrations of selected antibiotics inhibited Rgp activity by 20-50% and Kgp activity by approximately 10-30%, with macrolides showing the most inhibitory effects. These results indicate that macrolides may have clinical implications in inhibiting gingipain activity and preventing gingipain-induced damage during treatment of P. gingivalis infections.

Funder Acknowledgement(s): National Science Foundation funded S.T.E.M.E.R. program (Grant #: 0811507)/ National Institutes of Health, NIDCR Grant # (3RO1DE019730-04S1).

Faculty Advisor: Elaine Vanterpool, evanterpool@oakwood.edu

91
Subcategory: Microbiology/Immunology/Virology

Amphibian Cutaneous Bacteria Inhibit Human Fungal Pathogen Growth

Jacklyn Nguyen, California State University of Bakersfield
Co-Author(s): Kathleen Szick, California State University of Bakersfield

Previous research reveals that cutaneous bacteria on amphibians are protecting them against pathogens, such as the prevailing Batrachochytrium dendrobatidis (B.d.). It is hypothesized that bacteria isolates that previously demonstrated antifungal activity against environmental fungi may have inhibitory properties against human fungal pathogens. The sixty-one bacterial isolates were obtained from the skin of six bullfrogs and six toads from San Joaquin Valley in California (Ibarra & Szick, unpublished results). Five human pathogens: Epidermophyton floccosum (E.f.), Trichophyton mentagrophytes (T.m.), Microsporum gypseum (M.g.), Candida albicans (C.a.), and Cryptococcus neoformans (C.n.) were used to further test the antifungal potential of the amphibian cutaneous bacterial isolates. To test the hypothesis, challenge assays were carried out by streaking two bacterial isolates onto media plates that contained single plugs of individual fungi. For controls, we compared the bacterial isolates that were known to either inhibit the growth of the fungus or to have no inhibitory effects on growth of the fungus (positive and negative controls respectively). Challenge assays were repeated a minimum of three times. Results show that 72% of the bacteria inhibit the growth of M.g., 34% of C.n., and 16% of C.a.. To date, twenty-two of the sixty-one isolates have been challenged against E.f., 27% showed inhibition, and fifty-four of the sixty-one isolates have been challenged against T.m.; 52% showed inhibition. A majority of the isolates do show antifungal properties supporting our hypothesis. The need for new and naturally occurring antibiotics is rapidly growing due to resistance to certain pathogens, and the study of fungal inhibition could be a beneficial stepping-stone for curing those pathogens.

Funder Acknowledgement(s): The author gratefully acknowledges financial support from NSF under grant HRD-0331537 (CSU-LSAMP).

Faculty Advisor: Kathleen Szick, kszick-miranda@csub.edu

92

Subcategory: Microbiology/Immunology/Virology

Immunomodulatory Effects of IMP10 Peptide on IL-12 Levels in NZBWF1 Mice

Manelisi Victor Nhliziyo, Tuskegee University
Co-Author(s): SA Miller, SC Henley, FR Davis, JM Jaynes, and Marcia Martinez, Tuskegee University
H. Lopez, MuriGenics, Inc., Vallejo, CA

Systemic lupus erythematosus (SLE) is a chronic, inflammatory, multisystem disorder caused by aberrant immune responses. Cytokines often play direct roles in SLE pathogenesis, with abnormal levels of multiple cytokines present in the sera of SLE patients. Cytokines are pleiotropic and have multiple roles in the regulation of systemic inflammation, local tissue damage, and immunomodulation. An example of this is the pro-inflammatory cytokine, interleukin 12 (IL-12). Intrathymically, IL-12 is reported to promote apoptosis among the CD4+ CD8+ TCRlo triple positive (TP) thymocytes. However, IL-12 is well documented to favor T-helper differentiation into Th1 effector cells in the periphery. Elevated IL-12 levels are reported in individuals with active SLE and are associated with increased renal and pulmonary damage. Thus, modulation of IL-12 levels may be a viable target for treatment of SLE disease symptoms. Synthetic peptides designed to have immunomodulatory and anti-inflammatory effects in vivo provide a promising avenue as SLE therapeutics. IMP10 is a derivative of the synthetic lytic peptide D2A21. Previous studies showed that administration of IMP10 in models of pulmonary fibrosis resulted in a 10-fold reduction in circulating IL-12 levels.

Thus, we hypothesized that administration of IMP10 will reduce IL-12 levels and alleviate SLE symptoms in the lupus-prone NZBWF1 mouse. Female NZBWF1 mice were separated into two groups (pre- and post-diseased). Half of the animals within each group were treated intra-peritoneally with 154µM IMP10 peptide solution. The other half (controls) were injected with 100 µl of sterile saline. Pre-diseased animals and post-diseased animals were treated at ages 10 and 18 weeks, respectively. All treatments were delivered subcutaneously. Blood was collected bi-weekly and the sera analyzed for the presence of IL-12 and anti-DNA antibodies. Animals were humanely euthanized, and the kidneys, lungs, hearts, brains and spleens collected for histopathological analyses. We predict that IMP10 peptide treatments will significantly reduce IL-12 concentrations in the sera thereby reducing the organ damage seen in chronic SLE disease in NZBWF1 animals.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the NIH awarded to Marcia Martinez, Principal Investigator (G12RR003059/G12MD007585) and director for the MARC U*STAR Program at Tuskegee University, Tuskegee, AL, 36088(5T34GM087254-04).

Faculty Advisor: Marcia Martinez, mmartinez@mytu.tuskegee.edu

93

Subcategory: Microbiology/Immunology/Virology

Identification of Microcrustaceans as Predators of Batrachochytrium Dendrobatidis

Jose Orozco, California State University, Bakersfield
Co-Author(s): Nanse Mendoza, California State University, Bakersfield

Amphibian populations are declining rapidly worldwide due to habitat destruction and, more recently, because of the emergence of the amphibian pathogen Batrachochytrium dendrobatidis (Bd) (Kriger and Hero, 2006; Woodhams et al., 2011). Freshwater environments, such as ponds and lakes, have also been altered (introduction of mosquito fish, shrimp, nutrients, pollution etc.) by humans and, ultimately, eliminating many microcrustacean species that are natural predators of Bd-zoospores (Sarnelle and Knapp, 2004). Microcrustacean diversity was monitored throughout the seasons via molecular techniques and microscopy. Water and soil samples were taken in the spring, summer, fall and winter of 2011/2012. After DNA extraction, microeukaryote diversity was assessed by PCR followed by Denaturing Gradient Gel Electrophoresis (DGGE) (Yan et al., 2006), and different microcrustacean species that belonged to Cladocerans, Copepods and Ostracods were identified by microscopy from five ponds in the Southern San Joaquin Valley and the foothills of the Sierra Nevada in California. Four out of five ponds were also Bd-positive (fall samples only) when investigated with molecular methods (PCR with Bd-specific primers). We hypothesized that micro-crustacean diversity in Bd negative ponds and seasons would be different from microcrustacean diversity in Bd positive ponds which was indeed the case when all samples were evaluated. However, feeding experiments are being performed this year in order to prove that certain microcrustaceans are feeding on the Bd zoospores when presented with mixed diets of spores and algae.

References: Kriger, K.M. and J.M. Hero. 2006. Large-scale seasonal variation in the prevalence and severity of chytridiomycosis. *Journal of Zoology*. 271: 352-59.
Sarnelle, O. and R. A. Knapp. 2004. Zooplankton recovery after fish removal: Limitations of the egg bank. *Limnology and Oceanography*. 49: 1382-1392.

Yan, Q.Y., Y.H. Yu, W.S. Feng, W.N. Deng, and X.H. Song. 2006. Genetic diversity of plankton community as depicted by PCR-DGGE fingerprinting and its relation to morphological composition and environmental factors in Lake Donghu. *Microbial Ecology*. 54: 290-97.

Woodhams D, Bosch J, Briggs CJ, Cashins S, Davis LR, Lauer A, Muths E, Puschendorf R, Schmidt BR, Shaefor B, Voyles J. 2011. Mitigating Amphibian Disease: Strategies to maintain wild populations. *Frontiers in Ecology*. Accepted April 2011.

Funder Acknowledgement(s): Louis Stokes Alliances for Minority Participation.

Faculty Advisor: Antje Lauer, alauer@csub.edu

94

Subcategory: Microbiology/Immunology/Virology

Detection of Oil Spill Microbe in Shrimp Species of the Gulf of Mexico

Keith A. Perkins Jr., Southern University at New Orleans
Co-Author(s): Illya Tietzel, Southern University at New Orleans

In 2010, the largest oil spill in American history occurred which allowed alkane degrading microbes present in the Gulf of Mexico (GOM) to possibly grow in larger quantities that could offset the ecosystem. Alcanivorax borkumensis is an alkane degrading microbe that is naturally present in the GOM ecosystem. Farfantepenaeus aztecus and Litopenaeus setiferus are two species of Penaeid shrimp which are vital to the GOM ecosystem. Preliminary data showed that A. borkumensis has been found in the gut of fish in the GOM. Based on these findings the hypotheses arose if A. borkumensis inhabits shrimp gut and if these microbes are causing the species harm. In order to test these hypotheses many methods were used. Various DNA isolation kits were used to find the most effective procedure to isolate microbial DNA from the gut of shrimp. As positive control of gut content that contains DNA, the fish Brevoortia patronus was used. As positive control of DNA of A. borkumensis pure cultures of this microbe were employed. Gel electrophoresis (GE) was done to analyze the quality and amount of DNA isolated from the different kits. The most efficient kit for isolating A. borkumensis DNA was used for recovering of the microbial DNA in shrimp of unknown colonization status with A. borkumensis. For the detection of A. borkumensis Polymerase Chain Reaction (PCR) using primers specific for alkane degradation such as alkB1 and alkB2 were used. As negative control served reactions with no template DNA, as positive control served DNA isolated from A. borkumensis. GE was used to assess whether the specific PCR product was formed. The shrimp used in this study originated from South Louisiana.

The results were as follows: DNA isolation using B. patronus showed that Microbial DNA Isolation kits yielded the most DNA. Isolation of DNA from a pure A. borkumensis culture revealed that Fecal DNA Isolation kit yielded the most microbial DNA. Thus, the fecal kit was used on unknown shrimp samples. AlkB1 PCR of shrimp samples showed that F. aztecus #3 was positive for A. borkumensis. alkB2 PCR suggested that the negative control generated false positives. In conclusion, colonization of shrimp with A. borkumensis is unclear and its effect has not been identified. In the future, shrimp will be inoculated with A. borkumensis to troubleshoot the false positives and to assess if A. borkumensis could colonize the shrimp's intestine.

Funder Acknowledgement(s): This research was funded by the NSF award DBI-1040966 of I. Tietzel.

Faculty Advisor: Illya Tietzel, ITietzel@suno.edu

95

Subcategory: Microbiology/Immunology/Virology

Genetic Detection of Bacterial and Algal Communities Associated with HAB

Alicia Romero, Cal Poly San Luis Obispo/ Oxnard College
Co-Author(s): Tiffany Sidwell, UCLA

Jason Nefalar, Duan Nguen, and James Harber, Oxnard College
Erick Izaguire, CSUCI, Camarillo, CA

Much of southern California's coast is home to thriving bacterial communities capable of supporting growing numbers of detectable harmful algae blooms (HABs) that are responsible for poisoning of fish, seizures in marine mammals and Amnesic Shellfish Poisoning in humans. The symbiosis between the algae and bacterial communities is maintained by an exchange of nutrients including NH3 from nitrogen-fixing bacteria such as Vibrios. Seashore collected water samples from Ventura County and nearby North Los Angeles regions were verified to contain a number of the bacterial isolates, including Vibrio parahemolyticus, and neurotoxin producing algae species, Pseudo-nitzschia, and Lingulodinium polyedrum using real time PCR. Bacterial isolates were also verified carriers of the beta-lactamase (ampicillin resistance) gene through real time PCR, suggesting that horizontal gene transfer had occurred between the aquatic bacterial communities and terrestrial sources. Methods for genetic detection of the toxic algae species was accomplished with a protocol of seawater filtration, DNA extraction, purification, and quantitation followed with real time PCR amplification using species specific primers. Bacterial isolates were prepared through filtration, selection on MacConkey's agar, replica plating onto ampicillin tryptic soy agar, and single colony isolation. This provided the starting material for the DNA extraction for real time PCR. Amplified 16S rRNA and ampicillin resistance sequences were quantified and sequenced to allow identification of the bacterial isolates by BLAST submission and confirmation using traditional microbiology. Further investigation of bacterial communities and an expansion of this research may provide a basis for the utilization of genetic markers for indicator species to detect HABs and the bacterial communities that correlate with them.

Funder Acknowledgement(s): Oxnard College STEM

Faculty Advisor: Jane Lehr, jlehr@calpoly.edu

96
Subcategory: Microbiology/Immunology/Virology

Assessing Biomarkers of Oil Spill Weathering Along LA Shoreline

Joy Semien, Dillard University
Co-Author(s): Sean Wilson, James Watson, and Tequila Richard

The Deep water Horizon oil spill was the largest accidental marine oil spill to occur in Petroleum history. As a result of this catastrophe many of the coastal states were negatively impacted loosing over 10 billion dollars economically, 8,000 marine species, and damaging over 16,000 miles of coastal ecology. After three years, Ecological damages are still evident today; there is currently no basis to determine the long term ecological damages of the Gulf of Mexico and its shorelines. As REU researchers, we will assess biomarkers of the oil spill along the Louisiana coastlines through quantitative air and water testing. Our research is part of a collaborative program with Dillard University REU program and the University of Colorado's at Boulder Civil, Environmental, Architectural, and Engineering Department. Samples will be taken off the coastline of Louisiana near Grand Isle and Chauvin, La. We will rate the project success by assessing the collected data and comparing the data to other scientific studies in order to develop a key understanding of the possible long term effects of the BP oil spill. Our overall expectation of the completion of the project is that it will display key components of ecological damages along the Louisiana Coastline, as well as provide student researchers with the oppor-tunity to build professional and academic characteristics. Future research considerations include examining negative long term impact on the genotoxcity of mammalian cells as a result of over exposure to crude oil and dispersants from the BP oil spill.

Funder Acknowledgement(s): Our project is funded by a grant received from the National Science Foundation.

Faculty Advisor: Bernard Singleton, bsingleton@dillard.edu

97
Subcategory: Microbiology/Immunology/Virology

The Role of IL-12 on Thymocyte Apoptosis in the TNC Microenvironment

Rosemarie Somers, Prairie View A&M University/Tuskegee University
Co-Author(s): Sonni Ali Miller, Sheryce Henley, Floyd Davis, J'sanai Wheeler, and Marcia Martinez,Tuskegee University

Systemic lupus erythematosus (SLE) is an autoimmune disease that presents more frequently in women particularly those of African, Hispanic or Asian descent. SLE results from a loss of tolerance to multiple self-antigens, and is characterized by autoantibody production and inflammatory cell infiltration in target organs, such as the kidneys and brain. Understanding mechanisms associated with this loss of self-tolerance may lead to the development of more effective therapies and treatments for SLE. Thymic nurse cells (TNCs) are cortical epithelial cells of the thymus that appear to play a significant role in central tolerance during T cell education in the thymus. TNCs specifically interact with and internalize CD4+CD8+TCRlo triple positive (TP) thymocytes. These thymocytes are at the developmental stage where they undergo MHC restriction, a process where the cells learn to recognize self MHC-antigen. Approximately 95% of TP thymocytes that interact with TNCs become apoptotic and are degraded in the TNC cytoplasm. TP thymocytes are reported to be non-responsive to a variety of cytokines, yet responsive to IL-12. Although IL-12 promotes pro-inflammatory responses in the periphery, it influences the deletion of TP thymocytes in the thymus.

Therefore, we hypothesized that IL-12 may play a role in apoptosis among TP thymocytes in the TNC microenvironment. To demonstrate this timed TNC-thymocyte co-cultures were prepared in the presence and absence of recombinant IL-12. TNCs were replaced by macrophages in control co-cultures since the latter cell type is known to release IL-12 when stimulated. Culture media collected were analyzed by ELISA for secreted IL-12 and thymocytes collected were co-stained with fluorescently conjugated antibodies against CD4 and CD8, Annexin V and the viability stain 7AAD. Stained cells were analyzed by flow cytometry. It was observed that higher levels of IL-12 were released in cultures containing TNCs and thymocytes when compared with control cultures or those containing only TNCs or thymocytes. Surprisingly, when IL-12 concentrations were high apoptosis was 50% less among TP thymocytes co-incubated with TNCs than among thymocytes cultured alone or with macrophages. Ongoing experiments will analyze if reduction in apoptosis among TP thymocytes results from a decrease in IL-12 receptors on these cells.

Funder Acknowledgement(s): The project described above was supported by the IBS-REU Program DBI-1263207 Grant and the RCMI # 2G12RR003059-21A1 at Tuskegee University. I acknowledge the members of the Martinez lab at Tuskegee University: Sonni A Miller, Sheryce Henley, Floyd Davis, J'sanai Wheeler and Marcia Martinez. Thank you for your support.

Faculty Advisor: Marcia Martinez, mmartinez@mytu.tuskegee.edu

98

Subcategory: Microbiology/Immunology/Virology

Phylogenetic Analyses of Streptococcus Parauberis from Fish and Cattle

Keaira Thornton, Norfolk State University
Co-Author(s): Ashley Haines, Norfolk State University

Streptococcus parauberis is a gram-positive lactic acid bacterium that infects cattle and fish, which can negatively impact dairy and aquaculture fisheries. Recently it has become an emerging pathogen in these industries. In this work, nucleic and amino acid sequences of multiple housekeeping genes from fish and cattle isolates were analyzed. These gene sequences were used to construct phylogenetic trees using publicly available software. We hypothesized that analysis of multiple genes will better predict the closest relative to S. parauberis than the previous single gene analyses. In addition, amino acid sequences may further clarify our proposed phylogenies.

Our data suggest that S. parauberis may be more closely related to Streptococcus iniae (a fish pathogen) than to Streptococcus uberis (a cattle pathogen), the two model species that are most closely related to S. parauberis. These phylogenetic analyses improve our understanding of the evolutionary relationships between related bacterial species from different animal hosts. Focusing on the molecular epidemiology of S. parauberis will help explain how different host species are infected and may help prevent future outbreaks.

Funder Acknowledgement(s): Thurgood Marshall College Fund-DOD grant to NSU /STARS- National Science Foundation Grant #0714930.

Faculty Advisor: Ashley Haines, anhaines@nsu.edu

99

Subcategory: Physiology and Health

Effects of Exercise in Gilts During the Last 10 Days

Alexandria Bufford, Tuskegee University
Co-Author(s): Nathalie Trottier, Michigan State University, Lansing Michigan SROP (Summer Research Opportunities Program)

In the swine industry, loss of piglets during farrowing (birth) is a big issue, due to dystocia. This can be caused by piglets being too large, the sow's birth canal being too small, or the sow's inexperience with delivering piglets. This in turn puts the piglets at risk of being a still born or being born with trauma due to loss of oxygen. 70% of swine farms use a crate system during gestation, which prevents the sows from moving around, instead of a loose housing system which permits more movement. Our main concern is in gilts which are young sows having their first litter of piglets. Due to their inexperience with delivering piglets, our focus in this study is to investigate the effects of exercise during the last 10 days of gestation on dystocia in gilts. With more research in the exercising of sows and the effects on farrowing time and piglet health industry might shift towards a loose housing system to allow for more movement for the sows during gestation. There were 13 sows in the study which were due to farrow between July 11th and July 16th. The control and experimental groups each had various gilts due on different days. Each gilt was exercised the last 10 days of gestation for 20 minutes each day, twice a day. Once the 10 days of exercise was over each gilt was loaded into the farrowing crates and monitored during farrowing. Exercised gilts showed greater overall performance than the control. Control had an average piglet weight of 6.45 ± 4.7, average number of alive piglets 12.8 ± 4.7, average number of mummified piglets 8.1 ± 6.0, average percent of still born piglets 8.9 ± 6.0, and average percent of total alive piglets 83.0 ± 13.7. The exercised group had and average weight of 7.15 ± 1.3, average number of alive piglets 11.8 ± 2.8, average number of mummified piglets 1.5 ± 3.4, average number of stillborn piglets 0, and average percent of total alive piglets 98.5 ± 3.4. As well as overall litter performance and individual gilt performance, the control group had 60% of gilts induced and the exercised gilts had 20%.

Exercising gilts during the last two weeks of gestation improved litter performance and decreased the causes of dystocia.

With the data collected, this project provides a good start for a larger scale research study to collect data on a larger number of animals and to do statistical test for significant differences. With more evidence for increased movement during gestation, the overall hopes for this project is to improve industries piglet survival rate during farrowing and to hopefully move industries crate housing system to a loose housing system.

In the future, I hope to elaborate on the project with a larger sample size to allow for statistical analysis and to see if the results can be replicated. I would like to thank Dr. Nathalie Trottier from Michigan State University in the Animal Science Department for having me, and the SROP Program (Summer Research Opportunities Program) for giving me the opportunity.

Funder Acknowledgement(s): Becon Center for the Study of Evolution in Action.

Faculty Advisor: Richard Whittington, whittingtonr@mytu.tuskegee.edu

100

Subcategory: Physiology and Health

Effects of Interrupted Development on the Immune System of Megachile Rotund

Jerresia Edwards, Mississippi Valley State University
Co-Author(s): Kendra Greenlee and Sara Cummings, North Dakota State University
George Yocum, Joseph Rinhart, and William Kemp, United States Department of Agriculture (USDA), Fargo, ND

Megachile rotundata, commonly known as the alfalfa leafcutting bee, is a key alternative pollinator. Farmers store pupal M. rotundata over the winter inside a 6˚C incubator and then place the pupal bees into incubators at 29˚C to initiate adult development. Their goal is to time adult bee emergence with crop blooms. Factors such as weather can delay crops from blooming. To slow down bee emergence for better timing, farmers use a treatment called static thermal regime (STR). STR is an interrupted storage treatment which the bees are taken from 29˚C incubator, then placed into a 6˚C incubator for a week, and afterward returned to 29˚C to continue development. This delay usually results in a higher mortality rate. An alternative method to STR, fluctuating thermal regime (FTR), yields better survival. FTR is similar to STR except that when bees are at 6˚C, they receive a daily one hour pulse of heat at 20˚C. Although the survival rates of bees in FTR are better, we still do not know whether those bees are as healthy as untreated bees. To test how the temperature treatment affects bee immunity, we infected developing bees with E.coli. We compared untreated M.rotundata to those reared in both reared in both STR and FTR. After infecting them, we tracked their survival and development times during infection. Interrupting development with STR and FTR treatments affected survival and development times during infection. However, it is unclear from our results whether FTR or STR is better for bee health.

Funder Acknowledgement(s): This study was supported, in part, by the following grants: NSF-HBCUP-II, NSF IOS-0953297, and USDA ARS Fargo, ND awards.

Faculty Advisor: Rachael Beecham, rvbeecham@yahoo.com

101

Subcategory: Physiology and Health

Measurement of Hair Nicotine in Swiss Webster Mice Exposed to Cigarette Smoke

Trenton Frisbie, California State University Stanislaus
Co-Author(s): My Lo Thao, Flora Watson, and Scott Russell, California State University Stanislaus

Exposure to cigarette smoke is a worldwide public health problem. Cigarette smoke is a mixture of chemicals, the majority of which have a detrimental effect on the body at the physiological and cellular levels. The effects of chronic cigarette smoke exposure on hormone secretions are mediated by the pharmacological action of nicotine and other toxins found in cigarette smoke. Exposure to cigarette smoke can be first-, second-, or third-hand smoke. First-hand cigarette smoke (FHS) is the inhaled smoke from the filter or mouthpiece end of a burning cigarette. Second-hand cigarette smoke (SHS) is a mixture of two forms of smoke produced by burning tobacco: sidestream or mainstream smoke. Side stream smoke is smoke from the lighted end of the cigarette, cigar, or pipe. Mainstream smoke is the smoke exhaled by a smoker. Third-hand cigarette smoke (THS) is often smelled but not seen after tobacco has been smoked. THS encompasses the environment in which smoking has occurred as well as the chemical residues that coat all indoor surfaces such as walls, carpet, and furniture.

The aim of this study will be to determine the levels of nicotine absorbed by mice during exposure to FHS, SHS, and THS by measuring nicotine levels. We hypothesize that nicotine absorbed by mice exposed to FHS, SHS, and THS will be detected as nicotine in their hair. Previous studies have supported the use of hair as a biological indicator of substance abuse or exposure to environmental pollutants such as tobacco smoke. The most commonly used biomarker for FHS, SHS, and THS is nicotine in human body fluids such as urine, saliva, and serum. Several studies indicate that hair nicotine concentration is a useful biomarker of long term smoke exposure. Mice were randomly divided into experimental (FHS, SHS, and THS) and control groups. The experimental mice were exposed to either first-second-, or third- hand cigarette smoke once a day, five days a week, for eight months. Hair samples were collected by shaving the legs of the mice to obtain approximately 0.003 g. The amount of nicotine in the hair samples will be determined using an isotope dilution gas chromatography-mass spectrometry (GC/MS). Using this isotope dilution method we expect the chromatograms to show high nicotine levels in the experimental groups as compared to the control group. In the future of this study we will be analyzing previously collected hair samples obtained from mice exposed to FHS, SHS, and THS using gas chromatography-mass spectrometry (GC/MS).

Funder Acknowledgement(s): Louis Stokes Alliance for Minority participation in Science, Engineering, Mathematics, and Technology, California State University, Stanislaus. Central Valley Math and Science Alliance, California State University, Stanislaus. Research Scholarship Creative Activity, California State University, Stanislaus.

Faculty Advisor: My Lo Thao, mthao@csustan.edu

102

Subcategory: Physiology and Health

Investigating the Functional Significance of the Thalamocortical Tract

Christian Jaques Hissom, University of California, San Diego
Co-Author(s): Jim Conner, Dominic Pittman

Contrary to popular perception, our brains are not simply static systems that process and respond to external stimuli, but are constantly adapting themselves in a dynamic fashion. One area of the brain that has been an ideal model for studying learning and associated brain plasticity is the primary motor cortex. In this study, our goal is to evaluate how distinct populations of neurons in the thalamus and primary motor cortex contribute to learning and performance of skilled motor tasks in rodents. Thalamocortical inputs to the motor cortex are postulated to relay information from a variety of nuclei that mediate and coordinate motor performance, including the basal ganglia and cerebellum. Corticospinal neurons are the sole source of neuronal output to the spinal cord from the cortex and are postulated to play a direct role in skilled motor learning in rats. Prior studies attempting to define the function of these neuronal systems in skilled motor behavior have involved ablation strategies that resulted in damage to non-target cell populations, thus confounding the interpretation of experimental findings. The goal of the present study is to use a novel viral approach to selectively eliminate distinct populations of neurons implicated in motor function and examine subsequent changes in motor performance. It is postulated that behavioral changes will occur that restrict proper task performance and inhibit motor adaptation.

Funder Acknowledgement(s): NIH, MARC scholarship.

Faculty Advisor: Jim Conner, jmconner@ucsd.edu

103

Subcategory: Physiology and Health

The Use of Ultrasound to Control Ram's Horn Snails in Aquaculture

Mika Krienke, Mississippi Valley State University
Co-Author(s): Rachel Venn Beecham, Mississippi Valley State University
Bradley T. Goodwiller and James P. Chambers, National Center for Physical Acoustics, University of Mississippi

Using acoustics to improve aquaculture production was pursued on the possible use of ultrasound to control the ram's horn snail which is a host for the Bolbophorus trematode in commercial catfish ponds. The work presented here investigates snail elimination via exposure to high amplitude ultrasound. After initial laboratory tests indicated that a commercially available sonicator (operating at 20 kHz) is capable of killing individual snails in fish tanks nearly instantaneously, this study was undertaken to determine if the length of time snails were sonicated would affect the mortality rate. Tanks were set up with 20 snails in each and then sonicated for 0 (control), 30, 45, or 90 seconds. The number of snails that were killed were counted on day 0, 1, 2, and 5 post sonification. Significant differences between the control and sonicated tanks were found, but no difference was found in mortality for any of the other trial times. Field studies need to be conducted to see if the technology will work under pond settings as well as in a tank.

Funder Acknowledgement(s): This study was partially funded through NSF HBCU-UP II.

Faculty Advisor: Rachel Beecham, rvbeecham@yahoo.com

104

Subcategory: Physiology and Health

The Therapeutic Use of Atropine in Diabetic Neuropathy

Andre J. Mota, University of California, San Diego
Co-Author(s): Katie E. Frizzi and Nigel A. Calcutt, University of California, San Diego

Diabetic neuropathy, a neurological complication of diabetes, is associated with significant rates of morbidity and mortality. Since limited therapeutic approaches currently exist for diabetic degenerative neuropathy, we investigated the efficacy of novel therapeutic approaches. Specifically, we focused on the use of atropine, an alkaloid and commonly-used drug that affects the autonomic nervous system. To investigate the therapeutic potential of atropine, insulin-dependent (type-1) diabetes was

induced in mice via injection of streptozotocin (STZ), producing insulin deficiency and hyperglycaemia within 3 days. Atropine was applied daily to the eyes and feet of mice and testing for neuropathy was performed on the 4th and 8th weeks of the study. Severity of neuropathy was determined by assessing paw sensitivity to touch and heat and by measuring nerve conduction velocity. Corneal nerve fibers were also measured throughout the study in live animals by corneal confocal microscopy (CCM). At the end of the study, we will also measure cutaneous innervation of skin biopsies to detect any differences in epidermal innervation by calculating intra-epidermal and sub-epidermal nerve fibers (IENF and SNF). These assays will provide accurate, quantifiable information about degenerative neuropathy in the small sensory fibers innervating the skin and cornea. The preliminary results of our study suggest that atropine may prevent onset of degenerative neuropathy in diabetic mice, supporting use of this drug as a possible therapeutic approach to the treatment of diabetic neuropathy.

Funder Acknowledgement(s): Amgen Scholars Program; California Louis Stokes Alliance tor Minority Participation (CAMP) in Science, Engineering and Mathematics Program; Initiative for Maximizing Student Diversity (IMSD).

Faculty Advisor: Nigel Calcutt, ncalcutt@ucsd.edu

105

Subcategory: Physiology and Health

A Comparison of Vitamin D Deficiency in Adult Patients

Charles Newton, Southern University in Shreveport, LA
Co-Author(s): Marius T. McFarland

Hypovitaminosis D is a deficiency of vitamin D. It can result from inadequate nutritional intake of vitamin D coupled with inadequate sunlight exposure, disorders that limit vitamin D absorption and conditions that impair the conversion of vitamin D into active metabolites including certain liver, kidney, and hereditary disorders. Deficiency results in impaired bone mineralization and leads to bone softening diseases including rickets in children and osteomalacia and osteoporosis in adults. It was desirable to do a study due to the increased number of patients who were diagnosed with Hypovitaminosis D. This preliminary study is designed to establish patterns or factors which affect the incidence of Vitamin D Deficiency as well as to compare levels of Vitamin D Deficiency in adult patients. The data was analyzed to determine patterns of Vitamin D deficiency by age groups and gender. Patients were selected from a data bank of a local primary care clinic. Researchers studied demographic information including age, race and sex of patients as well as levels of Vitamin D in the body as possible factors in Vitamin D metabolism. Results of these findings were divided into three categories based upon severity of the Vitamin D deficiency in order to obtain an adequate amount of information and to possibly develop a correlation between the different cases of Vitamin D Deficiencies. The different levels were Mild, Moderate, and Severe. Furthermore, review of data to identify a possible connection between skin pigmentation and Vitamin D absorption was proposed.

Through the course of the preliminary study of 63 adult patients between the ages of 20-99, there was a noticeable pattern between the different levels of deficiency as well as a noticeable relationship between the genders and their age groups. The age group of 50-59, had the highest number of occurrences of mild and severe cases of Vitamin D deficiency, while the age group of 60-69 had the highest number of occurrences of deficiency overall and the highest number of moderate levels of Hypovitaminosis D. The women in the two age groups 50-59 and 60-69 had the highest occurrences of Vitamin D Deficiencies. While the men had a high level of occurrences in the age groups of 50-59 and 70-79. Though the women overall had the most cases throughout the entire experiment. The most astonishing factor was that the age group 50-59 had slightly more than half of the total number of patients used for the overall analysis.

Funder Acknowledgement(s): Office of Multicultural Affairs, Louisiana State University Health Science Center.

Faculty Advisor: Barry Hester, bhester@susla.edu

106

Subcategory: Physiology and Health

Effects of a ß-Adrenergic Antagonist On Spatial Memory In Birds

J'undra Pegues, University of Mississippi
Co-Author(s): Taylor Williams, Amy Hribar, and Lainy B. Day, University of Mississippi

ß-adrenergic blockers, such as propranolol, impair memory in mammals due to the reduction of stress during memory consolidation which reduces the emotional enhancement of memories. In mammals, both acute and chronic propranolol, impair spatial memory, exploratory behavior, and memory for place recognition. Studies in birds have also shown propranolol reduces discriminative and passive avoidance memory, but we know of no studies of propranolol induced spatial memory deficits in birds. Thus, the current experiment tested the hypothesis that propranolol reduces spatial memory in zebra finches (ZF) as it does in mammals.

To test spatial memory in mammals, the Morris Water Maze (MWM) is used. Rodents are trained to find a submerged platform in a homogenous appearing pool of opaque water using external cues, such as posters on the wall. We use the Day Escape Maze, a dry maze analog of the MWM, where birds must escape a hot plate by locating a 2”d hole in a clear Plexiglas arena. ZFs (24 females) were trained for 4 trials per day for 4 days. On day 4, after training, we conducted a 120s "probe trial". During the probe, the arena lacks an escape hole, and the cues surrounding the maze are rotated 180°. If spatial learning occurs, birds attempt to escape 180° from the original escape. On day 5, zebra finches completed 1 reactivation trial and 5 min later received IC injections of saline, 20 mg/kg propranolol, or 40 mg/kg of propranolol. Memory was tested 24 hours, 72 hours, and 1 week post injection. Two of these females were then given another reactivation trial 1 week later followed by an 80mg/kg dose of propranolol after 5 min. These subjects experienced respiratory stress, tremors, and ataxia but recovered and memory was tested 8 days post injection. We measured distance as well as duration to escape and escape velocity. No group differences were seen in any dependent measures during training, reactivation trials, or memory. All birds spent more time in the quadrant 180° opposite of the correct quadrant during the probe trail($t[48]=7.204$, $p< 0.00$). Even birds given 80mg/kg, exhibited no memory deficits between the reactivation trial and 24 hours post injection.

Thus, propranolol does not appear to block spatial memory consolidation in ZF. Avian species vary in ß -adrenoreceptor concentration in the area of the brain involved in spatial memory, the hippocampus (HP), and we are unaware of these concentrations in ZF HP. ß -adrenoreceptors are high in the avian arcopallium, a brain region involved in fear condition that is homologous to the human amygdala. A role of propranolol in fear conditioning in ZF would parallel the roles of propranolol in reducing memories for fearful stimulus in human soldiers with PTSD. Alternatively, we are investigating the levels of α-adrenoreceptor in ZF HP to determine if a selective α-adrenergic antagonist would be more likely to reduce spatial memory in ZFs.

Funder Acknowledgement(s): LSAMP, The University of Mississippi.

Faculty Advisor: Lainy Day, lainyday@gmail.com

107

Subcategory: Physiology and Health

Effect of Cold Atmospheric Pressure Plasma on Regenerating Tissue

Adonis T. Rivie, William Paterson University
Co-Author(s): Raphael Ezduemoihm, Kevin Martus, and Jaishri Menon, William Paterson University

Atmospheric pressure plasma has applications in wound healing, sterilization and treating diseases. The plasma jet can generate reactive oxygen species (ROS) such as atomic oxygen, superoxide, peroxide, and hydroxyl radicals. Significance of using exogenic nitric oxide (NO), another free radical generated by discharge plasmas, in therapeutic medicine has also been realized. In this context, plasma stimulated endogenous production of NO within the tissue cannot be ruled out. Our preliminary studies have shown that plasma exposure to tail amputation site in tadpoles, Xenopus laevis increases rate of growth of the regenerating tail.

We hypothesize that the effect of plasma on wound healing and growth of the regenerating tail could be partly by a) increased endogenous NO production and b) stimulation of vascular endothelial growth factor (VEGF). Tail amputation was carried out by removing 40% of tail and the amputated region was immediately exposed to helium plasma for trials of 40 and 60 seconds. The plasma was generated inside a quartz tube with a single electrode powered by an AC voltage (15kHz) having peak-to-peak voltages of 18kV. The feedstock gas was Helium flowing at 50 sccm that ultimately produced optically emitting species in the discharge region that included Helium, Nitrogen and OH radicals. In situ staining for NO and immunohistochemistry for nitric oxide synthases, neuronal (nNOS) as well as inducible (iNOS) and VEGF was carried out 24 h and 5 days post amputation.

Our results show that the closure of the wound, reepithelization, as well as rate of growth of the regenerating tail was faster in plasma treated tadpoles. In situ staining for NO indicated its increased production which might be responsible for increased VEGF production. Increased number of nNOS and iNOS positive cells in regenerate of experimental tadpoles might be attributable to role of NO in cell communication, stress and angiogenesis. Future studies will be directed towards identifying other free radicals following exposure to plasma.

Funder Acknowledgement(s): This material is based in part upon work supported by the National Science Foundation under Grant Number 1040108.

Faculty Advisor: Jaishri Menon, menonj@wpunj.edu

108

Subcategory: Physiology and Health

Too Young for a Stroke? College Students' Perceptions About Stroke

Emmanuel Sims, Southern University at Shreveport/ LSU Health Center
Co-Author(s): Alicia Thomas, Woodlawn High School, Shreveport Louisiana
Adam Dodd, Caddo Magnet High School, Shreveport Louisiana

A stroke, also known as a "brain attack", is a type of cardiovascular disease (CVD) that occurs when the brain is unable to get the blood it needs. While stroke most often occurs in older individuals, anyone can have a stroke at any time and at any age. There are two types of stroke: ischemic and hemorrhagic. Ischemic strokes are rare in individuals from 18 to 45 years of age, but can occur, with recent estimates of 4.9% of all strokes in the United States. Strokes can cause negative long-term physical and mental effects, most of which can be even more detrimental if presented during young adulthood. Young adults do not generally consider themselves at risk of having a stroke. However, many risk factors that can potentially lead to onset of stroke are common among college-aged individuals, including hypertension, obesity, migraine, diabetes, and smoking. Additionally, cardiovascular risk factors can present in young adulthood, increasing stroke risk. A recent population-based research study determined that substance abuse significantly increases the chance of stroke, and regular use of nicotine, cocaine, and alcohol have been proven to be associated with both ischemic and hemorrhagic stroke. Other drugs, such as amphetamines, have been associated with hemorrhagic stroke events. The purpose of this survey research was to assess the level of stroke awareness among college-aged students (aged 18 to 30).

Funder Acknowledgement(s): Jeanie McGee, DHEd, MSHS, CCRC4/Robert Schwendimann, MD4/Alireza Minagar, MD, CCPI4.

Faculty Advisor: Barry Hester, bhester@susla.edu

109
Subcategory: Physiology and Health

BPA Disrupts Conduction Velocity and Regeneration in Lumbriculus Variegatus

Araik Sinanyan, Humboldt State University
Co-Author(s): Bruce A. O'Gara, Humboldt State University

Bisphenol A (BPA) is a carbon-based synthetic compound used to make certain plastics that are common in consumer goods. Recent studies have shown BPA to exhibit hormone-like properties, which has raised concern for its possible hazards. The ability of Bisphenol A to disrupt both neurological function and regeneration were examined in the freshwater oligochaete worm, Lumbriculus variegatus. Worms can avoid predator attacks via a rapid shortening response mediated by the medial and lateral giant nerve fibers. Lumbriculus also possesses an extraordinary ability to regenerate lost body parts, such as might occur after a partially successful predator attack. Non-invasive electrophysiological testing showed that immersion in water containing 10 µM BPA led to time- and concentration-dependent reductions in the conduction velocities of the medial and lateral giant nerve fibers. Exposure to 10 µM BPA, measured in 24 hour increments, produced significant reductions in giant fiber conduction velocities (n = 8). To monitor regeneration, worms were cut into three equal parts and then exposed to BPA concentrations of 10 µM, 25 µM, and 50 µM (n = 8 worms per concentration). The regenerating ends were photographed and measured for growth using ImageJ. BPA exposure produced concentration-dependent reductions in the amount of regeneration present from cut surfaces. BPA induces conduction velocity reduction that could reduce the ability of the worm to escape predators, while its effects on regeneration disrupt the ability of the animal to repair predator-induced damage.

Funder Acknowledgement(s): This study was supported by the CSU LSAMP grant from NSF (HRD-1302873), awarded to Humboldt State University. I would also like to thank Bruce A. O'Gara and Jacquelyn Bolman for their unwavering support and direction throughout this project's entirety.

Faculty Advisor: Bruce O'Gara, bao3@humboldt.edu

110
Subcategory: Physiology and Health

The Effects of a Sublethal Dose of Botulinum Serotype E on the Swimming Performance of Channel Catfish (Ictaluruspunctatus) Fingerlings

Torri Thomas, Mississippi Valley State University
Co-Author(s): Rachel V. Beecham, Mississippi Valley State University, Department of Natural Science
Dana X. Gao and Patricia S. Gaunt, Mississippi State University, College of Veterinary Medicine

Visceral toxicosis of catfish (VTC) is a disease of cultured Channel Catfish Ictalurus punctatus in the MS Delta. The etiology of VTC is associated with botulinum serotype E (BoNT/E) which causes blockage of acetylcholine release at the neuromuscular junction leading to weakness and paralysis of skeletal muscles including those involved in swimming. This study attempted to determine if sublethal exposure to purified BoNT/E caused reductions in swimming performance and metabolism of channel catfish. Catfish swimming performance was assessed on stocker sized channel catfish (mean weight 62.35 ± 2.5 g) with 10 control (sham-injected) fish and 10 fish injected with a sublethal dose of BoNT/E. A modified Blazka type swim chamber was used to assess swimming performance. We injected catfish with either 0.01% trypsin or 400 pg purified BoNT/E digested with 0.01% trypsin intracoelomically, then acclimated an individual catfish in the swim chamber for 17 hours prior to swimming. Water temperature was maintained at ~28OC and dissolved oxygen was between 4 and 7 mg/L. A critical swimming speed (Ucrit) protocol was followed and dissolved oxygen and temperature were monitored every 2 minutes throughout the swim trial. Metabolic rate and cost of transport were calculated from the oxygen consumption at each test speed (10-70 cm/s). There was a statistical difference between the Ucrits (p = 0.0034), but no differences were found between the metabolic rate (p =0.69) or cost of transports (p=0.67) between the sham injected and BoNT/E groups. There was a difference in the cost of transport as it relates to the various speeds tested (p<0.0001). These results indicate that botulinum E interferes with the swimming speed of the catfish which could contribute to the mortality from the disease of VTC and potentially make the fish more susceptible to predation.

Funder Acknowledgement(s): This project was funded by USDA ARS-58-6402-7-190, USDA NIFA 2011-67015 30174. Additional funding was provided through MS INBRE, NSF HBCU-UP II and the U.S. Department of Education Title III, Plan B Program.

Faculty Advisor: Rachel V. Beecham, rvbeecham@yahoo.com

111
Subcategory: ***Physiology and Health***

The Effect of Sample Storage Time on Blood Gas and Electrolyte Readings for Channel Catfish, Ictalurus Punctatus

Bianca Vigliante, Mississippi Valley State University
Co-Author(s): Rachel Beecham, Mississippi Valley State University

Storage of whole blood can lead to problems because the erythrocytes possess a high metabolic capacity, which can cause large fluctuations in blood gases and electrolytes. This study was undertaken to determine the effects of sample storage time on blood parameters. Blood samples were collected from 32 market sized pond raised channel catfish. The whole blood was analyzed using a Stat Profile Critical Care Xpress Blood Gas Analyzer (Nova Biomedical) for osmolarity, blood urea nitrogen (BUN), lactate, glucose, magnesium (Mg), calcium (Ca), chloride (CL), sodium (Na), potassium (K), partial pressure of oxygen (pO_2), partial pressure of carbon dioxide (pCO_2), and pH. Whole blood was stored on ice and each blood vial was sampled at 0.5, 1, 2, 3, 4, 5, and 6 hours post sampling. Long-term cold storage of channel catfish whole blood caused significant increases in mean pO_2 and significant decreases in mean pH only. Further research should be conducted to determine the effects of blood storage on blue and hybrid channel x blue catfish as well.

Funder Acknowledgement(s): This project was funded by NSF HBCU-UP II.

Faculty Advisor: Rachel Beecham, rvbeecham@yahoo.com

112
Subcategory: Plant Research

Epifluorescence Microscopy of Temporal Interactions of E. cloacae and Onion

Jamil Baskett, Fort Valley State University/Washington State University
Co-Author(s): Brenda Schroeder, Mohammad Arif, Dima Mavrdi, and Olga Mavrodi, Washington State University

Onion (*Allium cepa* L.) producers in the Pacific Northwest are important contributors to the overall production of onions in the United States. According to the U.S. Department of Agriculture (2010), each acre of onions produced for storage was worth greater than $6,000. Losses due to onion bulb rots during storage can have a significant financial impact on the onion industry. *Enterobacter cloacae* is an infectious and important bulb rot pathogen that causes onion bulb decay in onion packing sheds throughout the Columbia Basin. The phenotype of *Enterobacter* bulb decay begins with light necrosis in a single or a few scales in the neck of the onion bulb which spreads towards the basal plate during storage.

The current understanding about *E. cloacae* colonization behavior in onion plant cell tissue is limited. During the summer of 2013, onions bulbs cv. Talon were inoculated with a GFP labeled strain of *E. cloacae* to study whether the pathogen colonizes in onion cell tissue intercellularly or intracelluarly as visualized by using epifluorescence microscopy. A *gfp* reporter gene was introduced into *E. cloacae* using electroporation. PCR followed by gel electrophoresis confirmed the insertion of *gfp* gene into the genome using GFPmut3 and BLA primer sets. Onion slice assays were performed to determine whether *E. cloacae* colonize in an intercellular or intracellular fashion. Onion bulbs were sliced and plated on water agar and inoculated with 10µl of the GFP labeled *E. cloacae* strain. Onions were incubated at 37°C and microscopic observations were recorded over a four day period using epifluorescence microscopy. Day one and two of microscopy results revealed intercellular colonization of the bacteria on the film of the onion tissue. This study would be helpful to understand the colonization behavior of *E. cloacae* in onion bulb rot tissue and the time required by pathogen to colonize the bulb tissue. Ultimately, this could help to develop efficient disease management strategies.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF HRD #0625289 awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

113
Subcategory: Plant Research

Morphing Structures in the Dionaea Muscipula Ellis

Victoria Forde-Tuckett, Oakwood University
Co-Author(s): Alexander G. Volkov, Oakwood University

The Venus flytrap is a marvelous plant that has intrigued scientists since times of Charles Darwin. This carnivorous plant is capable of very fast movements to catch prey. We found that the closing of the *Dionaea Muscipula Ellis* is about 100,000 - 300,000 times faster than the trap opening. The mechanism of this movement was debated for a long time. A Basler ACE camera AC2000-340KC interfaced to PC using NI PCle-1435 high-performance camera link is used to collect images with maximum speeds of 330 frames per second and with a minimum speed of 1 frame per minute to collect images during the trap closing and opening. In the Hydroelastic Curvature model the upper leaf of the Venus fly trap is visualized as a thin, weakly -curved elastic shell with principal natural curvatures that depend on the hydrostatic state of the two surface layers of cell, where different hydrostatic pressures are maintained. Unequal expansion of individual layers results in bending of the leaf, and it was described in terms of bending elasticity. The external triggers, either mechanical or electrical, result in the opening of pores connecting these layers; water then rushes from the upper layer to the lower layer, and the bilayer couple quickly changes its curvature from convex to concave and the trap closes. Anesthetic agents chloroform or ether induces lobes movement and closes the trap without the mechanical stimulation of trigger hairs.

To check this hypothesis, we drop from a micropipette 10 μL of ether on the midrib inside the trap without touching of lobes of mechanosensitive trigger hairs and the trap slowly closes in 10 s. This is at least 20 times slower than mechanical or electrical stimulation of the Venus flytrap. The similar effect can be induced by placing 10 μL of chloroform on the midrib inside the trap but the lobes closing time in this case is as fast as closing after mechanical stimulation of the trigger hairs. By studying the various curvatures in *Dionea Muscipula* Ellis, we hope to discover a new type of electrically controlled morphing structures, which can be used for the production of new artificial material for a new generation of aircrafts and spaceships.

Funder Acknowledgement(s): This study was supported, in part, by the National Science Foundation under Grant No. HRD 811507 and by the U.S. Army Research Office under contract/grant number W911NF-11-1-0132.

Faculty Advisor: Alexander Volkov, Agvolkov@yahoo.com

114
Subcategory: Plant Research

Antioxidants in Taraxacum Plant Tissues Grown Under Various Conditions

Kristal Gant, Elizabeth City State University
Co-Author(s): Jeffrey M. Rousch, Elizabeth City State University

Taraxacum spp. are known to have antioxidant and anecdotal medicinal properties. This herb has a long history of use in Chinese natural treatments of a variety of diseases. However, no study could be located that characterized the distribution within this particular plant tissues of key antioxidant molecules and also levels produced under various environmentally controlled conditions. This information is important to growers of the herb to potentially increase product effectiveness and also has implications for proper medicinal preparation.

The aim of this research was to determine the concentration in tissues of phenols and flavonoids in plants grown to specific days (triplicate experiments) and in plants collected under natural growth conditions. It was hypothesized that significant differences in the levels of these key antioxidants would be observed among plants grown to various days under controlled conditions and in tissues of plants collected from the environment. Antioxidant levels were compared to certified standards to act as controls in addition to replicate treatments and replicated experiment. Antioxidants were analyzed using spectrophotometric methods using gallic acid and rutin equivalencies for phenols and flavonoids, respectively. Significant differences among antioxidant levels were determined using ANOVA and Tukey's HSD test and canonical regression analysis for whole plants grown to specific days and tissues in uncontrolled plants, respectively. Phenols in controlled growth plants ranged from 1.8 – 15.5 g GAE / 100 g dw with significant difference between plants grown for 20 and 40 d. Flavonoids in controlled growth plants ranged from 2.2 – 2.5 g RE / 100 g dw with significant differences among plants grown for 20, 30, 40 and 50 d. Phenols in tissues of uncontrolled growth plants ranged from 4.6 to 18.5 g GAE / 100 g dw and flavonoids in tissues of uncontrolled growth plants ranged from 1.3 to 6.7 g RE / 100 g dw with significant differences among various tissue types. Comparisons of the antioxidant levels determined will be made to other herbal preparations used for human health and future work centered on extraction methods will be addressed.

Funder Acknowledgement(s): This study was supported and funded by the National Institute of Health Training Grant #1T34GM100831-02.

Faculty Advisor: Jeffrey Rousch, rouschj@mail.ecsu.edu

115
Subcategory: Plant Research

Toxicity of Plant Derived Phytochemicals Against Salmonella Enteritidis

Gregory Goodwin, Claflin Univeristy
Co-Author(s): Florence Anoruo and Randall Harris, Claflin University

Salmonella is a gram negative, rod-shaped bacilli that can cause diarrheal illness in humans. These groups of bacteria are responsible for many cases of gastroenteritis, typhoid fever, and food poisoning in the US and other around the globe.

Salmonella serotype enteritidis (SE) is one of the most common serotypes of Salmonella bacteria. Over the past decade, great emphasis has been put on discovering botanicals that contain plant derived antimicrobials. The heightened interest in discovering plants with antimicrobial potentials is due to the fact that they are more economical and pose little or no side effects compared to conventional antibiotics.

The purpose of this research was to determine the antibacterial effect of both aqueous and methanolic extracts of plants indigenous to Nigeria and other African countries against Salmonella enteritidis. We hypothesized that both aqueous and methanolic extracts of Psidium guajava and Mangifera indica extracts will have inhibitory effects on the growth of Salmonella enteritidis. Sensitivity assays (disk and spot diffusion) were conducted using aqueous and methanolic extracts of Psidium guajava (Guava) leaves, Mango leaves and stems.

Results indicated that the methanolic extracts of Psidium guajava (Guava) leaves, Mangifera indica (Mango) leaves, and stem all exhibited antibacterial activity against S.enteritidis. However, Guava extract showed slightly higher level of inhibition to Salmonella enteritidis than the Mango leaves and stems extracts. In future work different solvents will be used for extraction of phytochemicals from the selected plants. Also the chemical identity/structure of compounds contained in the individual plant extracts will be determined using Nuclear Magnetic Resonance (NMR). Also, extracts will be combined to see if combinations of phytochemicals will have synergistic effects on their toxicity against Salmonella enteritidis.

References: Rani, Phulan. 2004. Antimicrobial evaluation of some medicinal plants for their anti-enteric potential against multi-drug resistant Salmonella typhi. 18(8) pages 670-673. Nostro, A. May 2000. Extraction methods and bioautography for evaluation of medicinal plant antimicrobial activity. 30.(5) pages 379-384.

Braz, J. April 2006. Antimicrobial activity of some of the south-Indian spices against serotypes of Escherichia coli, Salmonella, Listeria monocytogenes and Aeromonas hydrophila. 37.(2)

Funder Acknowledgement(s): The opportunity to complete this research was made possible by funds from Claflin University's Extramural seed Grant.

Faculty Advisor: Florence Anoruo, fanoruo@claflin.edu

116

Subcategory: Plant Research

cDNA Cloning and Characterization of Flavanone 3' Hydroxylase (F3'H) Gene

Jasmine A. Hall, Florida A&M University

Co-Author(s): Anthony Ananga, Vasil Georgiev, Violetka Tsolova, Florida A&M University

Joel Ochieng, University of Nairobi

Flavanoids are key antioxidants that produce natural byproducts such as anthocyanin, proanthocyandin, and flavanoid pigments. Flavanone 3' Hydroxylase (F3'H) is a key enzyme in the biosynthesis of flavonols, anthocyanindins, and proanthocyanindins. In this study we report the cloning, and characterization of F3'H gene. The full length cDNA of F3'H from Vitis rondutifolia (designated as VrF3'H) was isolated and characterized. The full length cDNA of VrF3'H had an open reading frame (ORF) of 1092 bp encoding 364 amino acids with a calculated molecular mass of 40.8kDa and an isoelectric point of 5.60. Comparative and in silico analyses revealed that VrF3'H has extensive homology with F3'H from other plant species. Phylogenetic analysis indicated that VrF3'H belongs to the Vitis F3'H cluster and it is much closer to Vitis vinifera. Realtime-PCR (RT-PCR) analyses of VrF3'H transcripts showed that the VrF3'H was abundantly expressed in the red cells of physiologically mature red berries and not expressed in the skins of the green berries. We cloned the F3'H gene from the Muscadine grape for the first time and the sequence was deposited at the NCBI database (Gene Bank Accession no. KF040970).

This study will provide further resources for the use of functional genomics to improve the production of various nutraceuticals (healthy compounds) from Muscadine grapes.

Funder Acknowledgement(s): CURE Scholars Program(FAMU)/ USDA/NIFA.

Faculty Advisor: Edna Cofield, edna.cofield@famu.edu

117

Subcategory: Plant Research

Antibacterial Activity of Nigerian Botanicals Against the Growth of E.coli

Tranard J. Harvin, Claflin University

Co-Author(s): Florence Anoruo and Randall Harris, Claflin University

Anti-microbials are agents capable of destroying or inhibiting the growth of disease-causing microorganisms. Resistance of antimicrobial drugs has become a worldwide calamity (Kunin, 1993). Discovering natural/edible and renewable antimicrobial agents is a major aim of scientists because they are more economical, safer and sustainable. Plants are rich in a wide variety of secondary metabolites and previous research has reported that 25 to 50% of current pharmaceuticals are derived from plants and only a small amount is used for anti-microbial (Cowan, 1999). It was hypothesized that methanolic plant extracts from the selected botanicals would inhibit the growth of E.coli more than the aqueous extracts.

This research was conducted to determine the antimicrobial potentials of aqueous and menthanolic extracts of Psidium guajava (Guava), Cymbopogon citratus (Lemongrass), Mangifera indica (Mango), Ocimum Gratissimum (OG), and Vernonia Amygdalina (Bitter Leaf) against the growth of Escherichia coli (E.coli). Sensitivity assays, (disk and spot diffusion), were performed to evaluate the antibacterial properties of these plant extracts. Mango and Fresh Guava methanolic and aqueous extractions showed an intermediate antibacterial effect on the growth of E.coli. Future research that will be conducted includes performing Bio-film Assay to determine if E.coli bio-film production will be inhibited by plant extracts and evaluating how extracting plant material under different pH levels, temperature and solvents will affect their toxicity to E.coli.

Funder Acknowledgement(s): This project was funded by the Undergraduate Summer Research DOE Environmental Project.

Faculty Advisor: Florence Anoruo, fanoruo@claflin.edu

118

Subcategory: Plant Research

Variability in Camassia, an Examination of Common and Endemic Species

Florisela Herrejon Chavez, Portland State University/ Willamette University

The genus Camassia presents a valuable opportunity to explore the variation within common and endemic species. Camassia is a genus of wildflowers native to the United States that are of ecological and ethnobotanical significance. Oregon hosts four of its six species. Two of these species are common while the other two are endemic to restricted geographic regions. This study compares the levels of genetic variation and morphometric differences evident among one common species, Camassia leichtlinii, and both endemic species, Camassia cusickii and Camassia howellii. The purpose of this study was to answer the following questions: 1. How much genetic variation is present in the flowering and fruiting morphology of common and endemic species of Camassia? 2. Which morphological traits display the most variability? 3. Do the endemic species vary from each other in ways that reflect differences in their abundances and range? In order to answer these questions morphological data was collected from the three selected species at three different sites in Oregon. We measured at least 15 morphometric traits in multiple populations, including vegetative and reproductive features such as basal leaf number, stem diameter, height of the inflorescence, petal size, floral symmetry, and the dimensions of the fruit capsule. The morphological differences and variability of each species were compared using statistical tests, such as one way ANOVA and calculating the coefficient of variation for each measured trait.

Although the analysis is still in progress , the predicted outcome of this study is a significant difference in variability between the endemic and common species. A better understanding of the morphological variation in the common and endemic species of Camassia can aid future conservation and management efforts for rare populations of in this genus.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Susan Kephart, skephart@willamette.edu

119

Subcategory: Plant Research

Preliminary Systematics of Genus Eperua (Leguminosae; Caesalpinioideae)

Samira Khan, University of District of Columbia

One of the largest and most economically important families of flowering plants is the legume family, Leguminosae. Because of the agricultural importance of the Papilionoideae subfamily and the Australian special interests in the Mimosoideae/Acacia subfamily, the more basal subfamily, the Caesalpinioideae (150 genera/~2,700 species), has received relatively little attention and the status of the taxa and the relationships among them are uncertain. In this study we use two barcoding plastid molecular markers to explore phylogenetic utility in of one of the genera of the Caesalpinioideae, Eperua (14 spp). Eperua is not only an economically important timber tree but is one of the major trees used by the South American Amerindian communities. Eperua is found only on the Guiana Shield and contains both widely distributed riparian taxa and narrow endemics found in the highland tepuis. The sister group relationship of Eperua and Eurypetalum is similar to other Caesalpiniods in that Eperua is a Shield endemic and its sister group is restricted to Africa.

This work is an expansion on previous work that used combined morphological and sequence data in a total evidence approach to explore hypotheses of evolution, patterns of species radiation and floral morphology of Eperua. This study surveys the utility of two additional plastid markers, psbA-trnH and matK, for species resolution for 6 species of Eperua. DNA was isolated using Qiagen Plant DNeasy. Amplification using polymerase chain reaction and fluorescent sequencing was done following established molecular methods. For herbarium collections, the Phire and Phusion Hot Start DNA polymerase (Finnzymes) methods were utilized. Phylogenetic inference was done using parsimony (NONA and PAUP). We explored partitioned and combined morphological and molecular datasets to detect the level of information provided by different types of data and their potential incongruence. We found that the individual psbA -trnH and matK partions did not provide adequate variation to resolve all species. When the partions were combined with the ITS and trn-L datasets for the total evidence phylogeny, the combined phylogeny produced 8 most parsimonious trees (BL = 76, CI = 85 and RI = 85) and two major clades were recovered; species with pendent inflorescences and those with clustered, non-pendent inflorescences.

This study found that each of the individual plastid genes did not provide enough phylogenetic signal for total species-level resolution for the taxa surveyed but in combination with other markers increase the support of internal nodes. Future research will concentrate on increasing taxon sampling of Eperua and adding an additional low copy nuclear gene, LFY/FLO, to the combined dataset.

Funder Acknowledgement(s): This study was supported by a grant from NSF/HBCU-UP awarded to the STEM Center, University of the District of Columbia.

Faculty Advisor: Karen Redden, kredden@udc.edu

120

Subcategory: Plant Research

Use of Novel Compounds for Acceleration of Fruit Ripening and Management of Fruit Quality

Philip Latimore, Fort Valley State University/Washington State University

Co-Author(s): Christopher Hendrickson, State University, Pullman, WA

Increases in respiration and ethylene gas release are hallmarks of a ripening climacteric fruit. During harvest, storage, and transportation to market, the induction of these processes is often uncontrolled, and can lead to suboptimal fruit reaching market. To gain more control over this process, I have explored the efficacy of proprietary ripening compounds (RCs) that are thought to accelerate the ripening of organic Fuji apples through stimulation of ethylene and respiration. In this study, we used organic Fuji apples as a model crop system. After initial drenching in either 0, 2mM, or 20mM of each RC, respiration, ethylene release, and overall fruit quality were assessed using a variety of techniques. To confirm ethylene production, colorimetric assays were prepared using adsorbed $Pd(II)SO_4$ and $(NH_4)_2MoO_4$ on nylon filters in sealed jars.

The experiment was carried out with five of the proprietary RCs and three replicates per treatment. Blue-stained discs were imaged and measured with CIELAB colorspace detection to quantify intensity of ethylene release. Headspace ethylene was measured from each jar using a flame ionization detector. Fruit flesh firmness was tested with a fruit texture analyzer.

The study found that among the RCs tested, all treatments induced higher ethylene release then in untreated controls. Some variability in the response was seen among the RCs. Some exhibited maximum ethylene stimulation at higher concentrations, while others produced the largest response in the 2 mM treatment. Treated fruit exhibited visible signs of senescence. Additionally, treated fruit exhibited greater observed volatile production, suggesting RC treatment may allow for the complete set of ripening-related phenomenon to occur. This work demonstrates the activity of a set of new ripening-stimulating compounds on an agricultural commodity. With these RCs, we gain a toolset to better manage when fruits begin their terminal ripening process, allowing post-harvest managers to better retain fruit quality.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF DBI REU-Site Program awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University, Fort Valley, GA.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

121

Subcategory: Pollution/Toxic Substances/Waste

Diversity and Preliminary Systematics of the Two Genera, Dugesia and Girardia (Platyhelminthes, Tricladida, Dugesiidae) using Universal Barcoding Genes

Marilynn Lambinicio, University of the District of Columbia

Members of the three genera, Dugesia, Girardia and Schmidtea (Platyhelminthes, Tricladida, Dugesiidae) are found in freshwater habitats worldwide. These flatworms are free-living and serve in the role of carnivore in benthic habitats. The regenerative properties of these animals have been the main focus of current research efforts but little effort has focused on species delineation and phylogenetic relationships. Numerous species have been tentatively identified; however, very few have been verified on the molecular level. One study based 18S RNA and 18S DNA reclassified the taxa according to geographical location. Using modern molecular methods and techniques, we explore the utility of four gene regions, CO1, 16S, 18S and 28S in phylogenetic reconstruction.

This study utilizes these universally accepted barcoding gene regions to explore evolutionary species relationships among four taxa of Dugesia, Girardia and Schmidtea. We surveyed and downloaded sequences from GenBank for the four gene regions. Additionally, we isolated, amplified and sequenced DNA from laboratory maintained populations of Girardia dorotocephela (Woodworth, 1897) and G. tigrina (Girard, 1850) for the 16S ribosomal subunit. Sequences were assembled and verified using Sequencer (ver. 4.10.1) and aligned in BioEdit (ver. 7.0.9).

Data partitions were phylogenetically analyzed separately and in combination for a total evidence phylogeny using PAUP*.

Preliminary data shows that these regions, in combination, provide adequate resolution for species delineation and phylogenetic reconstruction. Our study does not support the results found in the most recent study. We found that the Asian taxon was nested within the North American taxa and were all sister to the European taxon. Future studies will include increased taxon sampling and multiple accessions of the taxa, expanding the molecular data set to include full length regions and surveying additional molecular markers.

Funder Acknowledgement(s): This study was supported by a grant from NSF/HBCU-UP - HRD-0928444-STEM Center, University of the District of Columbia, Washington, DC.

Faculty Advisor: Rosie Sneed, rsneed@udc.edu

122
Subcategory: Pollution/Toxic Substances/Waste

The Status of Microbial Organisms in the Gentilly Community Post Katrina

Breanna Ryan, Dillard University
Co-Author(s): Curvelle Lewis, Dillard University

After Hurricane Katrina struck New Orleans, Louisiana, on 29 August 2005, 80% of the city was inundated with water including the Gentilly community. In 2006, studies were conducted by Singleton et al. to establish the types and concentrations of airborne microbes both inside and outside of selected buildings in neighborhoods around the greater New Orleans area. Mold and other contaminants grew inside of the buildings and high concentrations of harmful micro-organisms were found. The purpose of this study is to determine the status of indoor airborne microbial organisms in buildings within the Gentilly area post Hurricane Katrina. Indoor airborne sampling was conducted for 6 hours at 4 buildings within the Gentilly area. Impingers were set up at site on tripod stand and connected to vacuum pump using rubber tubing. The temperatures of the buildings were recorded. The samples were collected in 20ml of sterile RNase/DNase free water and phosphate saline buffer. DNase free water was used to maintain the sample at 20mL. Various tests were then conducted on samples to identify the types of microorganisms present.

It was found that most bacteria identified were gram positive and cocci in shape and few were bacillus in shape and both gram positive and negative. These bacteria were capable of acid fermentation but did not produce gas. No spores were identified during endospore staining indicating the absence of harmful pathogens such as Bacillus anthracis. A small number of mold were identified. After 48 hours there was little to no growth of microorganisms as compared to research conducted by Singleton et al. in 2006 in which high concentrations of microbes were identified in buildings samples after 48 hours. This indicates that the concentration of microorganisms was less in these buildings as compared to research conducted in 2006. These results show that there have been improvements in the air quality of the buildings since Hurricane Katrina. This may be as a result of proper refurbishing and remediation of the buildings. Future research includes conducting DNA analysis for further identification of the micro-organisms found at the sample sites and determining the concentration and types of micro-organisms present outside of the buildings. Future research also includes retesting the sites that were tested by Singleton et al. in order to determine the status of their microbes since the year 2006.

Funder Acknowledgement(s): This study was supported by the NSF/LS-LAMP Program Awarded to Abdalla Darwish, Coordinator/Campus Director at Dillard University, New Orleans, LA 70122.

Faculty Advisor: Bernard Singleton, bsingleton@dillard.edu

123
Subcategory: Pollution/Toxic Substances/Waste

Effects of Lead (PB2+) and Temperatures on Zebra Fishes

Sheela Yang, University of Wisconsin-Milwaukee
Co-Author(s): Daniel Weber, University of Wisconsin-Milwaukee

By 2025, two-thirds of earth’s population will experience the urban heat island effect. This is when densely populated areas are significantly warmer than its surrounding rural areas causing an increase in illness and deaths in urban areas. Children who live in urban locations are often exposed to multiple environmental stressors beyond increases in temperature. These additional stressors can create major physiological and behavioral problems. One of these stressor is lead (Pb2+) exposure, a major environmental health hazard for children living in urban environments. The urban heat island effect, with increased temperatures, can intensify Pb2+ causing increased physiological abnormalities. In this study we used zebra fishes to model these interactions, to test the effects of heat and Pb2+ exposure. We found that larvae exposed to P2b+ had abnormalities which included edema, deformed jaws, and curvature in the spine. The increase in temperatures alone affected the control larvae but not to the extent of the larvae exposed to Pb2+ at a higher temperature. The increase in temperature intensified Pb2+ which caused an increase in zebra fish mortality. These findings are essential because, as cities devise plans for climate change adaptation, an accounting of interactions such as Pb2+ and temperature should be included to avoid underestimating needs and costs for appropriate medical and social services.

Funder Acknowledgement(s): This study was supported by a grant from the National Institute of Environmental Health Sciences awarded to Daniel Weber, Senior Researcher for the Children's Environmental Health Sciences Core Center, University of Wisconsin-Milwaukee.

Faculty Advisor: Daniel Weber, dweber@uwm.edu

Chemistry and Chemical Sciences

124

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

Synthesis of Novel Amino Acids in the Application of Antimicrobial Peptides

Soijett Blue, North Carolina A&T State University
Co-Author(s): Julius Harp, North Carolina A&T State University

Dipeptides are important compounds and are well acknowledged for their pharmacological applications in biological systems. 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., alanine-type) amino acids and we are 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. Dipeptides that contain cyclic unit are known to be rigid which facilitates receptor binding selectivity which translates into pharmacological specificity. In addition, Dipeptides containing 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). The ultimate resolution of this work lends application to the development of antimicrobial peptide that display optimal efficacy toward resistant microbial stains.

Funder Acknowledgement(s): The study of this research was supported by the North Carolina Louis Stokes Alliance for Minority Participates and the US National Science Foundation.

Faculty Advisor: Julius Harp, harpj@ncat.edu

125

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

Investigation of Drug-Cyclodextrin Guest-Host Inclusion Complexation

KaDesia Hawkins, Winston Salem State University
Co-Author(s): Sayo Fakayode, North Carolina A&T State University

Understanding the binding mechanism of chiral pharmaceutical drugs with humans is of considerable interest in biomedical and pharmaceutical study for effective drug design and drug therapy. This is particularly true because of the wide differences in the pharmacological effects of enantiomer drugs [1-4]. One enantiomer drug may be useful with therapeutic effect; however, the other enantiomer may be inactive and/or toxic [1-4]. Analysis of enantiomer drugs is challenging due to the similarity in the physical and chemical property of enantiomer drugs. Consequently, analysis of enantiomer drugs can only be achieved by use of chiral auxiliary or chiral discriminating agent. Cyclodextrins (CDs) (ordinary carbohydrate sugar) are commonly used chiral discriminating agents because of their low cost, commercially availability, stability, and non-toxicity [5, 6]. CDs possess hydrophobic cavity, promoting guest-host inclusion complex formation with most chiral molecules. This study explores the potential utility of CDs and ordinary UV-visible spectroscopy for the enantiomeric discrimination and analysis of propranolol hydrogen chloride (a beta-blocker use for the treatment of hypertension, anxiety, or panic) and 1-(9-anthryl)-2,2,2-trifluoroethanol (molecule of environmental interest) enantiomers. The influence of CD types and host concentration on the UV-visible absorption spectral of drug-host inclusion complexes was further investigated. In general, the degree of guest-host inclusion complexation is guest and host dependent. The chemical structure of drug molecules, conformation and orientation of enantiomer drug as well as the cavity size of CD host were also found to play significant role in the guest-host inclusion complexes formation. Further studies include the determination of the stoichiometry and the binding constant of the guest-host inclusion complexes.

Funder Acknowledgement(s): The study was supported by NSF HBCU-UP: Award #0927905; Start September 1, 2009 to August 31, 2014.

Faculty Advisor: Sayo Fakayode, sofakayo@ncat.edu

126

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

An *In Vitro* Assessment on the Effect of Diruthenium-Allopurinol as a Potential Anti- Cancer Agent in Michigan Cancer Foundation -7 (MCF-7) Breast Cancer Cells

George Lewis, Texas Southern University
Co-Author(s): Jamie Dooley-Renfro, Texas Southern University

Past novel anti-cancer drugs containing the platinum (Pt) metal as the central atom have been clinically recognized as being unsuccessful in cancer treatment. These platinum based drugs are administered during chemotherapy treatment to cancer patients. The down fall of these chemotherapy drugs is that they destroy the surrounding normal cells (tissue) during the treatment process. This is attributed to platinum based drugs being insoluble. Ruthenium complexes offer the potential of reduced toxicity, a novel mechanism of action, non-cross resistance and a different spectrum of activity compared to platinum containing compounds. Ruthenium organometallic complexes form monofunctional adducts with guanine in DNA in vitro and have a cytotoxic anticancer activity spectrum in preclinical models that suggests a lack of cross-resistance with the platinum based pharmaceutical drug, Cisplatin.

The synthesis of Diruthenium with Allopurinol (ALP) and its activity toward the Mammalian cancer cell line (MCF-7) and Basal Epithelial cell line was presented in past cancer research findings. Research efforts were successful in the synthesis and characterization of the Diruthenium-Allopurinol (Ruthanol) complex using the UV-Visible in which spectral graphs yielded identifying peaks at 291, 301, and 642 nm(s). Identifying peaks from the FT-IR were at 1698 nm and 1699 nm. The mass of the compound was identified and determined as 665 (m/z) using the Bruker Microflex Daltonics TOF-MALDI instrument. The cyto-toxicity level in the MCF-7 cell line at 104 was 73% at 75 mM; whereas the percent viability in the Basal Epithelial Cell line was 80%. MCF-7 cells are non-invasive and the tumors remain where they originate, the MDA-MB231 cells are selected for the current study. The MDA-MB 231 cells are highly invasive and they are capable of metastasizing throughout the body.

Preliminary cell culturing of the MDA-MB 231 cell line, administration of the above mentioned drug complex and Neutral Red Assay analysis in the current screening study provides experimental evidence to classify “Ruthanol” as an anti -metastatic drug.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Bobby Wilson, wilson_bl@tsu.edu

127

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

Synthesis of a Selective Kinase Inhibitor for the M.tb. Ser/Thr Kinase-Pkn

Aziz Mamur, New Jersey City University
Co-Author(s): Sameer Phadke, Michael E. Steffey, and Matthew B. Soellner, University of Michigan

Protein kinases are known for their key role in cell signaling and regulating biological processes such as proliferation, differentiation and apoptosis. One of the methods of developing kinase inhibitors is to mimic the interaction of ATP with the kinase pocket and recognize the so-called active conformation, a conformation otherwise conducive to phosphotransfer. The highly conserved nature of the ATP pocket, however, makes achieving selectivity for a particular kinase difficult. Herein, we are developing a selective inhibitor of a protein kinase PknB from the pathogenic Mycobacterium Tuberculosis (M.tb). PknB is one of the 11 ser/thr protein kinases (STPKs) encoded in M.tb. genome and mediates signal transduction in the mycobacterial cell and is essential for cell growth. We screened a library of kinase inhibitors obtained from GlaxoSmithKline (GSK) against PknB using a TR-FRET based assay and obtained a hit – GSK690693.

This compound was originally optimized by GSK for the inhibition of the human kinase AKT. Based on modeling studies, we hypothesized that N-acetylation of the piperidine group in GSK690693 could result in selective inhibition of PknB while resulting in a steric clash and thereby loss in potency of AKT inhibition. We describe here, our progress toward the synthesis of a selective PknB inhibitor based on the GSK690693 scaffold.

Funder Acknowledgement(s): National Science Foundation; Interdisciplinary Research Program for Undergraduates in the Structure and Function of Proteins at the University of Michigan.

Faculty Advisor: Matthew B. Soellner, soellner@med.umich.edu

128

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

Analytical Methods of Cotinine in Fingerprints as Markers for Nicotine Usage

Malcolm McNair, University of Mississippi
Co-Author(s): Sara Glenn, Nuwan Kothalawala, Vijay Reddy Jupally, Amala Dass, and Murrell Godfrey, University of Mississippi

Fingerprints are one of the most common pieces of evidence utilized in today’s world of forensic science. They are currently used to identify and connect both perpetrators and victims to a given crime scene. However, fingerprints have the potential to provide more information. It has been shown that fingerprints contain specific metabolites that provide chemical evidence that can help explain illicit behaviors.

The purpose of this study was to attempt to detect the metabolite of nicotine, cotinine, within fingerprint samples using various analytical methods including HPLC, GC-MS, and

MALDI mass spectrometry. Successful quantification and qualification of nicotine markers can lead to the detection of illicit drugs in other forensic samples. The identification of drugs and their metabolites in fingerprints can assist forensic scientists and law enforcement, in the event only circumstantial evidence is available, with additional tools to confine and prosecute suspects.

Funder Acknowledgement(s): Department of Chemistry and Biochemistry, University of Mississippi 38677; LSAMP.

Faculty Advisor: Murrell Godfrey, mgodfrey@olemiss.edu

129

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

Screening of Cigua-Toxins Found in the Invasive Indo-Pacific Lionfish

Khalin Nisbett, University of the Virgin Islands

In the early 1980s, the Indo-Pacific lionfish (Pterois volitans/ miles complex) invasion began in the Atlantic Ocean. The non-native lionfish travelled up the eastern coast of the United States then further east to the Bahamas. By 2004, the lionfish began to travel south within the Caribbean and continue to travel toward South America. The lionfish population in the Caribbean have since expanded to alarming numbers, rapidly consuming native fish and have high reproductive rates. One strategy in controlling the increasing population of lionfish is to encourage human consumption of this fish. However, this poses a possible problem in the Caribbean as there is high prevalence of Ciguatera Fish Poisoning. In the Caribbean, there is the presence of a tropical dinoflagellate, Gambierdiscus toxicus. This dinoflagellate contains a gambiertoxin used for self-defence, which biomagnifies and biotransforms to ciguatoxin as it moves up the food chain. World-wide, over 400 species of fish have been found to accumulate the ciguatoxins in their tissues. Recently, the USFDA added the Lionfish to their list of species that may contain ciguatoxins. These toxins affect humans neurologically and gastrointestinally. For this study, 33 lionfish samples were collected from the United States and British Virgin Islands and were processed for ciguatera toxin extraction using the United States Food and Drug Administration (USFDA) established protocol. The lionfish were collected at depths ranging from 6 to 32 m. The lionfish samples were 133-361 mm in total length and 40 –708 g in weight. Lionfish flesh was grinded followed by four consecutive extractions. Acetone was used to extract organic compounds, hexane to defat (remove non polar compounds), and chloroform to extract slightly polar compounds. The extract was purified via solid phase extraction. No controls were necessary as the data were independent of each other. The extracted ciguatoxins were sent to USFDA for toxicity analyses. Previous analyses showed that 40% of lionfish samples were shown to contain ciguatoxins in harmful amounts. We continue our research to solidify these finding, find correlation between location and toxicity and correlation between liver analyses and muscle analyses. Our results would allow our local government agencies and other organizations to make better informed decisions regarding the use of lionfish as a potential food source.

Funder Acknowledgement(s): This research was funded by Department of Interior National Park Service and the NSF HBCU-UP Grant Award No. HRD-0506096.

Faculty Advisor: Bernard Castillo, i2castillo@gmail.com

130

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

G-Quadruplex Stablity in Aqueous Cosolute Solutions

Carlos Rivera, St. Olaf College

G-quadruplexes are comprised of G-quartets that are characterized by coplanar arrangement of four guanines through Hoogsteen base-pairing. Consecutive G-quartets can initiate formation of inter- or intramolecular four stranded G-quadruplexes with tight metal coordination. In this study, we have characterized the stability of the G2 G-quadruplex (d (G2T2G2TGTG2T2G2) in aqueous glycine betaine, L-proline, and urea potassium chloride solutions using thermal denaturation monitored by uv-absorbance. G2 demonstrated remarkable resistance to the denaturing effects of L-proline and urea. The G2 transition temperature was nearly independent of proline and urea concentration indicating a balance of favorable and unfavorable interactions between proline and urea and the G2 solvent accessible surface area exposed during unfolding. Glycine betaine stabilized the G2 G-quadruplex although the degree of stabilization decreased with temperature. G2 stabilization in glycine betaine solutions indicated unfavorable interactions between glycine betaine and the surface area exposed during thermal unfolding. The differential interactions of glycine betaine, L-proline and urea with the G2 oligomer suggest these cosolutes may be used as probes of conformational and surface area changes during biochemical reactions. In the future, the incorporation of Differential Scanning Calorimetry (DSC) will hopefully be possible. Also, the same process will be undertaken for the G3 Quadruplex, which will hopefully shed more light on the contribution to stabilization a stack or loop has.

Funder Acknowledgement(s): National Institutes of Health (R15 -GM093331), St. Olaf CURI.

Faculty Advisor: Jeff Schwinefus, schwinefus@stolaf.edu

131
Subcategory: Cancer Research

Sphingolipid Analysis of Transformed Pancreatic Cancer Cells

Andrea Jenkins, University of Arkansas at Pine Bluff
Co-Author(s): Woodson Powell, Pomona College
Io-Guane Rivera, University of the Basque Country, Spain
Mark Kester and Todd Fox, Penn State Hershey College of Medicine

Although numerous genetic mutations have been identified in pancreatic cancer, much of the molecular pathogenesis of the disease remains undefined. While proteomic and transcriptomic analyses have been utilized to probe and characterize pancreatic tumor samples, lipidomic analyses have not previously been applied to identify perturbations in pancreatic cancer patient samples. We utilized a mass spectrometry-based lipidomic approach, focused towards the sphingolipid class of lipids, to quantify changes in human pancreatic tumor samples from pancreatic cancer patients. These analyses revealed that patients with positive lymph node metastasis have a markedly higher level of ceramide species (C16:0 and C24:1) in their tumor specimens compared to pancreatic cancer patients without nodal disease or patients with pancreatitis. In an attempt to further understand these changes, we next investigated if these changes in sphingolipid species correlated with pancreatic cell lines that undergo Epithelial to Mesen-chymal Transformation (EMT), a process that can lead to cancer metastasis. We hypothesize that TGF-beta1 transformed PANC-1 cells will exhibit a lipidomic profile similar to that observed in metastatic patient samples. PANC-1 cells were treated with TGF-beta1 to induce EMT, as evidenced by the decrease in epithelial markers such as E-cadherin and the increase in the mesenchymal marker vimentin. The sphingolipids were extracted and prepared for LC/MS/MS analysis. These analyses will help in the understanding of the roles of sphingolipids in pancreatic cancer progression and may identify new therapeutic strategies.

Funder Acknowledgement(s): National Institute of Health; Penn State College of Medicine, INTREPID PROGRAM.

Faculty Advisor: Antonie Rice, ricea@uapb.edu

132
Subcategory: Cancer Research

The Calculation-Guided Synthesis of Unsymmetric Derivatives of the E. Coli Siderophore

Stephanie Jones, California State University, Los Angeles
Co-Author(s): Carlos Godinez and Carlos Gutierrez, California State University, Los Angeles

Enterobactin is the E. coli siderophore that binds extracellular ferric ion and delivers it to the cytoplasm. It is composed of three serine residues linked head-to-tail into a 12-membered trilactone. The three identical serine alpha-amine functionalities are acylated as 2,3-dihydroxybenzamide units, giving the molecule a C3v symmetry. These six phenolate oxygens define the ferric binding domain of the molecule. There is a need to prepare unsymmetrically acylated enterobactin derivatives (where one of the acyl units is different from the other two) for in vivo studies to understand the details of iron transport, and also as shuttles to transport small molecules into E.coli cells. We hypothesized that an enterobactin trilactone core that is tris (protected) at the three alpha-amine functionalities can be selectively mono-deprotected. We initially worked with the tristrityleterobactin derivative, which was prepared in 85% yield from the stannylene acetal-catalyzed trimerization of methyl N-trityl-L-serinate. When this tris (protected) derivative was treated with just enough acid (HCl or p-TSOH) to remove only one of the three protecting groups, we saw surprising results: one-third of the tristritylenterobactin derivative was completely deprotected to the trilactone tris (ammonium salt); two-thirds of starting material was recovered unreacted. Spartan calculations gave an insight: the stepwise detritylation of the tristritylenterobactin derivative with acid implies that mono deprotection is energetically more difficult than subsequent reaction with acid to the bis-deprotected and the completely deprotected trilactone tris ammonium salt. Thus it is unlikely that we could recover the desired mono-deprotected material. We repeated the Spartan calculations with the trisBOC-protected enterobactin core derivative. These in-silico results are more promising: removal of one BOC to produce the bisBOC derivative is more favorable than removal of two BOC or three BOC groups. We have synthesized trisBOC-protected enterobactin core by completely deprotecting the tris-trityleterobactin derivative, and acylating the triamine with BOC -anhydride. We are now ready to test the hypothesis by attempting selective mono-deprotection by reaction with one equivalent of toluene sulfonic acid.

Funder Acknowledgement(s): Funded by CSU-LSAMP which is supported by the National Science Foundation under Grant # HRD-1302873 and the CSU Office of the Chancellor.

Faculty Advisor: Jefferson, mjeffer@exchange.calstatela.edu

133
Subcategory: Cell and Molecular Biology

Magnetic Immunoisolation of Autophagosomes and Aptamer Development

Abdimalik Ahmed, University of Minnesota-Twin Cities
Co-Author(s): Edgar Arriaga and Thane Taylor, University of Minnesota

Autophagy is a catabolic process in which cytoplasmic contents reach lysosomes, where they get degraded. Autophagy plays an important role in a number of vital processes including tumor

suppression and aging. Elucidating the physiological role of autophagy thus requires autophagosome isolation. This project uses two methods to isolate these organelles. The first method is to use magnetic beads incubated with anti-Lc3 antibody. This beads-antibody complex can target the autophagosome's outer membrane that contains LC3 proteins. A magnet is then used to separate the bound autophagosomes from the rest of the cell homogenate. Using Western Blots, I was able to show that the beads-antibody complex captured autophagosomes with a minor contamination of peroxisomes.

The second method, which I am currently investigating, is to use aptamers as affinity capture agents for isolation of autophagosomes. Aptamers are sequences of DNA/RNA bases that can fold into a 3D shape and can bind to a targeted structure. Aptamers that can bind against organelles are yet to be developed. The SELEX process, a process that is capable of generating aptamers against various targets, will be used. Autophagosomes obtained through method 1 will be incubated with a library of ssDNA. The bound and unbound aptamers will be separated via a magnetic field, and the DNA that binds to the autophagosomes will be multiplied through PCR and carried through SELEX cycle, producing the candidate aptamers. The sequence of ssDNA that exhibit binding affinity will be determined by 454 next-generation sequencing. This should result in aptamers that are specific against autophagosome surface, and which will be used for enrichment. These two enrichment techniques should allow the isolation of autophagosomes, enabling the study of the physiological role of autophagy in human cells.

Funder Acknowledgement(s): North Star STEM Alliance (LSAMP of University of Minnesota); Multicultural Summer Research Opportunity Program. University of Minnesota.

Faculty Advisor: Edgar Arriaga, arriaga@umn.edu

134
Subcategory: ***Cell and Molecular Biology***

Engineering Anaerobic Gut Fungi for Lignocellulose Breakdown

Jiehao Chen, University of California, Santa Barbara

Currently bio-fuel is an attractive and promising energy source to secure our nation's energy future. Anaerobic gut fungi which live in the digestive tract of large herbivores are among the most efficient degraders of lignocellulose, which is the most abundant raw materials on earth for the production of bio-fuel. The major contributor to fungi enzymatic efficiency is the large macro molecular structure called cellulosome complex which consists of four major components: functional enzyme, non-catalytic dockerin, and dockerin's binding partner cohesin and scaffoldin. While the bacterial cellulosome is well-characterized, the fungal cellulosome complex's molecular architecture remains elusive. Since the interaction between dockerin and cohesin is essential to the construction of cellulosome complex, it is crucial to identify dockerin's binding partner in order for us to be able to decipher fungal cellulosome architecture. In an effort to identify dockerin-binding proteins, DNA encoding a dockerin sequence was amplified using polymerase chain reaction and inserted it into an expression vector for high-level expression in E. coli. Then the isolated and purified dockerin proteins were put together with the cellulosome complex to measure binding activity to the cellulosome complex. It was revealed that multiple proteins bind to the dockerin, indicating the presence of more than one scaffoldin protein.

Funder Acknowledgement(s): Collaborative Biotechnologies (ICB); US Army.

Faculty Advisor: Charles Haitjema, charles.haitjema@gmail.com

135
Subcategory: Cell and Molecular Biology

Characterization of Morphine-6-O-sulfate Across the Blood Brain Barrier

Kelin Key, University of Arkansas at Pine Bluff
Co-Author(s): Kameron Lee and Antonie H. Rice, University of Arkansas at Pine Bluff

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 versus 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.

Funder Acknowledgement(s): NIH Grant P20-RR-16460 INBRE

Faculty Advisor: Antonie Rice, ricea@uapb.edu

136
Subcategory: Chemistry (NOT Biochemistry)

Renewable Solid Supported Catalyst for Biodiesel Synthesis

Lester Anderson, Delaware State University
Co-Author(s): Cheng-Yu Lai, Delaware State University

Biodiesel is defined as a fuel comprising monoalkyl esters of long chain fatty acids derived from vegetable oils or animal fats, either in pure form or mixed in any combination with petroleum -based diesel fuel. Our reserach addresses a critical aspect of current biodiesel production: the catalysts employed for the reaction converting triglycerides to their corresponding fatty acid monoalkyl esters.

A variety of catalysts could be employed for generating biodiesel, most commonly from triglycerides present in oils and fats through a process called transesterification. In most cases, however, these catalysts are used in liquid phase and therefore residual amounts are often found in the final composition of the biodiesel which could deleterious to car engine. The ideal catalyst would be easily separated from the reaction without contaminating the product. Our approach will solve the contamination problem by anchoring the catalytic units on solid support, allowing product separation via sedimentation and filtration.

We propose using cellulosic materials to build solid-supported catalysts. The proposed research focuses on biodiesel and it is intended to be part of a cooperative effort toward engaging in renewable energy research at Delaware State University.
We have developed and tested a few catalysts on cellulosic support. The catalytic units have been covalently attached to several substrates and tested for transformation of palmitic acid to the corresponding methyl-ester. The conversion to biodiesel, which yielded a full conversion for one set of catalysts, have been quantified via gas-chromatography mass spectrometry (GC -MS).

We concluded that the new catalytic support, based on cellu-losic fibrils, is very suitable for biodiesel generation.

Funder Acknowledgement(s): This research was supported by the HBCU-UP SMILE Program, an NSF-DSU undergraduate reseach scolarship.

Faculty Advisor: Cheng-Yu Lai, cylai@desu.edu

137
Subcategory: Chemistry (NOT Biochemistry)

High-Throughput Electrochemical Characterization of Fuel Cell Catalysts

Saad Azam, University of Arkansas at Little Rock
Co-Author(s): Charles C. Hays, California Institute of Technology

Much effort has been invested into research on developing catalysts on low temperature polymer electrolyte fuel cell over the last two decades. Platinum metal is a widely used material for these catalysts, but due to high cost and insufficient availability, new catalysts are being developed. In an effort to reduce the platinum group metal (PGM) loading for the cathode in hydrogen-air fuel cells, JPL has examined a wide range of alloy compositions where Pt metal is alloyed with valve metals (Ti, V, and Zr) and the late transition metals (Co, Ni). The results of the electrochemical measurements, voltage swept cyclic voltammograms and potentiodynamic polarization curves, were investigated using the rotating disk electrode (RDE), and the novel multi-electrode electrochemical test system developed at JPL. The samples that were studied were PtTF, and PtCoZr. In each system, measurements of the active area, revealed by measuring the area associated with the hydrogen-oxidation-reaction (HER) at anodic potentials were conducted; along with polarization curves conducted to determine the oxygen-reduction-reaction (ORR) current density at 0.9 V, vs. NHE). The sample studied was an array of PtCoZr thin films, with up to 30 atomic % Zr, and as little as 56 atomic % Pt, present in the alloy. This five year old sample was measured again for its electrochemical activity. This sample exhibited outstanding electrochemical activity in its original condition (110μA/cm^2 ORR, > 10X larger than (111) Pt thin films), and large surface areas (250μC/cm^2, ~ 2X > (111) Pt.). Previous measurements showed reproducible results with up to one year or more between measurements. X-ray photo-electron-spectroscopy (XPS) measurements showed that the electrochemically treated surface was dominated by Pt-Zr surface layers, with Co, being leached from the surface, and/or reconstructing below the upper surface. The ozone ashing treatment used to prepare the surface for XPS measurements resulted in a 3X loss of electrochemical ORR activity, due to the formation of complex oxides at the specimen surface. During five years of measurements, this sample underwent aggressive durability testing; e.g., thousands of cycles up to 1.6V NHE. Regardless of the extreme conditions, this sample still shows decent ORR activity (40μA/cm^2, still > 4X larger than (111) Pt), and active areas (230μC/cm^2), comparable to polycrystalline. From this we can conclude that this sample is still active and very durable to harsh conditions.

Funder Acknowledgement(s): NASA Space Grant funded this study in collaboration with the Department of Energy at Jet Propulsion Laboratory-California Institute of Technology.

Faculty Advisor: Jim Winter, jdwinter@ualr.edu

138

Subcategory: Chemistry (NOT Biochemistry)

Synthesis of Silicon-Based Calcium Ion Blockers

Irene Brako, Norfolk State University
Co-Author(s): Woodwossen D. Arasho, Norfolk State University

Silicon-based voltage sensitive calcium ion blockers (VSCCBs) will be presented as analogues of Flunarizine, which is a non-selective calcium ion blocker, and an existing antihypertensive drug. These compounds will play a potential role in the treatment of pain, hypertension, stroke, and devoid of the side effects of Flunarizine, one of which is drug-induced Parkinson's disease. Molecular design technique of drug discovery was used here to replace the carbon atom with a silicon atom at key locations in Flunarizine. The newly designed silicon-based compounds were prepared using established experimental synthetic procedures and purified using column chromatography. Each of these compounds were characterized by spectroscopic methods (IR, and NMR). The electro-physiological effects of these compounds on several types of voltage-dependent calcium channels will be evaluated using a Xenopus laevis oocyte expression system.

Funder Acknowledgement(s): W. Arasho; Stars Summer Research Program; Norfolk State University; National Science Foundation Grant-# 0714930.

Faculty Advisor: Woodwossen D. Arasho, wdarasho@nsu.edu

139

Subcategory: Chemistry (NOT Biochemistry)

Synthesis of Lanthanide-pyrazine Carboxylate Metal Organic Framework

Esmeralda Castaneda, Clark Atlanta University
Co-Author(s): Brandon Dennis, Geoffrey Kibakaya, Stephan Mathis II, and Conrad W. Ingram, Clark Atlanta University

Metal organic frameworks (MOF) are a fairly new class of ultra-high surface porous 1-, 2-, and 3-dimensional coordination polymers that have potential applications in gas storage, absorption, gas separation, catalysis, and sensors. They are synthesized from the coordination of metal ions and multi-dentate organic ligands which serve as the linkers. A MOF synthesized from a lanthanide metal ion and the highly multidentate ligand, pyrazine-carboxylic acid (L), could be potentially useful as a sensor, based on the presence of the fluorescent lanthanide ion, and with thermally stability from the highly coordinating pyrazine ligand. However, the synthesis is reported to be challenging since the ligand tends to decompose by decarboxylation under the hydrothermal synthesis conditions.

We herein report that novel La- pyrazine-carboxylate MOFs (La = Tb and Gd) were successfully obtained using $Gd(NO_3)_3 \cdot 6H_2O$ or $Tb(NO_3)_3 \cdot 6H_2O$, the pyrazine carboxylate ligand, L, in the presence of 4,4 - bipyridine and water in H2O(10mg/g solution) at 80 ºC. The structures were characterized using single crystal x -ray crystallography, thermogravimetric analysis, and porosimetry. The 3D MOFs obtained were isostructural and both crystallize in P-1 space group, and with structural formula of $C_{24}H_{40}La_4N_5O_{46}$ (La= Gd or Tb). The structure possesses 4 La atoms per unit cell, with average metal-oxygen bond length of 2.4 Å, and metal-nitrogen length of 2.5~2.6 Å. The ligand has full coordination to the metal ions through its carboxylate groups and through its nitrogen atoms to form the 3D connectivity. The total solvent accessible volume within the void space of the 3D structures is 25.4%. The Tb-containing MOF shows photo-luminescent properties that are characteristics of the terbium ion.

The results indicate that lanthanide-pyrazine will assemble under the solvothermal conditions used to form 3D-MOFs with no decarboxylation of the ligand. Further research will explore the use of other lanthanide and transition metal ion with this ligand for MOFs synthesis and further analysis on the physico-chemical properties of the structures will be conducted.

Funder Acknowledgement(s): This research was supported, in part, by grants obtained from the National Science Foundation, the National Nuclear Security Administration and Quality Education for Minority Network (QEM) awarded to Conrad. W. Ingram, Department of Chemistry, Atlanta, GA 30314.

Faculty Advisor: Conrad Ingram, CIngram@cau.edu

140

Subcategory: Chemistry (NOT Biochemistry)

The Effect of Near Space Conditions on PVCL Nanofibers

Dakeldrick Dismuke, Morehouse College
Co-Author(s): Amir Hobson, Jordyn Tagoe, Martial Webster, and Juana Mendenhall, Morehouse College

Smart polymers are affected by external forces such as temperature, pressure, pH, etc. Poly(N-vinylcaprolactam) [PVCL] is a thermo-responsive polymer that changes its molecular conformation upon temperature change. This research entails electro-spinning of PVCL nanofibers 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 how the material properties of PVCL nanofibers were affected by the high altitude/low temperature

exposure in a weather balloon at altitudes ranging between 45,000 - 85,000 ft. We hypothesize that PVCL fibers that contain antioxidants will protect the material degradation of PVCL fibers upon exposure to near space conditions. PVCL nanofibers were characterized before [and after] balloon launch using Scanning Electron Microscope (SEM) and Fourier Transform Infrared Spectroscopy (FTIR). SEM and FTIR determined the fiber structure and the chemical composition of the PVCL nano-fibers. SEM images compared the size and morphology of the fibers for each image. The 45% (w/v) PVCL solution produced thicker fibers than the 40% (w/v) PVCL solution. The 45% (w/v) PVCL solution also had a more consistent stream without globs when compared to the 40% (w/v) solution. FTIR spectra confirmed that PVCL and antioxidant PVCL nano-fibers were prepared successfully. Upon exposure to near space conditions, PVCL fibers displayed unique fiber structure and morphology in comparison to PVCL fibers with vitamin E and turmeric.

(Acknowledgement statement: Morehouse Department Of Chemistry, Webster, M., Miao, J., Lynch, B., Green, D., Jones-Sawyer, R., Mendenhall, J. Marcomol Master Eng 298,447-453 (2013).Ricka,M., Meewes,R.,Nyffenegger,T.Phys.Rev.Lett. 1990,65,657. Mingdong Dong, Rasmus Havelund Megin Chen, Chem. Mater. 2010, 22(14), pp 4214-4221).

Funder Acknowledgement(s): HBCU-UP, University of Wyoming, Morehouse Department of Chemistry.

Faculty Advisor: Juana Mendenhall, Jmendenhall@morehouse.edu

141

Subcategory: Chemistry (NOT Biochemistry)

The Use of Various Analytical Methods to Compare Quantitative and Qualitative Gunshot Residue Results

Maricia Echols, University of Mississippi
Co-Author(s): Nuwan Kothalawala, Vijay Jupally, Amala Dass, Sarah Glenn, Murrell Godfrey, and Shannon Roy, University of Mississippi

Gunshot residue (GSR) is commonly used as evidence to determine if a person has recently discharged a firearm, distances between suspects and victims involved in firearm related instances, primers and ammunition used to discharge a weapon, and other useful crime related details. Different methods have been proposed to detect GSR ranging from simple colorimetric tests to using expensive machinery such as a scanning electron microscope (SEM). This paper discusses using various analytical methods to develop quantitative and qualitative GSR results. Some crime laboratories and research groups cannot afford expensive instrumentation. It is important to verify whether or not other simpler analytical and cost efficient methods are just as reliable. Different guns containing various primers and ammunition were fired. The GSR was collected and analyzed using the Harrison-Gilroy colorimetric test, ICP-MS, UV-VIS, SEM, and VSC.

Funder Acknowledgement(s): Murrell Godfrey

Faculty Advisor: Murrell Godfrey, mgodfrey@olemiss.edu

142

Subcategory: Chemistry (NOT Biochemistry)

Simulations of Hydrogen Bond Arrangements in [Au25 (Aib)18] -1 Clusters

Svetlana Gelpi, Universidad Metropolitana/University of Connecticut
Co-Author(s): Neranjan V. Perera and José A. Gascón, University of Connecticut

In this project, Molecular Mechanics (MM) is used to determine the number of intermolecular hydrogen bond interactions found between 18 α-aminoisobutyric acid (Aib) oligopeptides protecting a 25 atom gold cluster ($[Au_{25}(Aib)_{18}]^{1-}$) which form a 1393 molecular system. This cluster goes under the general name of Monoprotected layer Cluster (MPC). MPC's consist of an inorganic core made by nobel metals surrounded by an organic mono layer. In 1990, Burst et al. developed one of the first MPC's with Au that was stable enough to form a precipitate. This MPC consisted of a 25 Au core protected by 18 alkenes. In 2006, Fabris et al. developed an MPC similar to Burst's but instead of being surrounded by alkenes it was surrounded by 18 Aib's. The interactions that stabilized the core made by Fabris et al. are 18 intermolecular hydrogen bonds confirmed by ^1H NMR characterization. This interaction protects the core in more extreme conditions rendering the MPC to work better under extreme catalytic conditions. The only challenge encountered was that the $[Au_{25}(Aib)_{18}]^{1-}$ could not form a precipitate. ^1H NMR data gives clues on how the Aib's are structured around the Au cluster making it possible to study the structure computationally. QM/MM hybrid studies are being conducted to properly understand the energy structures of the system and physical geometrical arrangements. Since the $[Au_{25}(Aib)_{18}]^{1-}$ had no XRD analysis we used the XRD data from the MPC synthesized by Burst et al. as a starting structure for our model.

This project consists of using MM to fully describe the system after the integration of the Aib's to the 25 Au cluster. MM in this project is used to find the 18 intermolecular hydrogen bonds which are the few details known about the $[Au_{25}(Aib)_{18}]^{1-}$ physical structure. After describing the $[Au_{25}(Aib)_{18}]^{1-}$ functional forms with MM they're applied to Monte Carlo (MC) simulations which solve Newton's equation of motion for atoms on the MM energy surface. The 18 Aib's are attached to the MPC cluster developed by Burst et al. Later, the deterministic (MC) technique using the metropolis algorithm is used on the $[Au_{25}(Aib)_{18}]^{1-}$ to geometrically optimize the cluster and find a global minimum. The global minimum is determined when all of the Aib's form 18 intermolecular hydrogen bonds. After all the necessary iterations were made using MC, a structure with 11 intermolecular hydrogen bonds was found. It was observed that during the simulations the 3_{10} -helical conformations the Aib's stayed intact. In the future we plan on using Molecular Dynamic (MD) techniques which bring accuracy to the calculations. This method relies on the new geometrically optimized structure found in this project.

Funder Acknowledgement(s): Camille and Henry Dreyfus New Faculty Award; National Science foundation career award; Start-up package funds from the University of Connecticut; Chemistry NSF-REU Program (CHE-1062946) funds

Faculty Advisor: José A. Gascón, jose.gascon@uconn.edu

143

Subcategory: Chemistry (NOT Biochemistry)

Investigating a Greener Synthesis for BHC

Cameron Ginochio, University of Minnesota-Twin Cities
Co-Author(s): Jane Wissinger and Mohsen Mahmoodi, University of Minnesota-Twin Cities

Because of its importance as a photoremovable protecting group used by the Distefano research group, the synthesis of 6-bromo-4-(chloromethyl)-7-hydroxycoumarin (Bhc) was investigated. A related coumarin was already synthesized in the 2311 teaching laboratory, therefore it was hypothesized that the same green methodology could be applied to the synthesis of Bhc and provide students with a connection to an active research program in the department. Unfortunately, the original teaching lab conditions do not work for Bhc. A wide range of green catalysts and conditions for the Pechmann condensation reaction between 4-bromoresorcinol and ethyl-4-chloroacetoacetate to produce Bhc were explored, but results show that brominated resorcinol proves to complicate the synthesis. A greener synthesis for Bhc would both provide students a connection with real world research and an environmentally friendly pathway to create a molecule that is valuable to cancer drug research.

Funder Acknowledgement(s): North Star STEM Alliance

Faculty Advisor: Jane Wissinger, jwiss@umn.edu

144

Subcategory: Chemistry (NOT Biochemistry)

Analytical Detection Methods of THC in Fingerprints as Markers for Marijuana

Kristyn Kelly, University of Mississippi
Co-Author(s): Sarah Glenn, Nuwan Kothalawala, Vijay Reddy Jupally, Amala Dass, and Murrell Godfrey, University of Mississippi

In modern day forensics, one of the most efficient ways to identify a suspect or a victim is through the use of fingerprints. However, fingerprints can be used to reveal more about a suspect's lifestyle. Fingerprints can yield visual data as well as chemical data. The analysis of metabolites in biological samples, including fingerprints, can provide a direct correlation of illicit drugs consumed by a suspect. The purpose of this study is to find the detection limits of THC, a metabolite of marijuana, in fingerprints and to use this information to determine one's marijuana usage. Analytical techniques including MALDI spectrometry, HPLC, FTIR, and GC-MS, will be used to quantify and quantitate metabolites of drugs such as marijuana in fingerprints. This study can benefit forensics and law enforcement by providing more cost effective, rapid, and reliable means of detecting illicit drugs in samples collected from suspects.

Funder Acknowledgement(s): Department of Chemistry, University of Mississippi; LSAMP-IMAGE University of Mississippi

Faculty Advisor: Murrell Godfrey, godfrey@olemiss.edu

145

Subcategory: Chemistry (NOT Biochemistry)

Nanopowders and Cosmetics: Are They Safe? A Toxicity Study

Brianna Merritt, Delaware State University
Co-Author(s): Daniela R. Radu, Delaware State University

Due to an overwhelming recent number of applications that involve the use of nanoparticles in consumer products, researchers in the environmental field pose the question of toxicity of engineered nanoparticles. Minerals like zinc oxide and titanium dioxide, commonly used in sunscreen lotions, foundation and other liquid types of lotions are harmless in their normal size. They simply sit on the skin rather than absorbing in to the skin since they are too large to penetrate its protective barrier. However, when these are broken down into nano-particles, which are often smaller than the size of a red blood cell, they are easily absorbed into the skin. We therefore desire to know the effects of nanomaterials on human health. However, the myriad of structures, morphologies, sized distributions and surface properties of nanomaterials invented

to date makes the study of their effects challenging and are prompting investigations in each individual case.
Our research project aims to elucidate the toxicity effects of nanoparticles and dispersions of zinc oxide (ZnO) nanoparticles of the same type used in industry.

The methodology used in industry to generate nanoparticles involves a wet-milling process. We have used micron size ZnO particles to produce our nanopowders. Further, the nano-powders were characterized for particle size distribution and purity. Once the nanoparticles size attained the desired size, they were further converted into dispersions. Both nanopowder and nanoparticles suspension were tested for toxicity in tissue culture using a neuronal cell line. There was no coating on the particles surface to mitigate side effects. The results of our studies indicate that the cells viability was very high, regardless the dosage. However, the appearance of the cells treated with the un-coated ZnO show signs of toxicity. We are currently studying the effects of coated particles and will compare the results.

In conclusion, the results indicate that there are surface related phenomena that must be investigated further to fully understand the toxicity of ZnO nanoparticles in industrial applications, especially in cosmetics.

Funder Acknowledgement(s): This research was supported by the HBCU-UP SMILE Program, an NSF-DSU undergraduate reseach scolarship**.**

Faculty Advisor: Daniela R. Radu, dradur@desu.edu

146
Subcategory: Chemistry (NOT Biochemistry)

Dicopper Complexes for C-H Bond Activation

Amina Mouhamed, University of Minnesota
Co-Author(s): William Tolman and Nicole Gagnon, University of Minnesota

With the goal of understanding the structural, spectroscopic and reactivity properties of particulate methane monooxygenase (pMMO), we aimed to develop a new mimic of the pMMO enzyme active site using small molecule copper complexes. pMMO is an enzyme found in bacteria and is unique in its ability to oxidize methane to methanol. Because little is known about the pMMO active site structure and mechanism, the Tolman lab is using small molecule complex models to try and replicate the properties of the pMMO active site and develop new oxidation catalysts. Success in activating C-H bonds can have far reaching impact in alternative energy sources and lead us closer to a methanol economy. Inspired by other literature and previous work in the Tolman lab, the current project involves designing ligands that can bind two copper atoms in a geometry like that proposed for the active site of pMMO. A ligand featuring two pyridine (dicarboxamide) groups was synthesized, with the aim of stabilizing a dicopper-oxo species. Four categories of reactions were run with slightly different conditions to try and isolate the dicopper chloride system. Emphasis was placed on deprotonating the ligand precursor with KH and then metallating with CuCl2. The products of the metallation reactions were characterized by mass spectrometry, UV-visible spectroscopy, and NMR spectroscopy. Attempts are underway to grow suitable crystals for X-ray crystallography. The product of the synthesis reaction appears to be a dicopper complex, as seen by mass spectrometry and UV-visible spectroscopy. Further characterization via elemental analysis, electron paramagnetic resonance spectroscopy, and X-ray crystallography are necessary to confirm the structure. After successful characterization, redox studies will be conducted to study the oxidation of C-H bonds.

Funder Acknowledgement(s): MSROP; North Star STEM Alliance; Darpa

Faculty Advisor: William Tolman, wtolman@umn.edu

147
Subcategory: Chemistry (NOT Biochemistry)

The Synthesis and Characterization of Chalcones for Use as Chemopreventives

Lauren Peace, North Carolina Agriculture and Technical State University
Co-Author(s): Marion A. Franks, North Carolina Agricultural and Technical State University

Cancer is defined as the uncontrolled growth of malignant cells. It is one of the leading causes of deaths in today's society. The statistics show that one in four deaths in the United States is caused by cancer. Because of unsatisfactory treatment options for many cancers there is a need to develop novel preventive approaches for this malignancy. One such strategy is through chemoprevention by the use of non-toxic dietary substances and botanical products. In order to facilitate this need, we are synthesizing a plethora of methoxy and boronic chalcones using aldol condensation. Chalcones are of interest to us because of their diversity, ubiquity in nature, and electronic structure. We believe that when these compounds are coupled with boronic acids, they will be more potent as chemopreventives than their methoxy counterparts. The goal of our research is to synthesize and characterize several different methoxy and boronic chalcone ethers and to determine the chemopreventive activity of these compounds. The chalcones were made using alkoxybenzaldehydes that were converted from hydroxy-benzaldehydes using the Williamson ether synthesis. Thus far, we have found that the percent yields for these reactions ranged from 17% to 50%. The newly synthesized chalcones were characterized via 1H and 13C NMR. The future work for this research would be to test these compounds to determine their chemopreventive and cytotoxic activity on various cancer cell lines and tumors.

Funder Acknowledgement(s): We would like to acknowledge the NIH #5P20CA138018-04 and NSF HBCU-UP/Talent-21 #1036299 for funding this research.

Faculty Advisor: Marion Franks, marionafranks@gmail.com

148

Subcategory: Chemistry (NOT Biochemistry)

Synthesis and Characterization of Dithiophosphoric Acid and Silane Complexes

Eboney Stallworth, Alabama A&M University
Co-Author(s): Adnan Elkhaldy and Afef Janen, Alabama A&M University

Organodithiophosphate compounds that contain sulfur, and their extensive application in various areas validates investigation of the coordination and bonding properties of sulfur-containing ligands; such as open and cyclic chains. Preparation of these new organometallic compounds of dialkyl and alkylene dithiophosphate complexes will increase our understanding of their structure and bonding. The focus of this research is the interplay between their structures and probable bioactivity. The purpose of this study is to: (i) prepare new ligands by using open chain as well as cyclic alcohols with phosphorus pentasulfide; (ii) synthesize new dithiophosphate complexes of MeClSi[S2P(OR)2]2 (where R = Et, n-Pr, i-Pr, i-Bu and Ph) and MeClSi[S2POGO]2 (where G = – CH2CMe2CH2–, – CH2CEt2CH2– and –CMe2CMe2–) by the reaction of Me3SiCl3 with O, O-dialkyl and alkylene dithiophosphate; (iii) isolate, purify and to characterize these compounds; and (iv) assess their antibacterial activities. New complexes were prepared by dropwise addition of the appropriate dithiophosphoric acid to methyl trichlorosilane in 1:1, 2:1, and 3:1 molar ratios and refluxed in benzene. All these new compounds are characterized using spectroscopic techniques (IR, ^{1}HNMR, ^{13}CNMR and ^{31}P NMR and x-ray crystallography). Preliminary results from IR spectra of these complexes were recorded in the region 4000 - 400 cm^{-1}. The disappearance of the thiol peak at 2500 cm^{-1} indicated that bond formation between the silicone and sulfur. ^{1}HNMR results corroborated IR findings, where the thiol peak disappeared at ~ 4-5 ppm. Future work will involve screening complexes for their cytotoxicity in cancerous cells.

References: A. A. S. El Khaldy, A. M. Abushanab, and Emad Abu Alkhair. Applied Organometallic Chemistry, Volume 25, Issue 7, Pages 487–595, 2011. Synthesis and Antimicrobial Studies of Bis (O,O'-Dialkyl and Alkylene Dithiophosphoric Acids) Adducts of Diphenyl Diselenide.
S. D. Brown, P. Nativo, J.-A. Smith, D. Stirling, P. R. Edwards, B. Venugopal, D. J. Flint, J. A. Plumb, D. Graham and N. J. Wheate, J. Am. Chem. Soc., 2010, 132, 4678–4684. Gold nanoparticles for the improved anticancer drug delivery of the active component of oxaliplatin.

Funder Acknowledgement(s): This research has been supported, in part, by the National Science Foundation-Grant # HRDO928904.

Faculty Advisor: Mostafa Dokhanian, mostafa.dokhanian@aamu.edu

149

Subcategory: Chemistry (NOT Biochemistry)

Improved Mechanisms for Rapid Measurement of Molecular SO2 in Wines

Jerry L. Thomas, Jr., Alabama Agricultural and Mechanical University
Co-Author(s): Patricia A. Howe, Gavin L. Sacks, Jussara M. Coelho, and Christine E. Hansen, Cornell University

Sulfur dioxide (SO2) is broadly used in the production of wine. Free SO2 has both antioxidant and antimicrobial properties. If the free SO2 and pH are known, then molecular SO2 can be measured [1]. Currently, the techniques most commonly used in small wineries are the Aeration Oxidation (AO) Method and the Ripper Method. A new, rapid, and inexpensive method based on quantification of free SO2 using SO2 gas detection tubes was recently described. The Pegram Method showed a linear correlation with gas tube color change versus free SO2.
The purpose of this research is to evaluate factors that could result in an incomplete or variable recovery by the Pegram Gas tube method as compared to AO or Ripper analyses of standard SO2 solutions. We hypothesized that our stock SO2 solutions were degrading due to oxidation. Sulfite can form sulfite radicals in the presence of low levels of iron or copper. These sulfite radicals can form peroxomonosulfate, which can further form sulfate radicals. These radicals can lead to chain reactions that further oxidize SO2 to sulfate. By preparing our stocks in 10% methanol, we provided an alternative pathway that inhibited the chain reaction and produced low levels of aldehyde.
An analysis was conducted using the Ripper Method to show the effects of pure water versus hydro alcoholic solutions on SO2 stability. Stock solutions prepared in water showed low concentration dependent recovery using a 50 mg/L SO2 solution. These working solutions gave recoveries between 30-95%. When prepared in 10% methanol, the recoveries for the working solutions were 95-100%. The recovery of the Pegram apparatus was evaluated, and determined to vary from 45-80%. A leak test was conducted using a water bath, and the apparatus exhibited several leaks in the tubing and jar lid. These results indicate that the variation observed in correlating Pegram and

AO apparatuses could be reduced by using methanol-containing SO2 working solutions and leak-free systems. This may lead to adoption of the Pegram method as an accurate, quick and inexpensive method for measuring free SO2 in wines.

[1] Boulton, R. B., V. L. Singleton, L. F. Bisson and R. E. Kunkee. 1999. Principles and practices of winemaking. Kluwer Academic/ Plenum Publishers, New York.

Funder Acknowledgement(s): This project was funded by the Cornell Food Science Summer Scholar Program and partially supported by the NSF-HBCU-UP project grant HRD0928904.

Faculty Advisor: Mostafa Dokhanian, mostafa.dokhanian@aamu.edu

150
Subcategory: Chemistry (NOT Biochemistry)

Investigation of the Hydrosilylation of Vinyl Pyridine with Trichlorosilane

Gabrielle Webber, Alabama State University
Co-Author(s): Joshua Abbott and Craig Barnes, University of Tennessee

With the goal of creating multifunctional solid acid building block catalysts, the targeted incorporation of tethered pyridinium and imidazolium groups has been explored. The key aspect leading to such functionalized silicate matrices is the preparation of the ionic precursor via hydrosilation of vinyl pyridine with trichlorosilane. Organic synthetic techniques to produce 4-(2-trichlorosilylethyl) pyridine have been previously reported, which provide evidence that an ionic precursor has to be synthesized prior to the synthesis of 4-(2-trichlorosilylethyl) pyridine. We hypothesized that the experimental procedure for the synthesis would proceed without a metal catalyst. The synthesis of the 4-(2-trichlorosilylethyl) pyridine precursor without a traditional metal catalyst is described. We employed a wide-ranging variety of methods of organic synthesis by varying the temperature, solvent, and reaction time until the optimum conditions were established. Proton (^1H) and (^{13}C) NMR spectroscopic techniques were used to confirm the identity of the targets. We have found that the reaction requires a small amount of base to prevent proton transfer reactions.

Additionally, our experimental design has provided a method to produce 4-(2-trichlorosilylethyl) pyridine precursor in high yields. Our studies have also proven that a coordinating solvent is needed, a non-coordinating base is required, and mild heating is required to produce the 4-(2-trichlorosilylethyl) pyridine precursor. These findings will be helpful for the breakdown of cellulose and can utilize renewable resources for bio energy, bio fuels, and other biodegradable chemicals. Future work will consist of the addition of sulfonic acid to the precursor of 4-(2-(trichlorosilylethyl) pyridine, incorporation into the silicate matrix, and catalytic testing.

Funder Acknowledgement(s): Thanks to Dr. Best and staff at University of Tennessee at Knoxville for giving me the opportunity to be a part of 2013 Chemistry REU Summer Research Program. Financial support of the work came from the National Science Foundation.

Faculty Advisor: Craig Eliot Barnes, cebarnes@utk.edu

151
Subcategory: Climate Change

Insights on Carbon Dioxide Interactions with N,N'-dimethylethylenediamine

Nancy Magee, Dillard University

The use of Metal Organic Frameworks (MOFs) is becoming increasingly popular in the scientific community. These crystalline, three-dimensional, porous materials are composed of metal ions and organic ligands, and have been used for a wide variety of applications ranging from catalysis to gas separation and storage. One application that has piqued interest, due to the rising concerns about atmospheric pollutants, is Carbon Capture and Sequestration (CCS). Previous research performed by the Gagliardi group (U of M) in collaboration with the Long group (UC Berkeley) performed a DFT mechanistic study that tackled the capture of carbon dioxide (CO_2) by N, N'–dimethylethylenediamine (mmen) anchored to the MOF Mg_2-(dobpdc), where dobpdc^{2-} is 4, 4'–dioxidobiphenyl-3, 3' –dicarboxylate) and explained the experimentally observed 1:1 (CO_2 : amine) stoichiometry by an effective 2:2 stoichiometry yielding a bis-carbamic acid complex. CO_2 capture by amines in aqueous media occurs through a 1:2 stoichiometry reaction, and the product consists of carbamate and ammonium adduct. Inside of the MOF, the corresponding intermediate species exists as neutral carbamic acid hydrogen bound to an amine.

This work investigates the nature of carbamate-ammonium complex species in the gas phase for mmen derivate species containing different substituents. Such substituents include strong electron-withdrawing (EWG) and electron-donating (EDG) moieties like chlorine and oxygen, respectively, in addition to the standard methyl moiety so that the effects of changing substituents can be highly evident. It is expected that the EWG and EDG of most stable carbamate-ammonium species will be on the ammonium and carbamate adduct, respectively. However, thus far, it has been found that, with a net electrostatic energy of -662.4 kJ/mol, the most stable species contains a methyl and chlorine substituent on its carbamate and ammonium adducts, respectively. Therefore, future perspectives of this project include exploration of the species with a combination of weak and strong EWG : EDG and vice versa in order to achieve the desired, stable 1:2 carbamate-ammonium complex species computationally.

Funder Acknowledgement(s): This research is primarily funded by the National Science Foundation and University of Minnesota Materials Research Science and Engineering Center. Computer resources were provided by University of Minnesota Supercomputing Institute. Special “Thank-you” to Laura Gagliardi, Nora Planas, Allison Dzubak, and Alison McManus for research support.

Faculty Advisor: Bernard Singleton, bsingleton@dillard.edu

152
Subcategory: Education

Updating the Analytical Chemistry Curriculum I

Sena Hussein, University of the Virgin Islands
Co-Author(s): Dr. Latesky and Recaldo Rogers, University of the Virgin Islands

Determination of the composition of Soda Ash using acid-base titrimetric analysis. The main goal of this project was to update the analytical chemistry curriculum and develop new experiments that could be used in the analytical chemistry curriculum. The experiment involved the analysis of a mixture of sodium bicarbonate and sodium carbonate or Soda Ash.

The goal of this experiment was to determine the percent composition of soda ash using titrimetry by using the MircoLab. Samples of soda ash were titrated using standardized HCl (aq). All titrations were monitored using a calibrated pH electrode and a Microlab data acquisition system. The titration curve demonstrated the expected results, with the pH at the beginning of the soda ash titration at 12.5, which decreased as acid was added. The first equivalence point represents the protonation of carbonate anion, and the second equivalence point indicates the second protonation of the bicarbonate anion. Determination of Ka values for monoprotic and diprotic weak acids; the purpose of this experiment was to determine the Ka values for a monoprotic and diprotic product. The Ka is the equilibrium constant for partial ionization of “weak acids” in water. In this case, the weak acid is p-Amino Benzoic Acid. For a monoprotic acid, the acid dissociation constant, Ka, is equal to the pH at the half-neutralization point. Titration of a known amount of completely titrate the acid. The pH at half this volume is equivalent to the pKa. The same process was used to titrate a diprotic acid (tartaric acid), and using the same process, Both Ka1 and Ka2 values were determined. Comparison of results with literature values showed close agreement (+/-0.5pK units) for both experiments.

Future studies include the development of additional laboratories for both quantitative analysis laboratory and the instrumental analysis laboratory. In particular, we are interested in incorporating laboratories involving the analysis of both freshwater (drinking water) and seawater using the Inductively Coupled Plasma Mass Spectrometry (ICPMS) or electrochemical methods (cyclic voltammetry, polarography, anodic stripping polarography).

Funder Acknowledgement(s): HBCU-UP

Faculty Advisor: Dr. Latesky, slatesk@live.uvi.edu

153
Subcategory: Materials Science

Surface Modified Nanocellulose for Epoxy Composites

Ayanna Jones, Clark Atlanta University
Co-Author(s): Greg Schueneman, Forest Products Laboratory, U.S. Forest Service
Eric Mintz and Lionel Cross, Clark Atlanta University

Single crystals of cellulose derived from trees exhibit modulus and tensile strength on par or better than aramid fibers, low density and thermal expansion, and have refractive index similar to most polymers, providing a potential source of bioderived renewable reinforcing materials for polymer matrix composites. In their pure crystalline form, these single crystals are termed cellulose nanocrystals (CNCs) and are 3-5 nanometers in cross-sections and about 200 nanometers in length. Upon extraction, the CNCs have hydrophilic surfaces mainly consisting of hydroxyl groups and a variety of acidic moieties imparted by the acid used to hydrolyze the amorphous content. In general, the CNC’s have 0.7-1 wt.% sulfur on a dry cellulose basis. Due to the CNC’s hydrophilic and ionic surfaces they are not compatible with most organic polymers. Thus, surface modification of the CNCs is necessary to improve the CNC-polymer interface. Herein we report the exchange of the sodium ion from sulfate groups on the CNC’s for ions with hydrophobic groups by treatment with benzyl trimethylammonium chloride (BTMAC), glycidyltrimethyl ammonium chloride (GTMAC), and cetyltrimethylammonium bromide (CTAB). The sodium halide was removed by dialysis and the resulting solutions freeze dried. The thermal stability of the ion exchanged CNCs were studied by thermo gravimetric analysis (TGA). The as received CNCs exhibited an onset of thermal decomposition of 278˚C under nitrogen while the ion exchanged samples had a lower thermal stability, with the onset of weight loss at 210-230˚C. While CNCs are dispersible in water, they are non dispersible in most organic solvents. We examined the dispersion of CNC-BTMAC and CNC-GTMAC in a variety of organic solvents. CNC-BTMAC was dispersible only in DMSO while CNC-GTMAC was in DMSO and propylenediamine. Future work will focus on the incorporation of these new biobased materials in polymer matrix composites.

Funder Acknowledgement(s): The authors would like to gratefully acknowledge support of this work by U.S. Forest

Service Grant 10-JV-11111104-066, and NSF grant HRD-1305041, and Richard Reiner/Alan Rudie of the Forest Products Laboratory, Madison, WI for providing CNCs for this research.

Faculty Advisor: Eric Mintz, emintz@cau.edu

154
Subcategory: Materials Science

Hydrolysis and Analysis of Simple Sugars Using Smart Fibers from Subterrane

Elmon A. Merriman, Morehouse College
Co-Author(s): Jeffrey Moore Jr., Duane Jackson, and Juana Mendenhall, Morehouse College
Ishara Emerson, Spelman College

The development of smart fibers as affinity membranes is of recent interest due to the study of enzyme activity in biological processes. Poly (N-vinylcaprolactam) [PVCL] and cellulose fiber mats have been fabricated to study the hydrolysis of in the presence of biological entities such as cellulase enzymes. PVCL is a water soluble, thermally sensitive, biocompatible polymer that undergoes a lower critical solution temperature (LCST) or cloudy point. PVCL-cellulose [PVCL-CELL] fibers, were electrospun and conjugated with fluorescent 5-(4, 6-dicholorotrazinyl)-aminoflourescein[DTAF]. PVCL-CELL fibers were fed to Reticulitermes species (sp) subterranean termites and simple sugar production was examined. Using absorbance measure-ments, Fourier Transform Infrared Spectroscopy (FTIR), fluorescent microscopy, thin layer chromatography (TLC) and high performance liquid chromatography (HPLC), enzymes such as cellulase and simple sugars were identified and analyzed upon the hydrolysis of PVCL-CELL fibers. Upon incubation at 26.5°C, minimal sugar content was produced using PVCL-CELL fibers. However at 50°C, a two fold increase of glucose was produced using the PVCL-CELL fibers. The fermentation of the sugars will be implemented on a larger scale, where these techniques will be used in the production of bioethanol, a biofuel.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF-HRD-104330, Morehouse College M-WISE Program awarded to Lycurgus Muldrow, Director for HBCU -UP, Morehouse College, Atlanta, GA 30314.

Faculty Advisor: Juana Mendenhall, jmendenhall@morehouse.edu

155
Subcategory: Materials Science

Decontamination of Heavy Metals with Chemically Altered Chitosan Composites

ValaRae Partee, University of Georgia
Co-Author(s): Gary Halada and Mike Cuiffo, Stony Brook University

The decontamination of water, soil, and metallic surfaces exposed to hazardous or toxic materials is currently an environmental priority. By remediating these interfaces in a safe and effective method, scientists can safely dispose of dangerous contaminants and reduce or eliminate hazardous secondary waste streams. Chitosan is a biodegradable linear polysaccharide that is derived by the deacetylation of chitin, a natural polymer found in fungi and crustaceans. In this study, chitosan is investigated for its remediation capabilities in two different methods. The first is by absorbing 100 mmol solutions of cerium chloride ($CeCl_3$), strontium nitrate ($Sr(NO_3)_2$), and potassium dichromate ($K_2Cr_2O_7$), both electrochemically and by saturation, onto type 304 stainless steel coupons that were electrochemically coated in hydrochloric acid based chitosan solution. The second method used chitosan cross linked with gluteraldehyde as a dip for contaminated and corroded steel pieces. 100 mmol solutions of $CeCl_3$, $Sr(NO_3)_2$, or $K_2Cr_2O_7$ were pipetted onto corroded 1010 steel and exposed to wet/dry cycles to further corrode the surfaces.

The exposed and corroded steel was then exposed to a 1000 watt heat lamp for 10 minutes and the surface layer, which had begun to peel from the underlying steel, was lightly scrapped off and made into Permeable Environmental Leaching Capsules (PELCAPs) for leach testing (Spalding, 2005). Fourier transform infrared (FTIR) spectroscopy, Raman spectroscopy, optical microscopy, and scanning electron microscopy (SEM) imaging, and energy dispersive analysis by X-rays (EDAX) were used to analyze the association of chitosan with contaminants and to determine chitosan's potential to successfully capture contaminants. It was determined that exposure to chitosan, as a dip or through electrochemical coating, can act as a safe and effective method for removal of toxic metal contaminants.

Further tests will be conducted to determine which method of remediation is the most effective and the development of chitosan filters are being considered.

[Disclosure (R8405), Patent Pending Decontamination Of Structural Steel Using Chitosan Dips and/or Sprays; Disclosure (R8406) Patent Pending Chitosan for Secondary Containment & Stabilization Of Uranium; Disclosure (R8423) Patent Pending Enhanced Decontamination of Metal Surfaces With Radioactive Contamination Using a Chitosan/Zero Valent Iron Slurry; Disclosure (R8424) Patent Pending Zero Valent Iron Slurries for Permeable Reactive Barrier Systems.]

Funder Acknowledgement(s): This work was funded in part by a grant from the National Science Foundation awarded to Gary Halada.

Faculty Advisor: Gary Halada, gary.halada@stonybrook.edu

156
Subcategory: Materials Science

The Development of All-Conjugated Block Copolymer Photovoltaics

Bridget Stewart, Prairie View A&M University/Rice University
Co-Author(s): Kendall Smith, Yen-Hao Lin, Jorge Mok, and Rafael Verduzco , Rice University
Bart Sheinberg, Houston Community College, Houston, TX

Organic photovoltaics (OPV) are an active area of research, promising to be a more cost effective method of generating electrical energy from solar radiation. Organic materials are compatible with a variety of flexible substrates, allowing them to be easily incorporated into various applications such as recharging cell phones, laptops, or powering small electronic devices. However, the efficiency of OPV devices continues to be below that required for commercial applications. Here, we explore self-assembly approaches to improved OPVs using all-conjugated block copolymers. All-conjugated block copolymers are comprised of two distinct semiconductive, conjugated polymer blocks linked covalently. We synthesize poly(3-alkylthiophene)-*block*-poly(9,9-dioctylfluorene) copolymers using a combination of Grignard metathesis and Suzuki-Miyaura polycondensation. Analysis by a combination of size-exclusion chromatography, ^{1}H NMR, and UV-VIS absorbance indicates successful synthesis of all-conjugated block copolymers with little or no homopolymer impurities. The self-assembly and thin film structure of all-conjugated block copolymers was analyzed by grazing-incidence wide- and small-angle scattering (GIWAXS and GISAXS). These measurements reveal a competitive crystallization process and a processing dependent structure. Crystallinity and crystalline orientation is enhanced with thermal annealing, and long-term solvent annealing results in randomization of the crystalline orientation and, in some cases, the formation of lamellae with long-range ordering. Device measurement studies show up to 3 % power conversion efficiencies for the best all-conjugated OPV. This work demonstrates the potential of all-conjugated block copolymers for improving the microstructure and performance of OPVs.

Funder Acknowledgement(s): This work was made possible and funded by the Department of Homeland Security, Office of Science and Technology, Award # 2009-ST-000031 (Creation of a Community College University Collaborative to promote STEM Research and Curriculum Enhancement). This work was supported in part by the Welch Foundation for Chemical Research (Grant # C-1750), and the National Science Foundation under Grant No. CBET-1264703. Use of the Advanced Photon Source, an Office of Science User Facility operated for the U.S. Department of Energy (DOE) Office of Science by Argonne National Laboratory, was supported by the U.S. DOE under Contract No. DE-AC02-06CH11357. Use of the National Synchrotron Light Source and Center for Functional Nanomaterials, Brookhaven National Laboratory, were supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-98CH10886.

Faculty Advisor: Rafael Verduzco, rafaelv@rice.edu

157
Subcategory: Nanoscience

Free Radical Oxidation of Methionine and Methionyl-containing Peptides

Sarah Joyce Berryhill, Hampton University
Co-Author(s): Yao Akpamagbo, Alexis Fennoy, Danielle Oliver, Sainath Babu, and Michelle O. Claville, Hampton University
Rao M. Uppu, Southern University

Methionine (Met) is a naturally occurring sulfur-containing amino acid, essential for normal growth and metabolism. Oxidation of methionine has been associated with Alzhemier's and Parkinson's disease. We hypothesize that reactive oxygen species such as peroxynitrite (PN) and hypochlorous acid (HOCl) may have a role in methionine oxidation, possibly through distonic ion radical intermediate. In order to understand the mechanism, Met and a Met-containing peptide (2µmol) were allowed to react with either PN or HOCl (0 to 3µmol) at physiological pH (pH 7.0). An aliquot of the reaction was analyzed by Reverse Phased-HPLC equipped with the Supelco Discovery C18 column (150 x 4.6 mm; particle size: 5 µ) using an isocratic mobile phase that contained 5 mM 1-hexanesulfonic acid and 0.25% (v/v) triethylamine (pH adjusted to pH 7.0 with acetic acid) at a flow of 1.0 mL/min and monitored at 220nm. About 66.5% of MET and 64.2% of MET-GLY with half the stochiometric amount of HOCl was oxidized. The stochiometric equivalents of HOCl completely decomposed both MET and MET-GLY peptide while stochiometric equivalent of PN, was about 50% in Met and 74% in Met-Gly. Experiments are currently being done to characterize the products through NMR and IR spectroscopy. The findings from these experiments will highlight the importance of cellular oxidants in Met oxidation.

Funder Acknowledgement(s): This research is supported by grants from NSF-1230357 (formerly 0847742) and NSF HRD: 1238838.

Faculty Advisor: Michelle Claville, michelle.claville@hamptonu.edu

158
Subcategory: Nanoscience

Synthesis of Azide Ligands for PAMAM Dendrimers

Michael County Jr., Southern University/Xavier University of Louisiana

Co-Author(s): Lauren Luce, Janet Manono, Barry Hester, and Stassi DiMaggio

In 2007, cancer caused about 13% of all human deaths world-wide (7.9 million). Rates are rising as more people live to an old age and as mass lifestyle changes occur in the developing world. Current treatments of cancer include invasive and destructive techniques such as radiation and surgery, with hidden and toxic side effects. One way of combating the side effects of surgery and chemotherapy is by using targeted drug delivery made from Poly (amido amine) (PAMAM) dendrimers. Our task was to synthesis azide Ligands for the conjugation of PAMAM dendrimers. Dendrimers are starbranch polymers that can be synthesized by generation, increasing in size and number of terminal amines. Small functional molecules, such as cell targeting agents, drugs, and dyes, can attach to the terminal amines creating a multifunctional macromolecule.

Unfortunately, these conjugation reactions result in a distribution of products varying in numbers of conjugates which are difficult to separate from each other. The azide ligand is very polar and allows prep-HPLC separation of the populations. It will also give a unique point of attachment for the small functional molecules to control the number of conjugates per polymer. We believe by controlling the stoichiometry of conjugates that this will aid nano-delivery systems transition by eliminating polydispersity.

Funder Acknowledgement(s): REU and LA-SIGMA program 2013; Xavier University of Louisiana, Department of Chemistry; RCMI/NIH 5G12RR02620.

Faculty Advisor: Berry Hester, bhester@susla.edu

159
Subcategory: Nanoscience

Fabrication and Characterization of PLLA and PCL Nanofiber Membranes

Kurt Deixler, Delaware State University
Co-Author(s): Dula Man and Sherron Howard, Delaware State University

Biocompatible nanofibers can provide enhanced cell adhesion and proliferation due to their similarity to the extracellular matrix components. Numerous different biomaterials have been used to construct nanofibrous scaffolds for bone, cartilage, ligament, and skeletal muscle tissue engineering. Electrospinning is a popular technique to fabricate a variety of nanofiber scaffolds with desirable characteristics, and the process is aptly modulated by the parameters such as voltage, flow rate, and distance between spinneret and collector. In this study, we fabricated polycaprolactone (PCL) and poly-L-lactic acid (PLLA) nanofiber membranes, characterize their nano features using a scanning electron microscope, evaluate their crystallinity using X ray diffractometer, thermogravimetrical analysis, and examine their capacity of supporting cell growth on them. For cell growth assay, human colon cancer cells HCT116-19 and Dojindo Cell Counting Kit were used. Our data show that PCL forms more neatly aligned nanofibers, exhibits more crystallinity, and has higher decomposition temperature. The FTIR peak pattern of the two different nanofibers is similar, but shifted distinctly. Our data also show that HCT116-19 cells grow along the nanofiber orientation.

Funder Acknowledgement(s): This study was supported by the Delaware State University SMILE program. We thank lab members Dr. Kmiec, Dr. Goudy, and Dr. Melikechi from Delaware State University for instrumental help.

Faculty Advisor: Dula Man, dman@desu.edu

160
Subcategory: Social Sciences/Psychology/Economics
Isolation and Characterization of the Essential Oil of Catnip

Alyssa Allen, Virginia State University
Co-Author(s): Alexus Shabazz and Colleen Taylor, Virginia State University

The squash bug causes damage to plants in the cucurbitaceous family and is responsible for countless crop losses every season. The pest causes the infected plant to wilt and eventually die by sucking nutrients from the leaves and causing a disturbance in the water flow. According to the popular literature and internet sites devoted to organic gardening, companion planting with the mint family is one method to deter infestation of these crops by the squash bug. Despite the amount of information in the farming community and in popular literature regarding companion planting as it relates to squash bugs, little to no peer reviewed research has been done to assess what affect the mint plant family chemical components have on the ability to ward off squash bugs. Mint family plants are quite invasive and thus producing an inexpensive application may benefit gardeners. In our initial research, we report methodology used to abstract the essential oil from dried plant leaves of the catnip plant from the mint family. Nepetalactone is the major component of this oil. We have begun initial characterization by UV/Vis and IR of the extract obtained by steam distillation. Initial studies via gas chromatography are in progress. We are testing the extract on squash plants located on a 17 acre property in Powhatan County, Virginia. We report here the initial results of this application of infestation by the number of adult squash bugs and egg clusters on a variety of squash plant types in different locations, soil type and planted in boxes and directly on the soil.

Funder Acknowledgement(s): Colleen Taylor Virginia State University Chemistry Department; Amber Dollete, HBCU UP / LSAMP Programs; Virginia State University.

Faculty Advisor: Colleen Taylor, Cmtaylor@vsu.edu

161
Subcategory: Water

Water Nutrient Content Influence on Bioluminescence in St.Croix, USVI

Jamila Martin, University of the Virgin Islands

In the 1960s, a hotel development located in Salt River Bay, US Virgin Islands created a man-made embayment, which today developed into the bioluminescent, Mangrove Lagoon. Within Mangrove Lagoon, bioluminescent dinoflagellates emit light when the water is agitated, producing a vibrant glow. The primary factors influencing the abundance of these dinoflagellates are not yet fully understood. We observed that there was significant bioluminescence throughout Salt River Bay, however, the highest concentration was observed within Mangrove Lagoon.

The main objective of this study was to examine the nutrient content in Salt River Bay and compare it with that of Mangrove Lagoon to investigate if nutrient content influences the concentration of bioluminescent dinoflagellates. Four sample sites were selected for the collection of water samples for the analysis of nutrients. Water samples were obtained during the night between the hours of 9 pm -11 pm from the surface and bottom of the water column. The sample sites were located within Mangrove Lagoon, in the mouth of Mangrove Lagoon, and two in Salt River Bay, which is connected to open ocean. The nutrients tested for this study were Total Nitrogen (TN), Total Phosphorus (TP), Nitrates and Total Organic Carbon (TOC), all of which used EPA approved methodologies. The results of Pearson’s correlation analyses between Mangrove Lagoon and Salt River Bay did not reveal a significant difference (P-value > 0.05) for any of the nutrients tested. Directions for future work include correlating the nutrient concentration with the abundance of the dinoflagellates within Mangrove lagoon and Salt River Bay.

Funder Acknowledgement(s): This research was funded by NSF HBCU-UP Grant Award No. HRD – 0506096 and the Department of Interior National Park Service.

Faculty Advisor: Bernard Castillo II, bcastil@live.uvi.edu

Computer Sciences and Information Management

162
Subcategory: Computer Engineering

Seeing by Touch Without Contacts

Franklin Palmer, City College of New York
Co-Author(s): Edgardo Molina and Lei Ai, City College of New York

Touch is one of the most natural methods of navigation available to the blind. In this work, we propose a method to enhance a person's use of touch for surrounding awareness by placing range sensors coupled with small vibrators throughout their body. This would allow them to be able to feel objects and obstacles in close proximity to them, without having to physically touch them. Other groups have sought to use haptic, vibratory feedback to provide navigational information to the blind, but they have concentrated on providing feedback that either conveys navigational information or is designed to enhance the use of another device, such as a white cane. Our device seeks instead to enhance a person's sense of physical awareness with their surroundings by providing feedback that directly corresponds with distance to nearby obstacles.

To this end, we are building a device that is as small and unobtrusive as possible. Our previous attempts at creating this type of device concentrated on designing clothing that integrated all of the control circuitry, sensors, and vibrators into a tight-fitting format. In testing we found that this approach had several disadvantages: it was difficult to construct, difficult to clean, necessitated different clothing for different users, and could not be worn in conjunction with other pieces of clothing. We have since sought to construct an array of connected vibrators and range-sensors that are as small, modular, and reconfigurable as possible. To this end, we have begun building small armband devices for the vibrators that can be worn as close to the skin as possible, which then connect wirelessly to range-sensing armbands that can be worn on top of any clothing the user might be wearing.

Funder Acknowledgement(s): This work is supported by NSF EFRI-REM under Award EFRI-1137172 to the City College of New York and the City College Entrepreneurship Program.

Faculty Advisor: Zhigang Zhu, zhu@cs.ccny.cuny.edu; Tony Ro, tro@ccny.cuny.edu

163
Subcategory: Computer Science & Information Systems

Developing the Interactive Chromatin Modeling Program

John Bell, Southern University at Shreveport
Co-Author(s): William Johnston, James Liman, Victoria Bamburg, and Thomas Bishop, Louisiana Tech University

The Interactive Chromatin Model web server (ICM-Web,www.latech.edu/~bishop) is a tool to model chromatin. ICM-Web integrates both bioinformatics and computational biology allowing the user to input a sequence of DNA and choose from several different energy models and nucleosome placements to generate a 3D representation. Using El Hassan's algorithm (1995) and Bishop's dinucleotide based folding model (2008), ICM-Web generates a nucleosome energy diagram, 3D representation of DNA and chromatin, and plots of DNA helical parameters. The current version of ICM-Web evolved rapidly from its original design. The rapid evolution produced an unstructured mix of FORTRAN 77 and FORTRAN 90. The primary limitation of implementation is that the program allows only one type of nucleosome footprint. It was decided in moving forward with this program that ICM is to be redesigned either using C++. The hypothesis is that since both FORTRAN and C++ are high-level languages, there will be no noticeable difference in the processing time. To compare the two programs, a segment of the ICM code was translated into C++. Both the FORTRAN and C++ code segments were then utilized to process DNA sequences ranging from 10 base-pairs to 1 million. The DNA sequences were identical and each set of data was run three times to ensure timing accuracy. All tests were run on the same machine. The results were that with the 100 base-pair sample, the C++ code ran 42% faster and with the 1 million base -pair sample, the C++ code ran 51% faster. We can conclude that the C++ code will provide faster throughput ICM.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under the NSF EPSCoR Cooperative Agreement No. EPS-1003897 with additional support from the Louisiana Board of Regents.

Faculty Advisor: Josephine Loston, jloston@susla.edu

164
*Subcategory: **Computer Science & Information Systems***

Developing a Non-Intrusive Method to Increase the Privacy of Android Camera Enabled Applications

Jarvis Brewer, Savannah State University
Co-Author(s): Ahmal Baloubi, Shaw University
Qatrunnada Ismail and Apu Kapadia, School of Informatics and Computing, Indiana University

As technology continuously emerges so does the staggering issues revolving around security. Our research focuses on enhancing privacy of cellular devices that operate on the Android operating system. Android, being an open source platform, easily increases the applications that these devices have to offer, however it also increases the risk that an app may attempt to access personal and private information through the act of “virtual theft”. This particular type of crime involves malicious applications being installed on the device which then can gain access and or control the mobile phones’ multiple sensors, also known as “sensory malware”. Current Android devices put the burden on users to install apps that will not steal visual information nor share photos that are damaging. Our goal focuses on exploring systems that can lessen the risk of camera-enabled applications and reduce the burden on the user. By incorporating the location services (GPS, network, Wi-Fi) already installed on these devices, we are designing a conceptual system which will then allow the user to control when their photos are taken and how they are shared based on the location of the device. This system allows users the option to set certain regions on a map interface that when entered into by the device sets the camera into different modes to lower the possibility of information being captured and shared without the user’s permission. The concepts outlined in this project could then be integrated into current and future Android devices to reinforce their security.

Funder Acknowledgement(s): Indiana University Bloomington, IN. This research is supported by NSF grant no. CNS-1016603. The contents do not necessarily reflect views of the sponsors. Other affiliated universities are Savannah State University and Shaw University.

Faculty Advisor: Apu Kapadia, williamsk@savannahstate.edu

165
Subcategory: Computer Science & Information Systems

Utilizing Dijkstra’s Algorithm to Determine the Shortest Route to Campus Buildings

Jasmine Butler, Savannah State University
Co-Author(s): Alfredo Villanueva, Department of Engineering, Technology & Mathematics, Savannah State University

Savannah State University (SSU) students and employees utilize various routes to get to locations on campus. It is important to travel on or off campus as with any location in a feasible, safe, and timely manner. As the campus continues to flourish and increase with incoming freshmen, faculty/staff, and visitors, it is critical to arrive at the desired destination in a timely manner. When using Google Maps, MapQuest and/or various internet mapping services to determine the shortest path, it only gives the street way to get to a destination. In all actuality, there are several routes a traveler may elect to take to arrive to several buildings given other means (i.e. walking, bicycling, etc.).

The principal objective of this research is to demonstrate the shortest path between several buildings on campus using Dijkstra's Algorithm. Using this method could get people to their destinations quicker than they may have imagined. Dijkstra's Algorithm is a scientific graph search algorithm that solves the single-source shortest path problem for a graph with non-negative edge paths. Its purpose is to find the shortest path from a starting vertex (point) to all the other vertices.

Additionally, the algorithm keeps track of the set of vertices for which the distance has been calculated until it gets to its final vertex, which is the destination. In order to determine the shortest path, I used a programming language that allows for the destination of the distances to be calculated. The programming language I used to demonstrate the shortest path was C++, and it found the distances between the buildings shown and the overall shortest path. Initially, what you want to do is have a start destination and calculate your way to the end. The final product of this project is the actual map and C++ coding which declares how the shortest distance is determined/calculated.

Funder Acknowledgement(s): NSF-HBCU-UP (MAGEC-STEM Plus); Grant#HRD-0928454.

Faculty Advisor: Alfredo Villanueva, williamsk@savannahstate.edu

166
Subcategory: Computer Science & Information Systems

Contradiction: Public Access to Private Accounts

Danielle Butts, Norfolk State University

The increasing use of social media by internet users requires a controlled effort to ensure protection of data from unintended viewers. Unfortunately, many users are unaware that their data is not always private. In particular, individuals that use multiple social networks are vulnerable to malicious attacks, identity theft, stalking, and other related offenses. Social media monitoring tools (SMMT) are available and used to extract data from social media sites (SMS) exposing information such as phone number, date of birth, social security number, e-mail address, or personal internet website. Use of SMMTs can result in someone gathering an entire profile of an individual. This research effort involves the investigation of security risks in using social media and the prospect of collecting a full synopsis of individuals who use multiple social networks. The research includes creation of various mock SMS profiles, evaluation of them with three SMMT environments to determine the complexity and effort required to retrieve profile data. The SMMTs are also assessed for accuracy in retrieving data and exposing security breaches in SMS. The hypothesis is that it is moderately simple to extract security related data from social network accounts using SMMTs. Based on analysis of the free SMMTs tested, it was not straightforward to extract security-related data from social networks using the tools. However, further research with commercial SMMTs is required to determine if these products are more reliable in retrieving information from SMS.

The research results helped to identify security and privacy criteria for incorporation into a comprehensive tool that will help the user recognize weaknesses in their privacy settings. The social network user is provided knowledge of what can be done to prevent privacy violations from happening in the future. Protecting the user's privacy and educating users about their security is the objective in this research development. The assessment of existing SMMTs and design of an interface for the comprehensive tool is the scope of this work. Future work is needed to implement the user-friendly monitoring tool that social media users can use to safely evaluate the privacy risks of their personal media accounts.

Funder Acknowledgement(s): This research effort was funded by Washington-Baltimore-Hampton Roads-LSAMP.

Faculty Advisor: Felicia Doswell, fdoswell@nsu.edu

167
Subcategory: Computer Science & Information Systems

Drug Repurposing

Shanice Caldwell, Savannah State University/Rensselaer Polytechnic Institute
Co-Author(s): Deborah McGuinness and James McCusker, Rensselaer Polytechnic Institute

The purpose of this research is to find new effective treatments for disease using existing drugs. Our approach is to gather and integrate existing data using semantic technologies to help discover promising drug repurposing. Many diseases are based on genetic or epigenetic changes that can be targeted indirectly via upstream regulatory pathways. Targets need to have a high likelihood of affecting all possible changes, and so need to have upstream interactions that cover multiple genotypes/epigenotypes that might drive the same phenotype. This interaction information is available from a number of sources, many of which are already available as linked data. The genes and proteins in these pathways are also represented in linked data. We can potentially aggregate information that represents transcription, epigenetic, and genetic state in many different diseases using a common means of expression. These facts and probabilities can be used to determine if, for instance, a drug target is likely to affect a particular phenotype. We can essentially simulate reactions of already-approved drugs by finding out what downstream effects they may have on disease. The simulation is enabled by background semantic models of effects and pathways.

Funder Acknowledgement(s): Louis Stokes Alliance of Minority Participation

Faculty Advisor: Deborah McGuinness, mcguid@rpi.edu

168

Subcategory: Computer Science & Information Systems

An Accessible Game Using a Close-Range Depth Sensor

Alpha Diallo, City College of New York
Co-Author(s): Edgardo Molina, City College of New York
Hao Tang, Borough of Manhattan Community College

Video games are a multibillion dollar industry with annual unit sales of over 300 million. Yet by their very nature, video games are inherently inaccessible to the 280 million blind and visually impaired people around the globe. The recent emergence of consumer 3D depth-sensing devices such as the Kinect heralds the prospect of new and immersive gaming experiences previously impossible with traditional input modalities. In this study, we present an accessible game of "Rock-paper-scissors" for the blind and visually impaired. Using a close-range, finger-tracking depth sensor, we implement a game that is both played and controlled using physical hand gestures that the user performs within the field of view (FOV) of the sensor. Game instructions and feedback are provided by audio and speech synthesis. Our goal is to investigate the accessibility challenges present in gaming user interfaces that incorporate close range depth sensors. For simplicity, the game only requires 5 gestures. There are two command gestures: thumbs-up to begin a new game round, and a hand wave to listen to synthesized audio of instructions. The remaining three gestures are used for gameplay: a closed fist for Rock; an open hand for Paper, and 2 extended fingers for Scissors. Preliminary testing with visually impaired users has revealed that there is one overarching challenge in implementing accessible user interfaces with close range gesture tracking sensors: having the user perform the appropriate gestures while staying within the field of view of the sensor. Tests were conducted with blind users playing the game on a PC with a close-range depth sensor attached. We noticed that players tended to make quick and erratic movements while performing gestures, often taking their hand out of the sensor's FOV. We discussed potential fixes that use more audio or vibrotactile feedback to alert the user when the hand goes out of view, however we find that these solutions tend to overwhelm crucial senses of the visually impaired. We decided in favor of a physical enclosure to help the hand remain within the sensor's FOV. Testing of this solution is still to be done and will be the next step in our future work.

Funder Acknowledgement(s): This work is supported by NSF EFRI-REM under Award EFRI-1137172, and part of the work was done when the authors visited Carnegie Mellon University in the summer of 2013.

Faculty Advisors: Zhigang Zhu, zhu@cs.ccny.cuny.edu; Yaser Sheikh, yaser@cs.cmu.edu; and Martial Hebert, hebert@ri.cmu.edu

169

Subcategory: Computer Science & Information Systems

Creation of a Donation Drop Box Locator Application Using Google Maps API

Keythe Gentry, Morehouse College

This research highlights the construction of an online interactive map tool that can display donation drop box locations and gives an assessment to the credibility of the company that owns the box. The website will allow users to distinguish between for-profit and not-for-profit donation drop boxes. The map was designed for maximum convenience using the Google Maps API to access specialized tools. Some of the tools have multiple ways of being accessed. The map has the ability to pan in any of the cardinal directions. It can zoom down to the street view of any given location. Users have the ability to switch between three different map views (road map, satellite, and terrain). For convenience, the for-profit and non-profit donation boxes are color coded: blue for non-profit and red for for-profit. The donation drop box locations are preset on the map's display so that users do not have to input their location. The application was created using the HTML, CSS, Javascript, Twitter Bootstrap, and Google Maps API. At the bottom of the description there will be a link to another page on the site that speaks to the credibility of the charity. The option for the user to put in their address to find locations nearest them will be added. Also, location pointers will be color-coded to make it easier to identify non-profit drop boxes and for-profit drop boxes. There will be the option to search for donation drop boxes.

Funder Acknowledgement(s): This research is supported by the following grant(s) NSF-HRD-1043330, Morehouse College M-WISE Program.

Faculty Advisor: Kinnis Gosha, kgosha@morehouse.edu

170

Subcategory: Computer Science & Information Systems

Syracuse University Wireless Grids Lab Emergency Response Research

Jermaine Henry, Syracuse University

The Wireless Grids Lab is a research center supported through the School of Information Studies at Syracuse University, which works in conjunction with faculty, students, and other organizations within and outside of the university. With the goal of investigating all aspects of human interaction with devices and information technologies that exist and are emerging, Wireless Grids strives to develop and share insights that will enhance our relationship with technology (WiGiT). The Grids main area of study encompasses emergency services and disaster response for private and public agencies, hospital and healthcare information sharing and coordination for practitioners, home/personal networking to connect them with devices, friends and families across boundaries, and enhancing presence and involvement with underrepresented members of society (WiGiT). As part of this, the Wireless Grids lab, along with Virginia Tech and RIT have developed a concept of hardware and software designed to maintain communication between emergency responder devices even if cell towers and Internet networks go down during a natural or manmade disaster (Stirling). The Intelligent Deployable Augmented Wireless Gateway Technology improving the ability of public emergency response communication devices, along with other devices such as cell phones, CB radios and walkie-talkies, giving them the capability of interacting and working together. The ultimate vision of the grid is that of an adaptive network offering a secure, inexpensive device with real-time access to dynamic, heterogeneous resources which maintains the desirable characteristics of a simple distributed system, such as stability, transparency, scalability and flexibility (Stirling).

Funder Acknowledgement(s): Syracuse University School of Information Studies; the Wireless Grids Lab; the National Science Foundation; the Louis Stokes Alliance for Minority Participation.

Faculty Advisor: Jasmine B. Akinsipe, jbakinsi@syr.edu

171
Subcategory: Computer Science & Information Systems

Identifying Early Warnings of Illnesses via Medical Monitoring Web Service

Leon Hunter, Delaware State University
Co-Author(s): Gary Holness, Delaware State University

The purpose of my research is to develop an end-to-end system capable of recognizing and alerting for medical conditions in home-care patients. Because of the increasingly large number of people, specifically the elderly, who access the healthcare system for management of chronic illness (diabetes, heart disease, high blood pressure, etc), there is a danger of over-burdening health-care resources as well as decreasing quality of care. The goal of my research is to develop a system that would aid in the prevention of catastrophic medical events through persistent intelligent monitoring and early-warning alerting. Although home-care nurses can make interventions such as adjusting a patient's medication, a nurse is neither able to tend to an elderly person at all times nor notice very subtle changes in a patient's health status. If a biosignal indicates that a patient may be experiencing the early stages of an adverse medical event, it is unlikely that the caregiver will identify the warning sign in its more benign early stages until the patient's condition has worsened. The system monitors biosignals through the use of various sensors including a pulse oximeter, thermometer, and ECG electrodes. The sensors are presented as web-services whose data are analyzed using statistical techniques implemented in a cloud-based framework. If a sensor reads a biosignal that indicates a patient may be experiencing an event that is potentially detrimental to the patient's health, the system will alert the appropriate person(s) capable of treating the patient. For example, an elevated heart rate is an example of a biosignal that might escape notice. Under these conditions, my system will trigger an alert to be sent to the necessary caregiver via E-mail, short message service, phone call, or any combination of the three.

Funder Acknowledgement(s): This research is funded by the National Science Foundation Award #HRD – 0928404.

Faculty Advisor: Gary Holness, gholness@desu.edu

172
Subcategory: Computer Science & Information Systems

Automated Construction of Neuronal Models Using Computational Intelligence

Myles Johnson-Gray, Delaware State University
Co-Author(s): Parth Patel, Emlyne Forren, Atish Malik, and Tomasz G. Smolinski, Delaware State University

Multi-objective evolutionary algorithms (MOEA) are a popular tool for generation and tuning of neuronal models. However, one weakness of 'traditional' MOEAs is that they largely ignore the plethora of available biological knowledge that could be used to make the process more efficient, and instead rely on the convergence efficiency of the algorithm alone. We propose to remedy this situation by hybridizing MOEAs with a fuzzy logic-based controller. Fuzzy logic (FL) is a form of multiple-valued logic, which can emulate and incorporate human-like intelligence into a system controlling a process within a closed loop. Fuzzy IF-THEN rules can be used to determine the best adjustment to the evolutionary process based on its current output. The use of fuzzy logic allows for utilization of linguistic rules that are easy to articulate and understand by humans (e.g., 'IF spiking frequency is too low, THEN increase axon sodium conductance'), but at the same time can be directly applied to the neuronal models generated by the MOEA via fuzzification (i.e., translation of crisp numerical values into linguistic concepts) and defuzzification. Importantly, as the loop continues to execute, more rules can be extracted from the evolutionary algorithm itself by simply identifying the changes across the generations that produce improvement, and mapping

that information onto the fuzzy logic domain. In our experiments, we compared this approach to the 'traditional' model generation using evolutionary algorithms without fuzzy control on three different models of neurons from the crustacean stomatogastric ganglion, namely the anterior burster and two types of the pyloric dilator : bursting and spiking. While our hybridization approach generated more physiologically realistic neuronal models than the 'traditional' MOEA (172,799 to 165,191), the success rates of the applied fuzzy IF-THEN rules were highly variable and relatively low. This highlights the difficulty of the task of predefining such rules due to non-linear effects and local relationships between parameter values and the characteristics of neuronal activity. Therefore, the capability to extract new rules from the generation of neuronal models becomes even more critical and potentially useful. Not only was our hybridized approach able to generate rules that have been confirmed by pre-existing biological knowledge, but also several novel and intriguing rules.

Funder Acknowledgement(s): NSF HBCU-UP 0928404, NSF EPSCoR 0814251, NIH NCRR 5P20RR016472-12 and NIGMS 8P20GM103446-12, NIH NIGMS RISE R25GM089669, NIH NIGMS MARC U*STAR T34GM008250.

Faculty Advisor: Tomasz G. Smolinski, tsmolinski@desu.edu

173

Subcategory: Computer Science & Information Systems

Information Security Risks Awareness Based on Categories: A Literature Review

Tony Rhendell Jones, Jr., Talladega College
Co-Author(s): Gladys M. Swain and Syed Raza, Talladega College

The increasing utilization of information technology is affecting the status of information security, and is gradually becoming an area that plays an important role in one’s everyday life. Information Security is more commonly used to describe the tasks of protecting information that is in a digital format. Information security threats are events and actions that present a danger to information assets. Information security is included in organizations, the general public, sociopolitical, computer ethical and institutional educational dimensions. For this reason information security should be taken very seriously; the rules should be read and abided by. This project involved the collection of various risk factors that could result in great losses, to businesses, industries, institutions and their employees if information is breached.

Funder Acknowledgement(s): NSF/HBCU-UP

Faculty Advisor: Gladys M. Swain, GSwain@talladega.edu

174

Subcategory: Computer Science & Information Systems

AntigenBridges: Online Resource to Visualize Sequence Information

Namarta Kumar, Mississippi Valley State University
Co-Author(s): Jialiang Yang and Xiu-Feng Wan, Department of Basic Sciences, College of Veterinary Medicine, Mississippi State University

Rapid identification of emerging influenza antigenic variants is crucial to the prevention and control of influenza disease. Traditional serological assays to detect antigenic variants are expensive, labor intensive, and time consuming, which have become a major bottleneck for a successful vaccination program. With the advances in sequencing technologies, genomic sequences have become one of the cheapest, fastest and most accessible biological resources. Previously we developed and experimentally validated a computational method to quantify influenza antigenic distances solely using hemagglutinin (HA) sequences (Sun et al. 2013. Mbio. 4(4). pii: e00230-13). In this study, we developed a webserver for AntigenBridges, and this webserver is supported by PHP. The users can input a set of influenza sequences, and AntigenBridges can quantify the antigenic distances for these viruses. The users can also visualize the antigenic relationships of these viruses to be compared using either two or three dimensional antigenic cartography. Future study is to expand AntigenBridges to other subtypes of influenza viruses besides H3N2 influenza A virus. In summary, AntigenBridges can be used in timely identification of influenza antigenic variants thus potentially facilitate selection of vaccine strain candidates.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Xiaoqin Wu, xpwu@mvsu.edu

175

Subcategory: Computer Science & Information Systems

Applying Gene Ontology Analysis to Increase Understanding of Cell Processes

Thalia Lake, University of Virgin Islands/University of Wisconsin
Co-Author(s): Mark Craven, Deborah Chasman, and Deborah Muganda -Rippchen, University of Wisconsin

The cells of living organisms are controlled by complicated systems. Cellular systems could be understood by using a measure of similarity to select sets of genes. After identifying these sets of similar genes, one can understand what is going on in the cell. High-throughput experiments can be used to measure the behavior of many genes at once under different experimental conditions. Next, computational methods can be performed to identify clusters of genes with similar measured attributes. We can do this by performing Gene Ontology enrichment analysis using GOstats. Gene Ontology provides a structured vocabulary that describes cellular components, molecular function and biological processes. The goal is to determine that clusters will be represented by distinct and overlapping sets of Gene Ontology terms. We applied these methods to two datasets, one relevant to circadian rhythms and the other to HIV replication. We found that there is some enrichment in each cluster, and each cluster has different terms associated with them. We can use the knowledge gained by this research to potentially guide future biological discoveries that are relevant to improving human health.

Funder Acknowledgement(s): National Science Foundation (NSF) grant DBI 1063085; NSF grant IIS-1218880; NHGRI grant supporting the Genomic Sciences Training Program T32HG002760.

Faculty Advisor: Teresa Turner, tturner@live.uvi.edu

176
Subcategory: Computer Science & Information Systems

Computational Study of Function Recovery in Crustacean Pacemaking Neurons

Atish Malik, Delaware State University
Co-Author(s): Kenneth Shim and Tomasz G. Smolinski, Delaware State University
Astrid A. Prinz, Emory University

Neurons in the crustacean stomatogastric ganglion (STG) receive neuromodulatory inputs from other parts of the nervous system through the stomatogastric nerve (stn). After the stn is cut or blocked, the bursting activity of the system disappears, as STG neurons initially lose their activity pattern. Interestingly, however, the neurons typically recover their function within 24 to 96 hours, and again exhibit activity similar to that of an intact STG. One possible explanation for the occurrence of this phenomenon is coregulation of ionic current levels, and specifically the changes that appear to take place in such relationships in response to neuromodulator deprivation. Here, we propose a computational approach to study this phenomenon in two very important STG neurons: the anterior burster (AB) and pyloric dilator (PD), which together form the pacemaking kernel in the pyloric central pattern generator, which drives the tri-phasic rhythmic activity of the pylorus in the animal. As the starting point, we use hand-tuned AB and PD Hodgkin-Huxley-type conductance-based models, for which we define a parameter search space by extending the ranges of the parameters to -100% and +400% of the original hand-tuned values. We then utilize multi-objective evolutionary algorithms to explore the parameter space in search of models that exhibit electrical activity resembling that of neurons in presence of neuromodulation, despite being simulated without it. We consider such models to represent 'recovered' neurons, as they function without neuromodulation. We then analyze the model parameter search space for relationships between the parameter values for both neurons. The results obtained from our research coincide with the observation in physiological studies. In the AB model, for example, we observe a change in the slope of some of the identified relationships. In the PD model, on the other hand, we see both the dispersal of some of the relationships, as well as formation of new ones. Interesting-ly, one particular parameter, the delayed rectifier current, seems to play an essential role in most of the relationships impacted by the deprivation of neuromodulation and the successive recovery. Additional computational and physiological experiments should be conducted to further study the role of this current in the process of function recovery in STG neurons.

Funder Acknowledgement(s): NSF HBCU-UP 0928404, NSF EPSCoR 0814251, NIH NCRR 5P20RR016472-12 and NIGMS 8P20GM103446-12, BWF CASI Award.

Faculty Advisor: Tomasz G. Smolinski, tsmolinski@desu.edu

177
Subcategory: Computer Science & Information Systems

Quantitative Evaluation of Open Education Resources: The Website Architecture

Jalen Mayfield, Philander Smith College
Co-Author(s): Levie McGee

The concept of sharing educational resources freely around the world, termed here 'open education," has been adopted by a considerable number of institutions. Not only that but open education is gaining acceptance both inside and outside of the academic community to be used as a mechanism for instructional innovation. Although a number of studies have focused on website structure and architecture in different contexts such as e-commerce, e-health, and e-government , no study examined the Open Education Resources (OER) architecture and its links to user satisfaction and intentions to re-use.

In this study we apply theories and practices from human-computer interaction and information science to analyze the website architecture of seven OERs and propose a framework to quantitatively evaluate OERs' architecture. A multi-methodological approach has been adopted to conduct the study. First, content analysis has been applied focusing on content, navigation and interactivity for seven different OERs. Second, OERs are analyzed using a Webanalyzer tool to perform a manual classification task. Finally, data is collected from 135 users of OERs to validate a scale to quantitatively evaluate website architecture. Exploratory factor analysis and regression are applied to study the dimensionality of OER architecture and relationships with satisfaction and intentions to re-use. The seven OERs have been analyzed in terms of content and interactivity using a manual coding practice with a 95% agreement among judges and 0.8 for Cohen's kappa. In addition each one of the OERs has been mirrored offline to investigate the website structure and navigation using a Webanalyzer tool. Findings indicate that there are different navigation structures (i.e., simple hierarchy, complex hierarchy, and web-linked site) among OERs. Finally, a survey is used to collect quantitative measures of users' perspective considering content, navigation and interactivity. Based on data collected from 135 users with 60% of them females, we found that exploratory factor analysis resulted in affirming the three dimensions of OERs' architecture: content, navigation and interactivity. Regression study yields significant links among dimensions of OER's architecture and the variables of satisfaction and intentions to re- use, with content dimensions having the height correlation with both satisfaction and intentions to re-use. This work is in-progress. Our future steps include collecting another dataset to conduct confirmatory factor analysis study and equation modeling to confirm the dimensionality of OER's architecture. Our findings would be important to academic institutions who have established their OERs and to the ones who are in the process of building their own OERs.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF/HBCU-UP Program-Award no. 1238895- HBCU-UP II project.

Faculty Advisor: Samar Swaid, sswaid@philander.edu

178
Subcategory: Computer Science & Information Systems

Creating Software Defined Network Topologies with Mininet

Magdalene McArthur, Howard University

Software defined networking is a progressive field of study. Developed within the last ten years, network virtualization allows the user the ability to quickly create network test beds and try new protocols and topologies. Software defined networks remove restrictions on doing real networking research by eliminating the need for hardware equipment. In this study, the network virtualization tools were used in order to create 4 fully-functional network topologies with unique architectures. The virtual machine workflow Mininet and its Openflow components were utilized in order to generate the 4 unique network paradigms, which included a minimal network with 2 hosts connected to 1 switch, a network which contains 4 hosts and 4 switches where each host is connected to 1 switch and all switches are connected to each other, a network with 3 hosts and 1 switch where each host is connected to a single switch, and a tree based topology with defined depth and fan-out. After their creation, the "iperf" command was entered which runs a network performance test between two nodes within a network topology at a time. Each network passed the performance test and showed signs of full efficiency and communication. Future studies could investigate how to utilize these network designs as a prototype for real multi-machine hardware-based networks.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1238466. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Teneisha McIntyre, tmcintyrev@gmail.com; William Yu, wyu@ateneo.edu

179
Subcategory: Computer Science & Information Systems

Using Visual Studio 2010 for Windows Phone to Animate Moving Objects

Carlton McClain, Alabama State University
Co-Author(s): Iraj Danesh, Alabama State University

Using current Internet era application development environments can move students' programming abilities to another level, enabling them to code windows phone programs that interfere with the physical environment and create sophisticated applications. This study is conducted in two phases. First, the entire Windows Phone development environment necessary for developing and testing windows phone applications is studied and used. This includes software development tools such as web-browser Microsoft Silverlight, Microsoft Integrated Development Environment (Visual studio 2010 Express), .NET Framework 4.0, XNA Framework and XNA Game Studio 4.0, and The Windows Phone Emulator. Several windows phone applications are being coded, compiled, and tested by the emulator. Second, the hardware sensors that are frequently used in developing applications for detecting physical phenomena such as acceleration (Accelerometer), angle of rotation (the compass), rotational velocity (The Gyroscope), and Geographical location (GPS) are studied and applied in the development of animation of kinematics of rigid bodies in Physics. While the windows phone is used for creation of applications, it may also be used as a great gaming device. Work is in progress to examine the developed animation of a ball on actual physical windows phone devices such as Nokia Lumia 900 Windows Phone 7.5. The study reveals differences between Silverlight programming for the web and Silverlight programming for windows phones, indicating Windows Phone has the upper hand when it comes to interaction with these sensors. This approach brings about a choice and an auxiliary alternative to advanced programming, specifically in educational settings and serves as an addition to pedagogy. Future work is to expand these applications and animations and test them on actual physical windows phone devices.

Funder Acknowledgement(s): A large debt of gratitude is owed to my research advisor Iraj Danesh, NSF, and HBCU-UP STEM Scholars Program Award #0505872 that made this research possible.

Faculty Advisor: Iraj Danesh, Idanesh@alasu.edu

180
Subcategory: Computer Science & Information Systems

Adaptive Morphological Filtering for Calibrating Multiple 3D Cameras

Christopher Okonkwo, Norfolk State University/Carnegie Mellon University

Multiple 3D cameras aid the intelligent workcell system to provide a safe environment for humans and robots to work together. The system requires the calibration of the 3D cameras to detect a spherical target in the point-cloud frame. In this project, an algorithm to perform a morphological operation for calibrating of multiple 3D cameras is implemented. Morph-ological operations are used to isolate objects in images. The disadvantage is that the radius has to be manually selected for every image. An adaptive algorithm takes advantage of the additional knowledge of the 3D-point cloud, applies a distance transform and is adaptive so that the radius of operator corresponds to a fixed world matrix. Performing morphological filtering using a manually fixed radius can be difficult. If the radius is small, some noise will remain. But if the radius is large, some useful information will be lost. In this project, we implement an adaptive radius method to remove a specific portion of the image and segment the target reliably in all the frames regardless of the distance to the camera.

Funder Acknowledgement(s): This research is supported by Carnegie Mellon University Robotics Institute and by NSF grant awarded to Daniel Huber, Senior System Scientist, Carnegie Mellon University.

Faculty Advisor: Aprillya Lanz, alanz@nsu.edu

181
Subcategory: Computer Science & Information Systems

Integrating ASP-based Planning and Diagnosis with POMDPs for Knowledge Representation and Reasoning on Mobile Robots

Olatide Omojaro, Georgia Perimeter College/Texas Tech University

Co-Author(s): Patricia Andrews, Colorado College
Mohan Sridharan, Shiqi Zhang, and Sri Harsha Atluri, Texas Tech University

Mobile robots operating in real-world domains frequently encounter challenges due to an uncertain and dynamic environment. To successfully accomplish any given task, robots frequently have to generate an effective plan, and deal with non-deterministic action outcomes and unforeseen changes in the environment. Towards this objective, this project adds navi-gational planning and diagnosis capabilities to an existing architecture that integrates high-level logical inference with low-level probabilistic decision making. Answer Set Programming (ASP), a non-monotonic logic programming paradigm, is used to represent and reason with incomplete domain knowledge, while Partially Observable Markov Decision Processes (POMDPs) are used to probabilistically model the uncertainty in sensing and acting on robots. Robots equipped with this architecture adapt sensing and acting to the tasks at hand, revising existing knowledge based on information extracted from sensors and humans. This architecture is evaluated primarily in simulated domains. Experimental results demonstrate successful planning, diagnosis, default reasoning, and non-monotonic reasoning using ASP for different domains. Experiments also show successful creation of POMDP models, as well as generation of suitable policies for these models. Future work on this project will evaluate this architecture on physical robots.

This project also investigates (in parallel) the design and use of a mobile robot in the high-throughput phenotyping domain. To support precise navigation and measurement of characteristics of individual plants in the field, sensors such as RTK GPS and LIDAR are explored. Future work will consider the use of the knowledge representation and reasoning architecture for robots in the phenotyping domain.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) and the Department of Defense under Grant No. CNS-1263183. All opinions, findings, and conclusions or recommendation expressed in this material are those of the authors and do not necessarily reflect the views of NSF or the Department of Defense.

Faculty Advisor: Mohan Sridharan, mohan.sridharan@ttu.edu

182
Subcategory: Computer Science & Information Systems

Forensic Analysis of Cell Phones: Challenges and Solution

Omunique Owens, Norfolk State University

The use of digital devices such as personal data assistants (PDA), cell phones, tablets, and digital cameras have increased within the last decade. Due to the ubiquitous nature of these devices, they are used for many purposes. These include personal information managers that house calendars, to do lists, journals, reminders, and text message transformations. Cell phones are being used for criminal activities as well. They include cyber bullying, detonation of explosives, terrorist threats, mmurder and embezzlement of funds. Consequently, law enforcement officials use the data of such crimes as evidence to prosecute criminals.

Our reason for conducting this research is to identify any challenges that result from Digital Forensic investigations of mobile devices, and determine which solutions, if any, can be put in place to resolve these issues. In our research we investigated current cell phone forensic data extraction methods using two forensic commercial tools: Paraben's Device Seizure and Encase Software. We conducted our research on two types of cellular devices, both in different states of power. The first cell phone that was used was an AT&T Samsung A887 Solstice that was obtained without a SIM card and without cables, and was initially powered off. The second cell phone used was a Verizon Palm Treo 700W smartphone, which was obtained with power and all cables intact.

The results of the investigation using the Paraben's Device Seizure on the Samsung Solstice A887 proved less than expected, due to various error messages that appeared on the screen. During the investigation, it was determined that there was a connection error involving the digital device, and to check the cord that was being used. A USB cord was used to extract data, but on further analysis, we then realized the cord had malfunctioned. With this problem discovered, a new data cable was used. The acquisition method was tried again, but the same error appeared. When the extraction process was being conducted with the Encase software, a connection problem again appeared. Each avenue from switching computers to replacing data cables was taken. As with the first cell phone, Encase proved difficult to use and the investigations on both cellular devices were unsuccessful. Due to the results we observed when trying to obtain data from cell phones, we have come to the conclusion that forensic extraction of cell phones is challenging. Finding the right software tool to extract every type of data is extremely difficult. The results we found during the extraction process did not compare with what we expected to accomplish. We expected to extract any information from the cell phones using the software. We expected to utilize two forensic tools, one commercial tool (Paraben's Device Seizure), and one open source tool (Autopsy Sleuth Kit).

Funder Acknowledgement(s): National Science Foundation Grant Number 0714930.

Faculty Advisor: Cheryl Hinds, chinds@nsu.edu

183

Subcategory: Computer Science & Information Systems

Door Detection of Subway Trains in New York City

Rodny Perez, Borough of Manhattan Community College
Co-Author(s): Hao Tang, Borough of Manhattan Community College, City University of New York

Even though big cities have made progress to make services and daily living more accessible to the visually impaired, travel in our bus and subway systems continues to be very challenging. The visually impaired have so far depended on their touch and hearing senses, as well as a limited and usually unreliable in-station braille system. Previous research on the field of computer vision have proven to help the visually impaired in assisting with tasks such as riding buses, pedestrian crossings and indoor navigation. This research aims to use image-based methods to overcome the challenge of riding the subway. We have developed a Computer-Vision algorithm that enables visually impaired passengers to detect the subway doors from images captured by a Smartphone camera. By simply holding the camera in front of the subway doors, the system will recognize the doors, and will inform the user of the exact location of the door by using audio feedback. Our algorithm employs a hybrid method that combines a robust image-based detection algorithm based on the door's general and stable features (edges and corners) along with other feature-based methods to detect the frame of the doors. Using an edge detection method and a corner detector based on local and global features, our algorithm detects corners and edges from images. By employing a robust door detection algorithm that uses the geometric constraints of a subway door, we classify these edges and corners as possible door frame candidates. Since producing the least amount of false positive detections is our goal, we have trained a machine learning algorithm from a database of several hundreds of images that we collected, including both positive and negative samples, to differentiate the subway doors from other doors and objects to confirm as a true door. Our experiments show that the algorithm successfully detects the subway doors if the viewing angles are not too oblique and doors are not occluded. Without code optimization, the program takes a few seconds to complete detection. For future work, because the detection of each door candidate could be performed separately, it can be easily programmed with a parallel processing method and near real-time performance could be achieved.

Funder Acknowledgement(s): This study is supported by a grant from NYCLSAMP awarded to Rodny Perez, an undergraduate student in Computer Science, Borough of Manhattan Community College, City University of New York.

Faculty Advisor: Hao Tang, htang@bmcc.cuny.edu

184
Subcategory: Computer Science & Information Systems

A Comparison Between Still-Image CAPTCHA and Video CAPTCHA

Bathsheba Petty, Philander Smith College
Co-Author(s): Diamond Hawkins

CAPTCHA or Completely Automated Public Turing Test to tell Computers and Humans Apart is exactly what its name says, an automated Turing test used on webpages to tell humans apart from computer programs. Recently, CAPTCHAs vary in types and models. For example, there are text CAPTCHA , audio CAPTCHA, animation CAPTCHA and image-based CAPTCHA, among others. However, Image CAPTCHAs and Video CAPTCHAs have been widely adopted by different websites. As a result, it is imperative to understand usability factors that would support efforts to develop robust usable CAPTCHAs. In this study, we propose a framework to be used to evaluate the usability of Image-CAPTCHAS and Animation CAPTCHAs. We hypothesize that both CAPTCHA types have the same set of usability factors. Based on a critical literature review and content analysis for user generated content of 78 different resource, we found that usability issues differ. Not only that, but we identified usability categories for both types. Our data analysis indicate that for image-based CAPTCHA to be usable, developers should consider factors of: image size, number of images, image pixels, images content, click positions and alternatives to solve. On the other hand, video CAPTCHA usability includes factors of: color of moving object, speed of movement, background, context of use, understand-ability of moving objects, and direction of movements. A future step in our research is to develop a tool to automatically evaluate the usability of CAPTCHA. This work contributes to efforts in usable security, human-computer interaction and security.

Funder Acknowledgement(s): NSF HBCU-UP

Faculty Advisor: Samar Swaid, sswaid@philander.edu

185
Subcategory: Computer Science & Information Systems

Automated Web Server Immune System

Alfonso Puga, California State University, Bakersfield
Co-Author(s): Melissa Danforth, California State University, Bakersfield

Successful attacks against web servers are goldmines of sensitive information about companies and consumers that can then be exploited for monetary gain. Response time against this type of attack is critical. An automated system built to intercept packets (the basic unit of communication for the Internet) could be used to analyze incoming traffic for early detection of malicious web activity in a server, which could foil attempts of hacking the web server. Being automatic would help alleviate the response times of system administrators. In order to confirm the possibility of an automated detection system being more efficient than a regular system administrator monitoring the network, we first have to construct such a system. My research consists of designing the packet interceptor and analyzer for HTTP[1] information transferred through packet payloads. Currently this research is being conducted on an isolated net-work machine for packet analysis and an off-site machine for developing data structures that will be used in the automatic detection algorithm. The packet analyzer uses the PCAP libraries [2], default UNIX libraries[3], and data structures to capture and fingerprint packet payloads by analyzing the HTTP headers and enumerating the special characters and combination of special characters to assign a threat level. Once finished, the algorithm sends over the fingerprint to a genetic algorithm designed by my mentor Dr. Danforth to determine whether to communicate a major issue or not. Currently we are able to properly fingerprint the HTTP payload to determine a threat level. However, since packets are able to be fragmented, the next major step is to handle the plethora of fragmentation issues to properly reassemble the HTTP payload that arise from using the PCAP libraries since it hands over the information one packet at a time. Additionally, the code is not yet complete as each major section is being modularized to allow for future development. [1]Acronym for Hypertext Transfer Protocol, a widely used protocol for transferring and processing requests from and to web servers. [2] Open source packet capture libraries, the acronym is short for “packet capture”. [3] POSIX and header files for networking on Linux and UNIX systems.

Funder Acknowledgement(s): Partial support for this work was provided by the National Science Foundation's (NSF) Federal Cyber Service: Scholarship for Service (SFS) program under Award No. 1241636. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of NSF.

Faculty Advisor: Melissa Danforth, mdanforth@csub.edu

186
Subcategory: Computer Science & Information Systems

Development of the Personalized Sign Language Translator Utilizing the Motion Sensing Device

Jasmine Roberts, Savannah State University
Co-Author(s): Tiffany Villanueva and Hyounkyun Oh, Department of Engineering, Technology & Mathematics, Savannah State University

A number of individuals in the world suffer from hearing issues, e.g. deafness, hearing impairment, hearing loss, etc. which often causes trouble in communication with normal people. Moreover, the fact that each country adopts a different sign language, which also has thousands of expressive patterns, delays the development of an efficient translator. Thus, this research focuses on the general outline and simple implementation of PC-based personal sign language translator which can fill up the user based necessity. It begins with analyzing the patterns of personal unique finger position/movement while considering distances, angles, and directions of fingers or palms. Informed pattern data are then saved in the library together with corresponding audio sounds. From the starting motion, finger/hand movement information is extracted from the color image and depth images, and then identified with patterns in the library to generate an appropriate audio output. Here, the translator is temporarily implemented through the Visual Studio 2010 with C# programming. Further study addresses the potential of a more convenient and effective interface in establishing a mean of effective communication with those with hearing disabilities.

Funder Acknowledgement(s): NSF-HBCU-UP (MAGEC-STEM Plus) Grant #HRD-0928454 .

Faculty Advisor: Hyounkyun Oh, williamsk@savannahstate.edu

187
Subcategory: Computer Science & Information Systems

Wireless Sensor Network for Seismic Data Acquisition of Mount Cameroon

Saboor Salaam, Howard University
Co-Author(s): Tanyi Junior and Ngai Miren, University of Beau, Cameroon

Mount Cameroon is a volcanic mountain situated in the center of a densely populated and very fertile area of Southwestern Cameroon. In the past century more than five eruptions have occurred; the latest eruption occurred in 1999. Though no life was lost, the effect of this particular eruption and accompanied seismic tremors was potentially devastating. Therefore, the need for a working system to monitor the seismic activity of Mount Cameroon is critical. The current system, centered in Ekona, utilizes a WSN (Wireless Sensor Network) to monitor activity. This system is suffering for several reasons—some of which include cost, theft of equipment by villagers, human dependence etc. This paper details a project which aimed to carry out a survey of the existing set-up and propose a more robust wireless sensor network which could be less expensive, less human dependent, easy to redesign, more flexible, and able to cover as much Mount Cameroon surface area as possible. This design is not intended to serve as a final design, but instead the first iteration of a new system that ultimately must be implemented. Furthermore, the University of Beau plans to continue the project using our design as its blueprint.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Wayne Patterson, wpatterson@howard.edu

188
Subcategory: Computer Science & Information Systems

Bus Sign Detection

Alexander Sato, Borough of Manhattan Community College
Co-Author(s): Hao Tang, Borough of Manhattan Community College

There are objects that a visually impaired individual cannot identify even with a Seeing Eye dog or a cane. Instead, a smart phone camera can help these individuals in detection of everyday objects. Specifically, this research focuses on creating a mobile app that detects bus stops. First, an initial detection is obtained by applying a filter to the input image in HSV color space and only pixels with similar color to the bus stop sign are kept. Then using a blob detection method, the regions of interests (ROIs) from the initial detection are determined, and small noises are removed. Scale-invariant feature points are then extracted from the ROIs and compared to the feature points extracted from a template image of a bus stop sign in New York City. A high match should indicate a positive result. In addition, we calculate a planar homography, a geometric transformation between the input image and the template image given correspondences of the matched feature points, with the robust RANSAC method, because any two projections of a planar scene in three-dimensional space follow a homography. We then apply the homography to warp the input edge image to match the template edge image to verify the matching hypothesis. Our results show, if input images are captured under reasonable conditions (bus stops are captured in close range and orientation angles are not too oblique), the bus stop can be correctly identified. We also show and analyze some examples that the match rate drops drastically, in bad conditions. Our future work includes improving the robustness of the matching algorithm and porting this program onto an actual mobile device.

Funder Acknowledgement(s): This work is supported by NSF EFRI-REM under Award #EFRI-1137172, to the City College of New York.

Faculty Advisors: Hao Tang, htang@bmcc.cuny.edu; Zhigang Zhu, zhu@cs.ccny.cuny.edu; Yingli Tian, ytian@ccny.cuny.edu

189
Subcategory: Computer Science & Information Systems

Scrawler 3D for Entertaining and Vocabulary Learning Purposes

Christopher Small, Grambling State University
Co-Author(s): Abarnit Shrestha, Olaotan Olowofela, and Germyma St.Croix, Grambling State University

Nowadays many games are available for entertaining and learning purposes. However, many games concentrate on one purpose or another. In this research project we propose the game called Scrawler 3D which combines these two purposes. Scrawler 3D is process of developing games using C++ incorporated with OpenGL for visualization. Scrawler 3D combines elements of two games, “Snake” and “Scrabble”. Snake is a classic game where the player controls a snake and moves it towards the food; each time the snake passes over the food, it grows. In Scrabble, the player has to make words out of letters that are on the randomly picked tiles. Scrawler 3D is a hybrid of both where the player has 2 objectives, one being to move the snake using up, down, left and right arrow keys and the second to eat the randomly placed letters to make a word. Some essential elements of the game are a game board, a snake, letters and score tracking. One of the challenges is the inclusion of the word making aspect of the game. We tackle this problem by using one word in a level. The letters from that word are placed in random coordinates of the game board and as the player passes over the letter, it is added in the array which is constantly compared with the library. Once the user makes a valid word, the score is added and the letters are placed back on the board in random locations. For example, the word for the level is “HEART” and the 5 letters are placed randomly in the board. Suppose the player passes through “A” first and “R” then “T” which spells “ART” and matches the word in the library, thus awarding points to the player. The game also requires user input --moving the snake up, down, left or right, and the snake moves to the desired direction. One of the approaches we are taking is to use glTranslatef() in OpenGL to determine how the snake moves. If “A” is the head of the snake and the coordinates it is on are (3,0,0), (3,1,0), (4,0,0) and (4,1,0), then if the user presses right arrow then glTranslatef() increases the coordinates so the position is increased by a certain amount and continues to increase until the user presses either up/down arrow or the snake’s head touches the border. glTranslatef is also implied on body “B” and takes the position of “A” with each increment and “C” takes the position occupied by B. To move the body of the snake up, the head moves one position above when the user presses the up arrow. The body has to move one position to left or right depending on the direction the snake was moving before the user pressed the up key and only after that the body moves one position up. Finally the user score depends on the combination of the letters the snake eats. In conclusion, this game can be used to help with vocabulary learning as well as to entertain. For further work, we eventually plan to apply textures on the objects and make the snake look more realistic. We are also planning to add more game modes and difficulty levels.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the Air Force.

Faculty Advisor: Jaruwan Mesit, mesitj@gram.edu

190
Subcategory: Computer Science & Information Systems

Effects of Wireless Communications on Robot Team Performance

Tommy Suriel, University of the District of Columbia
Co-Author(s): Briana Wellman, University of the District of Columbia

Cooperative multi-robot systems are beneficial in coverage applications such as surveillance, search and rescue, and hazardous waste clean-up. They can work in parallel and complete tasks faster than one robot. If one robot fails, the other robots can continue with the job. In addition, if there is a hazardous mission, robots can be deployed instead of human teams to avoid human injuries and casualties. When multiple robots collaborate to finish a task, communication between robots can increase the speed of completion. Communication can avoid robots from interfering with each other and decrease duplication in coverage. Usually, point-to-point wireless communications can be used to coordinate robots. Nevertheless, in numerous coverage tasks the efficiency of communications can be erratic due to unidentified environmental characteristics and network conditions. In this research, we investigate the effects of limited wireless communications on robot team performance. We hypothesize that unreliable wireless communications network degrades robot team performance in an exploration task. Multi-robot exploration has gained a lot of attention in current years but only a minor number of approaches have taken limited communication into account. In early approaches, a line-of-sight constraint was used to keep robots within communication range [1], [2]. Experiments will be conducted in an outdoor area with concrete obstacles to test robot team performance with limited wireless communications. The robots that will be used are three adept amigobots, each with eight sonar sensors. Making an examination of how much the robots cover the area being explored is what will determine how good their performance is. For preliminary results, the signal strength and link quality were tested to determine the reliability of wireless communications network for the test area.

Future work includes conducting experiments with a team of robots to gather the amount of time it takes to explore the area. Results will be compared to results from simulated robots under perfect network conditions. It is expected that the robot team from simulation will have a better performance than the real robot experiments due to wireless communication limitations.

References: [1] R. Arkin and J. Diaz. Line-of-sight constrained exploration for reactive multiagent robotic teams. Advanced Motion Control, 2002. 7th International Workshop on, pages 455-461, 2002.
[2] A. Howard, M. Mataric, and G. Sukhatme. An incremental deployment algorithm for mobile robot

Funder Acknowledgement(s): NASA consortium of Washington DC and the STEM Center of the University of the District of Columbia.

Faculty Advisor: Briana Wellman, briana.wellman@udc.edu

191
Subcategory: Computer Science & Information Systems

Stepping Through Virtual Communication into Virtmon

Gwendolyn Tennell, Indiana University Purdue University Indianapolis/Southern University at Shreveport
Co-Author(s): Feng Li, Indiana University-Purdue University Indianapolis

While isolation is an important property from a security perspective, virtual machines (VMs) often need to communicate and exchange a considerable amount of data. Research in virtualization technology has been focused mainly on increasing isolation of co-resident virtual machines. The isolation properties of virtualization demand that the shared resources are strictly separated. The machine registers are also restricted; therefore virtual machines are forced to fallback to inefficient network emulation for communication. This research is based upon a stealthy way to communicate between virtual machines and virtual machine managers (VMMs) running on the Linux operating system. Virtmon is a paravirtualized virtual machine introspection (PVMI). It is a platform upon which users install and load a group of kernel modules. The Virtmon project utilizes the intra-to-exo channel to communicate stealthily between the virtual machine and its virtual machine manager, and the exo-to-intra channel to communicate stealthily between the virtual machine manager and the virtual machine, using a shadow region. The shadow region hides any activity between the machines and monitors which keeps malware from detecting and hijacking the communication between the two. The unrestricted PVMI framework shifts the challenges from bridging the semantic gap to protecting and hiding the PVMI mechanism. Therefore, communication is secure, allowing undetected assistance from a privileged VMM to a VM. The Virtmon project has not only allowed the VMM to cross communication barriers undetected but also allows for unrestricted registers into which more data can be exchanged.

Funder Acknowledgement(s): National Science Foundation and Department of Defense

Faculty Advisor: Josephine Loston, jloston@susla.edu

192
Subcategory: Computer Science & Information Systems

Bandwidth Analysis of Video Transmission in a Distributed Environment using PlanetLab

Jared Wagnac, Tennessee State University
Co-Author(s): Tamara Rogers, Tennessee State University

Internet videos are very popular in the social community and are viewed frequently using multimedia platforms, such as YouTube, Instagram, Vine, Pheed, and more. Some of these videos have been viewed or uploaded hundred millions of times through computers, which inspired the following question. Which region amongst the United States has a faster upload time based on the time of day? If these videos are so common in social media, there must be a region in the country that has quicker bandwidth traffic to view them compared to the rest. Also if there was a specific time of day that affected the traffic as well. To approach this, a list of active nodes was created and divided using PlanetLab into the four main regions of the country (Northeast, Midwest, South, & West). Each region was evenly distributed of nodes, having 32 in total. Once each node was proved active through PlanetLab, a script was developed and used to upload a video file from YouTube four times a day. Once the video was uploaded, another script was used to calculate how much time it took to upload the file to each corresponding node. After a week of monitoring, it appeared that the Midwest region has the quickest upload speed and the best results happened at nighttime. This research is still being performed to determine its accuracy, but as of now no new inconclusive evidence has been noticed. To conclude, different regions in the US have faster upload times depending on the time of day. Data could also be affected from this research focusing on different time zones simultaneously. It was predicted that the night would have the fastest speeds, due to less traffic from individuals at home in their beds or spending times with their families. This research could also expand to other devices such as smartphones and tablets, because a high volume of videos are viewed through those outlets and may open high potential security risks, leading to future research questions.

Funder Acknowledgement(s): This study was funded by the NSF Targeted Infusion Award awarded to Tamara Rogers and Sachin Shetty, College of Engineering, Tennessee State University.

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu; Tamara Rogers, trogers3@tnstate.edu

193
Subcategory: Computer Science & Information Systems

Mobilizing the Classroom to Transform K-12 Computing

Lacey Wright, Auburn University
Co-Author(s): Cheryl Seals and Albanie Bolton, Auburn University

For over 25 years, HCI researchers and developers have been challenged with improving usability of products. The widespread use of the Internet by millions of diverse users for socializing is a new phenomenon that raises new issues for researchers and developers. The educational research community has begun to provide broader access to quality computer science courses in K-12 education in order to build a stronger talent pool, especially within underrepresented populations. While enrollment in high school STEM courses has increased substantially, the percentage of high school students who take Computer Science (CS) is lower now than it was 20 years ago. Outreach efforts have commenced to overcome these enrollment discrepancies. The CS 10K Project aims to address this fundamental challenge by developing effective and engaging new high school curricula in computing and getting that curriculum into courses taught by well-prepared teachers in high schools. The ultimate aim of our research is to develop a game that could translate one of the big CS ideas to be taught in computer science high school courses. The first step in achieving this goal involved developing scenarios that demonstrate the big ideas that are associated with CS. Next, these scenarios are transformed into a gaming application. An example of this is the Code Breaker game. This game illustrates the CS principle Cryptography, the art of writing or solving codes, through the use of the Caesar Cipher encryption method. The Caesar Cipher, one of the simplest forms of encryption, substitutes each letter in the plain text message by for a letter of some fixed number of positions down the alphabet to form the encrypted message or cipher text. The game design consists of three components: a tutorial of the concept, practice of the concept, and the game component that challenges and tests the retention of the material learned about the concept. In conclusion, a tool was implemented that could help teach CS principles better and grab the user's attention. Computer games are very popular among children and adolescents. These kinds of tools make it easy for teachers to incorporate them into their class while increasing their ability to move between virtual and physical implementations of the tool. Since this was only the first working prototype of the game, the future work for this project will mainly focus on improving much of the aesthetics of the design of the game that will make it more appealing to young students. The next steps would be to test and evaluate this game first on high school students. Other possible future work could be to add levels for lower grades to the current Code Breaker game and explore other opportunities for more versions for other big CS ideas, with the intention to motivate and improve the education of K-12 students.

Funder Acknowledgement(s): National Science Foundation, STARS Computing Corps

Faculty Advisor: Cheryl Seals, sealscd@auburn.edu

194
Subcategory: Computer Science & Information Systems

Software Defined Radio Implementation of a Fourier Transform: S-DRIFT

Carlos Young, Virginia State University
Co-Author(s): Giti Javidi and Ehsan Sheybani, Virginia State University

The Universal Software Radio Peripheral (USRP) is a software defined radio with numerous capabilities depending on the configurations of daughterboards you use. Our basic USRP model had been configured to receive a signal from local radio stations in the DC, Maryland metropolitan area with the basicRX model daughterboard. The programmable USRP was running off the python/ block code implemented in the GNU Radio Companion (GRC) software from the GNU Company on the Ubuntu OS. With proper parameters and sinks, we were able to tune into the radio signal, record the signal and extract the Inphase(I) and Quadrature(Q) rate data from this code in order to plot the phase and magnitude of the signal. Using the terminal along with proper MatLab and octave code it became possible to read the I and Q data and observe the Fast Fourier Transform plot along with the I&Q data. With the proper equations, and you could determine not only the direction of arrival but one would also be able to calculate the distance from the receiver to the exact location where this signal is being transmitted from.

The purpose of doing this experiment was to gain experience in signal processing and receive hands-on experience with the USRP and potentially add a tracking system. Results have become inconclusive due to time, but research and experiments will continue in the fall and spring once proper resources are allocated and potentially continue in next summer if allowed.

Funder Acknowledgement(s): NASA

Faculty Advisor: Giti Javidi, gjavidi@vsu.edu

195
Subcategory: Environmental Engineering

Ecosar: Synthetic Aperature Radar Development

Paul Fon, Virginia State University
Co-Author(s): M. Perrine and R. Zimmerman, NASA Goddard Space Flight Center

E. Sheybani and S. Garcia-Otero, Virginia State University

EcoSAR is an advance airborne polar metric and single pass interferometric P-band SAR instrument in development at NASA Goddard Space Flight Center (GSFC) through NASA's instrument Incubator Program(IIP). EcoSar will provide two and three dimensional fine scale measurements of terrestrial ecosystem structure and biomass on board the NASA P3 aircraft. These measurements directly support science requirements for the study of the carbon cycle and its relationship to climate change. Synthetic Aperture Radar Interferometry(InSAR) is highly sensitive to the spatial variability of vertical structure parameters and provides quantitative information on the layered structure of the vegetation, such as depth and density. Polarimetric interfermetric SAR(POlInSAR) combines polarimetry and interferometry providing sensitivity to vertical distribution of scattering mechanisms. Furthermore, the variation in interferometric phase height with polarization permits to derive tree height. This paper presents the development of an ecological radar system at NASA GSFC, which includes testing of the radar system and evaluating plant growth on the ground from an airborne platform.

Funder Acknowledgement(s): Cipair

Faculty Advisor: Singli Garcia-Otero, sgarcia-otero@vsu.edu

196
Subcategory: Genetics

Using LD Data from 1000 Genomes to Identify Common Haplotype Blocks

Emily Ajumobi, Elizabeth City State University
Co-Author(s): Charles Czysz and Alain Laederach, University of North Carolina at Chapel Hill

In this research project, our objective is to study linkage disequilibrium (LD) in the human genome. The proposed hypothesis is that the Single Nucleotide Polymorphisms (SNPs), within an LD block, that are spatially close to one another are more likely to have a link that exists between them. The methods and tools that were adopted included using Perl programming scripts under the command line interpreter. Data was imported from an online database using MySQL. Thereafter, object-oriented Perl library functions such as grep and subroutine were applied to perform queries. MySQL commands were used in order to perform queries to access and manipulate information from the database. In the first program, a query was written and executed so that for a given rs number associated with a specific SNP, it would produce a linked secondary SNP. A subroutine was implemented so that it would recursively run until it no longer found an associated SNP2_rs. Next, a hash map was created in order to eliminate finding duplicate rs values and their associations. The hash map was also used to group each rs value to a particular ld block. This was done by creating a hash named %LD_idfind. The hash map was also comprised of key-value pairs. The key represents the rs value while the value represents the group number that each rs number belongs.

The preliminary results included a histogram sample plot about chromosome one within the CEU population (Northern Europeans from Utah). The independent variable, distance, represented how far apart consecutive SNPs were found and the dependent variable was the number of SNP associations. The histogram showed a declining trend in SNP associations as the distance increased. Thus, SNP LD pairs are more likely to be close in sequence space on the genome, and this is due to the fact that these blocks are inherited through recombination.

Funder Acknowledgement(s): This project was funded by National Institute of General Medical Sciences.

Faculty Advisor: Alain Laderach, alain@unc.edu

197
Subcategory: Genetics

Analysis of Aflatoxin Resistance in Maize for Gene Expression Prediction

Brandi Smith, Mississippi Valley State University
Co-Author(s): Andy Perkins, Mississippi State University
Juliet Tang, Leigh Hawkins, and Marilyn Warburton, U. S. Department of Agriculture-ARS, Mississippi State University

The fungus *Aspergillus flavus*, a common host of cereal grains and legumes, is a producer of the toxin, aflatoxin. 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. The aim of this study was to link single nucleotide polymorphisms (SNPs) and insertions and deletions (InDels) in maize DNA sequences with genes that may have functionalities related to resistance in maize. One method used was a program which was developed to automatically align DNA sequences and identify InDels, thus eliminating the need for manual alignment. Another method utilized a pipeline of scripts for locating genes near the SNPs in any user-defined window. The annotations for the discovered genes are then retrieved from various public databases (maizegbd, maizeseq, TAIR, and Phytozome.)

Ultimately the goal is to be able to select progeny (offspring) 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): National Science Foundation

Faculty Advisor: Charles Bland, bland.charles@gmail.com

Ecology, Environmental and Earth Sciences

198
Subcategory: Air

Analysis of MWR Data to Compare IPW Measurements to Other Instruments

James Fallon, CUNY City College
Co-Author(s): Zaw Thet Han, Barry Gross, and Fred Moshary, CUNY City College

Vertical meteorological profiles of temperature and RH are critical parameters for numerical weather forecasting. Both thermal and microwave sounders can be used on satellite platforms to retrieve these profiles but significant errors occur in the satellite algorithms especially nearer to the surface. Methods to independently assess these profiles are therefore critical. One approach is the use of balloon-sonde launches, but these launches are sparse and launched only 2 times a day (0 and 12UTC). To get continuous validation data, alternative profiling instruments are needed. One approach is the use of hyper-spectral passive microwave radiometers (MWRs) which can provide unique vertical profiling information about temperature, RH, and water vapor. However, the algorithms are again very sophisticated, and these radiometers should periodically be cross-referenced with other instruments to gauge the veracity of the data. Our objective was to determine the accuracy of the MWR using independent remote sensing instruments with a particular focus on integrated precipitable water (IPW). In particular, large scale statistical match ups were made against both ground-based GPS receivers and sun photometers We find that for clear sky conditions, the MWR at City College is sufficiently close to the integrated water vapor data collected by City College's sun photometer with RMSE < 0.15 cm. In addition, further work is currently being done to assess the accuracy of the MWR cloud height calculation using direct comparison with LIDAR measurements where cloud base heights are extracted from a flexible wavelet analysis.

Funder Acknowledgement(s): This project was made possible by the Research Experiences for Undergraduates in Satellite and Ground-Based Remote Sensing at CREST_2 program funded by the National Science Foundation (NSF) under grant AGS-1062934. Its contents are solely the responsibility of the award recipient and do not necessarily represent the official views of NSF.

Faculty Advisor: Barry Gross, eebmg@yahoo.com

199
Subcategory: Air

Summer Wind Analysis on the Kapi'olani Community College Campus

Tatiana Oje, Kapi'olani Community College

In contemporary meteorology, global wind is the movement of the air in the Earth's atmosphere, primarily driven by pressure gradients and heat from the Sun. Local wind patterns result from global winds interacting with local topography. Historically, weather during the summer months on the Hawaiian island of Oahu is characterized by an intensification of a semi-permanent anticyclone called the Pacific high pressure system. This system circulates the atmosphere over Oahu, driving northeasterly (NE) and east-northeasterly (ENE) winds, commonly known as trade winds. The purpose of this project was the engineering design and implementation of the Maunuunu Weather Station (MWS) in order to investigate the weather's influence on local wind patterns. This study focused on the surface winds in the Maunuunu Mala garden on the Kapiolani Community College (KCC) campus during the dry season of Kauwela in order to test the hypothesis that the NE winds dominate, with speeds following the diurnal trend to peak during the mid-day. The MWS anemometer recorded a steady stream of data in 30 minute intervals. Weekly wind speed averages were plotted per hour, and weekly average wind direction was distributed into 16 directional angles on a compass rose. Sensory and forecast observations from the National Oceanic and Atmospheric Administration (NOAA) website were also documented for correlation. Data results collected from May 13 to June 14, 2013, plotted per week, showed the consistent diurnal trend in wind speed that grew in magnitude at sunrise, peaked during the mid-day and declined to a minimum after sunset. Wind directions during the collection period were dominated by NE and ENE winds, and were consistent for 25 out of the 31 days. From May 18 to May 23, southerly winds dominated. In context with NOAA forecasts, the wind patterns during this particular period correlated with a cold front in the NE Pacific Ocean. The collective MWS data and NOAA observations support the hypothesis of prominent NE winds with a diurnal peak during mid-day. To trace wind patterns farther from KCC campus, wind stations need to be developed and installed throughout the region. The existing anemometer siting can be improved, and the study can be contrasted to data collected in the winter months.

Funder Acknowledgement(s): This study was supported, in part, by grants from NSF/EPSCoR and NSF/TCUP.

Faculty Advisor: Aaron Hanai, hanaia@hawaii.edu

200
Subcategory: Air

Improving Spatial Coverage and Resolution of Satellite Aerosol Retrievals

Daniel Vidal, City College of New York
Co-Author(s): Barry Gross, Lina Cordero, and Nabin Malakar, City College of New York

Developing tools to improve the spatial coverage and resolution of satellite aerosol retrieval products such as Aerosol Optical Depth are needed to improve regional estimations of PM2.5. In particular, PM2.5 (ultrafine aerosol mass) is an important quantity since these particles are small enough to enter the human body and cause health issues. The strong connection between aerosol extinction and particle mass makes satellite retrieval of AOD an important tool for PM estimations. At the same time, the vertical distribution of aerosols is an important factor since aerosols are generally trapped within the Planetary Boundary Layer. The Moderate Resolution Imaging Spectro-radiometer (MODIS) is the sensor used onboard Terra and Aqua satellites to retrieve AOD measurements. To improve the original product, we combine the Level 2 AOD granules and project them onto a fixed high resolution grid (0.1 deg) which is consistent with WRF (Weather Research and Forecast model) data products. Inverse distance weighting (IDW) is used to control the information quality (at least 25 % of data are valid) and an iterative algorithm is applied to keep the best resolution and improve coverage. By using a Neural Network approach where satellite AOD and WRF PBL heights are integrated, we produce PM2.5 maps which improve on traditional estimates using satellite AOD alone. Further improvements such as adding more meterological parameters as well as improving spatial coverage in the presence of clouds will be discussed.

Funder Acknowledgement(s): This project was made possible by the National Oceanic and Atmospheric Administration (NOAA), Office of Education Educational Partnership Program award NA11SEC4810004. Its contents are solely the responsibility of the award recipient and do not necessarily represent the official views of the U.S. Department of Commerce, NOAA.

Faculty Advisor: Barry Gross, eebmg@yahoo.com

201
Subcategory: Climate Change

Correlations between Aerosol PSDs & Precipitation in Puerto Rico

Sergio Bracho, City College of New York
Co-Author(s): Nathan A. Hosannah and Jorge E. Gonzalez, City College of New York

The impacts of aerosols on clouds and precipitation remain as important as they are elusive. The objective of the present study is to investigate aerosol particle size distributions (PSD) effects on precipitation in the Caribbean by attempting to establish correlations between PSD and precipitation, with the higher goal of increasing prediction accuracy for regions that are heavily exposed to naturally occurring Sea Salt and intrusions such as Saharan Dust aerosols. To achieve this end, PSD and precipitation data for three sites in the island of Puerto Rico including, Mayaguez (18N, 67W), La Parguera (17N, 67W) and San Juan (18N, 65W) were collected from the Aerosol Robotic Network (AERONET) and National Climatic Data Center (NCDC) weather stations, respectively. The data was analyzed to determine the seasonal and intra-seasonal relationships between PSD and precipitation during the early rainfall, mid-summer drought, and late rainfall seasons. Results suggest that aerosols affects precipitation totals in the Caribbean in a climatological sense, and that the Saharan Dust intrusion is a key parameter for suppressing rainfall during the midsummer season. In addition, PSD is important in modification of localized short duration precipitation events. Future goals include the investigation of satellite imagery during the midsummer season in order to monitor the evolution of the Saharan Dust intrusion, and the ingestion of observed PSD attained from this study into a cloud resolving numerical model for a series of localized precipitation events that occurred during the Saharan Dust intrusion.

Funder Acknowledgement(s): This research is supported by the National Science Foundation's Research Experiences for Undergraduates Grant No. AGS-1062934 in collaboration with the National Oceanic and Atmospheric Administration Cooperative Remote Sensing Science and Technology Center under the leadership of Reginald Blake, Janet Liou-Mark, Shakila Merchant, and Chinedu Chukuigwe.

Faculty Advisor: Jorge E. Gonzalez, gonzalez@me.ccny.cuny.edu

202
Subcategory: Climate Change

Investigating the Methane Footprint of Compressed Natural Gas Stations

Valerie Carranza, Los Angeles Valley College/University of California, Irvine
Co-Author(s): Francesca Mia Hopkins and James Tremper Randerson, Joshua Miu, University of California, Irvine
Susan Bush and James R Ehleringer, University of Utah

In recent years, natural gas has taken on a larger role in the United States’ discourse on energy policy because it is seen as a fuel that can alleviate the country's dependence on foreign energy while simultaneously reducing greenhouse gas

emissions. To this end, the State of California promotes the use of vehicles fueled by compressed natural gas (CNG). However, the implications of increased CNG vehicles for greenhouse gas emission reduction are not fully understood. Specifically, methane (CH4) leakages from natural gas infrastructure could make the switch from conventional to CNG vehicles a source of CH4 to the atmosphere, and negate the greenhouse-gas reduction benefit of this policy. The goal of our research is to provide an analysis of potential CH4 leakages from thirteen CNG filling stations in Orange County, CA. To improve our understanding of CH4 leakages, we used a mobile laboratory, which is a Ford Transit van equipped with cavity-ring down Picarro spectrometers, to measure CH4 mixing ratios in these CNG stations. MATLAB and ArcGIS were used to conduct statistical analysis and to construct spatial and temporal maps for each transect. We observed mean levels of excess CH4 (relative to background CH4 mixing ratios) ranging from 60 to 1700 ppb at the CNG stations we sampled. Repeated sampling of CNG stations revealed higher levels of excess CH4 during the daytime compared to the nighttime. From our observations, CNG storage tanks and pumps have approximately the same CH4 leakage levels. By improving our understanding of the spatial and temporal patterns of CH4 emissions from CNG stations, our research can provide valuable information to reduce the climate footprint of the natural gas industry.

Funder Acknowledgement(s): Special thanks to the National Science Foundation for funding the REU Program. Thank you to the Department of Energy's Office of Biological and Environmental Research for funding our research.

Faculty Advisor: James Randerson, jranders@uci.edu

203

Subcategory: Climate Change

Climate Change: Satellite Image Analysis of Receding of Glaciers in Alaska

Shaundra Cook, Virginia State University
Co-Author(s): Shobha Sriharan and Gregory Frey, Virginia State University
Anupma Prakash, University of Alaska Fairbanks
Stacy Nelson, North Carolina State University
Gulnihal Ozbay, Delaware State University
Darlette Meekins, Virginia Department of Transportation, Richmond, VA
Chunlei Fan, Morgan State University, Baltimore, MD

Global warming and climate change have become issues of interest over the past decade. According to glaciologists, the temporal coincidence of glacier retreat with the measured increase of atmospheric greenhouse gases is often cited as an evidentiary underpinning of global warming. Since 1980, a significant global warming has led to glacier retreat becoming increasingly rapid and ubiquitous, so much so that some glaciers have disappeared altogether, and the existence of a great number of the remaining glaciers of the world is threatened. The retreat of glaciers, notably in Alaska (western North America, Asia, the Alps, tropical and subtropical regions of South America, has been used to provide qualitative evidence for the rise in global temperatures since the late 19th century. Because glaciers are so sensitive to temperature fluctuations accompanying climate change, direct glacier observation may help answer these questions.

This presentation is on the land cover changes due to receding of glaciers in Alaska, by using remote sensing technology. As part of the research engagement in the USDA NIFA Climate Change Grant at Virginia State University and Summer Internship at the Geophysical Institute, University of Alaska Fairbanks, land cover changes were studied by using the data from satellite images of Anchorage and its surroundings. The Landsat images of three different years, 1986, 1999, and 2009 were obtained from the United States Geological Survey (http://earthexplorer.usgs.gov/). By using Erdas Imagine 2010 software, the subsets of each of these images were prepared to study the changes in the land cover features such as glaciers, melting ice, glacial deposits, water, sediments, and vegetation. Supervised classification was performed to select pixels that represent above-mentioned land cover features. The resulting classification was recoded to represent these categories for accuracy assessment. The results show that the glaciers around Anchorage receded significantly during the last two decades (1986-2009). This contributed to the accumulation of melted ice and glacial sediments around the glaciers, which in turn led to the enlargement of water bodies such as rivers and ponds, sediments around rivers, and increased vegetation. The studies suggest that mapping of change in glacier area and its surrounding land cover will provide data on glacier retreat and its impact on ecosystems which are important for animals, humans, and plants.

Funder Acknowledgement(s): USDA NIFA Capacity Building Grant on Climate Change and GIS

Faculty Advisor: Shobha Sriharan, sriharan@vsu.edu

204

Subcategory: Climate Change

Trends in Precipitation and Temperature in Northeast America the Past Forty Years

Felicia Francis, New York City College of Technology
Co-Author(s): Behzad Asadieh, Nir Knakauer, Felicia Francis, Behzad Asadieh, and Nir Knakauer, City College of New York

The objective of the research is to investigate trends in precipitation (rainfall), maximum and minimum temperature, and how they are affected by the theory of global warming. The topic was chosen to bring awareness to these changes, the effects of these changes and possible solutions for Northeast America. Data was collected from the Global Historical Climatology Network (GHCN). The data range from the years 1973 to 2012. The yearly and monthly regress was calculated, along with the mean annual of each month for precipitation, maximum and minimum temperature for the forty year period. We discovered that precipitation increased by 9.5%, minimum temperature increased 1.32 degrees kelvin and maximum temperature increased 0.76 degrees kelvin. Trends in precip-itation, maximum and minimum temperature encountered a steady increase from 1973 to 2012, with minimum temperature increasing at a faster rate, and the theory of global warming might be a factor. In the future investigating the theory of global warming may be a question.

Funder Acknowledgement(s): This research is supported by the National Science Foundation's Research Experiences for Undergraduates Grant No. AGS-1062934 under the leadership of Dr. Reginald Blake, Dr. Janet Liou-Mark, Mr. Chinedu Chukuigwe, and the City Tech Foundation. This work was benefited with the assistance of my mentor Behzad Asadieh and my mentee Jack Neustadt. This study was supported by the National Oceanic and Atmospheric Administration-Cooperative Remote Sensing Science and Technology Center for supporting this project through Cooperative Agreement No: NA11SEC4810004. I would like to acknowledge GHCN network for providing the data.

Faculty Advisor: Behzad Asadieh, basadie00@citymail.cuny.edu

205
Subcategory: Climate Change

Thermal Observations and Characterization of Manhattan's Urban Heat Island

Awolou Sossa, New York City College of Technology, New York, NY
Co-Author(s): Brian Vant-Hull and Maryam Karimi, City College of New York

Urban areas experience a higher temperature compared to their rural surroundings; this phenomenon is called Urban Heat Island (UHI) effect. Our hypothesis is that surface temperature varies in different areas of New York City depending on the land cover. This study's objective is to characterize the variation of the temperature at the street level in different areas of New York City and to explain why those variations occur. The method used consisted of collecting climatic data on sixteen routes in New York City in June and July 2013. The instrument used is a mobile data logger equipped with three sensors which measure the temperature, the relative humidity and the luminosity at the street level. The data are compared with the Central Park weather station data. The results reveal that Central Park has the lowest temperature. Also climatic data vary in the space throughout the city and depends on the land cover. Further studies will include the derivation of the land cover in New York using satellite images as well as a correlation between the observations on the different areas of the city. This work is a step toward a more accurate prediction of the pattern of temperature at the street level, and therefore an enhancement of the characterization and mitigation of the UHI in New York City.

Funder Acknowledgement(s): This research is supported by the National Science Foundation's Research Experiences for Undergraduates Grant No AGS-1062934 under the leadership of Reginald Blake, Janet Liou-Mark, and Chinedu Chukuigwe

Faculty Advisor: Brian Vant-Hull, brianvh@ce.ccny.cuny.edu

206
Subcategory: Ecology

Owl Butterfly Oviposition Patterns on Banana Leaves

Tayler Elam, Spelman College

While butterfly eggs are more frequently found to be laid singly, a few species seem to oviposit in clusters, including the owl butterfly *Caligo memnon*. Though *C. memnon* egg clusters are relatively small, between five to ten eggs, groups of clusters occur that appear clumped. This study took place within an individual Caligo butterfly garden located in the local Ranario (Frog Pond) of Santa Elena - Monteverde, Costa Rica. Number and nearest neighbor distances of *C. memnon* egg clusters on banana leaves were measured in the enclosure. Group sizes of early instar caterpillars were counted, as well. Butterflies lay egg clusters next to one another on 85 percent of banana leaves examined (n = 8 leaves). As early instar groups consisted of over 900 individuals, it appears that early instars benefit from larger groups than a single female lays in a single cluster. Therefore, clumping clusters from multiple females may be a means to increase group sizes of early instar caterpillars while still spreading eggs among many leaves, hence avoiding risk. *Musa acuminata* are tough, healthy leaves, and it appears that young caterpillars gain from living in a group by guiding each other's foraging. Of the several plausible factors which may account for the occurrence of clumped oviposition patterns in butterfly families, increased fitness is best supported by this study.

Funder Acknowledgement(s): This research was based upon work supported by the National Science Foundation under Grant #HRD-0963629 (G-STEM) and the U.S. Department of Education; Student Aid and Fiscal Responsibility Act; Title III Grant (SAFRA, Part F).

Faculty Advisor: Yonas Tekle, ytekle@spelman.edu

207
Subcategory: Ecology

Effect of Decreasing Stream Flow on Aquatic Insect Biomass in Hamākua

Lauren Kapono, University of Hawaii at Hilo

Climate change is expected to impact Hawaii with drier and hotter days. Rainfall is anticipated to decrease resulting in decreased stream flow. Stream ecosystems are very important as they host many aquatic organisms. One component of stream ecosystems is aquatic invertebrates. Aquatic insects are important as they are a food resource for native birds, bats and fish. They also contribute to biodiversity in the streams, as most of the insects in Hawai'i are native. Insects need the stream to move food resources downstream, create oxygen in the water, and overall provide a healthy habitat.

This study was conducted to show how the effects of decreasing stream flow effects aquatic insect biomass. Samples analyzed were previously collected in the year of 2012, using a surber sampler net. They were picked out of any substrate, identified, and then dried to be weighed. The five most dominate species were analyzed, Cheumato-psyche, Chirnomidae, Hydrachnoidea, Cyclopidae, and Erinna. A length-mass regression was used to determine biomass in two steams located on Ham'kua, Hilo Hawaii. The first stream Kolekole with the most rainfall of 7,400 mm of rain/year and the second stream is Ka'awali'I with 400 mm of rain/year. After running a length-mass regression to determine total biomass, it was proven that there is a significant difference in biomass as stream flow decreases with a p-value of 0.05. Because there is decreasing biomass as stream flow decreases, stream organisms could potentially be influenced.

Funder Acknowledgement(s): Keaholoa STEM program.

Faculty Advisor: Richard MacKenzie, rmackenzie@fs.fed.us

208
Subcategory: Ecology

Analysis of Leaf Area Index using Reflectance Data in the Sierra Nevada

Dion Kucera, Humboldt State University

Leaf Area Index (LAI), the unit area of leaves per unit area of ground, is an important parameter in many ecological models but is one that is difficult and expensive to calculate. Better estimates of LAI would provide scientists the data required to better understand vegetation-atmosphere interactions and other ecological processes. We modeled LAI along a gradient in the Sierra Nevada mountains, beginning at the San Joaquin Experimental Range field site in an oak woodland savanna and terminating at the Upper Teakettle field site in a mixed coniferous forest. We expected that LAI would decrease as we moved higher along the elevation transect, and sought to quantify this change using data from NASA's DC-8 aircraft. As well, elevation was analyzed for an influence, if any, that it provides in the determination of LAI. Shuttle radar topography mission data was used as an elevation dataset, and LAI was analyzed by calculating spectral vegetation indices (SVIs) from reflectance measurements. We validated our remote sensing estimates of LAI via a comparison to an analysis via airborne LIDAR and the Beer-Lambert law. We found that LAI decreased as the transect increased in elevation. Elevation itself was a poor determinant of LAI, with the highest r2 value being .2002 for Quercus douglasii in terms of SAVI (an SVI).

Future steps could isolate more significant variables in the determination of leaf area index. As well, it would be important to validate the estimates of LAI against in-situ field data. We anticipate knowing the spatial distribution of LAI across the transect will be valuable for scientists to understand ecosystem level interactions and the distribution of primary productivity in the Sierra Nevada mountains.

Funder Acknowledgement(s): NASA SARP (Student Airborne Research Program)

Faculty Advisor: Shane Grigsby, shane@geog.ucsb.edu

209
Subcategory: Ecology

The Effect of Temperature on Monarch Butterfly Larvae Development

Sara Mohammed Nur, University of Minnesota

Monarch butterflies are found wherever there are milkweed plants and are widely distributed across North America. Their range spans from Central America up to southern Canada, and from both the Atlantic and Pacific coastlines. Monarchs migrate to warmer climates during the winter season, and these migratory patterns are distinct. The migratory nature of monarchs has been linked with the increase of parasitic transmissions, which may be negatively affecting monarch populations. The purpose of this experiment was to observe the growth rate of monarch butterflies over each phase of the butterfly cycle and determine whether or not temperature plays a significant role in development time. The hypothesis to be tested was that monarch caterpillars in colder habitat setups would develop more quickly into butterflies (in preparation to fly in migration to warmer habitats) and survive at higher rates in hotter climates. Butterflies, like many other species, have a specific climate niche at which they survive best. Individuals not in that climate niche will seek out the preferential climate if they can (the butterfly's caterpillar form must develop more quickly).

Pupation to the adult stage takes about 9-15 days under normal temperatures, but it is important to note that monarch eggs and larvae are vulnerable to high temperatures. Four varying climate groups were setup, 20°C, 25°C, 30°C, and 35°C, for the cool climate, the control, the warm climate, and the hot climate groups, respectively, in which two milkweed plants, a thermometer, and 9-10 monarch larvae were placed at random. Data collection occurred 6 days each week for an initial estimate of 4-5 weeks – data collection spanned only 3 weeks. Average growth rates and survival/mortality were documented 6 days a week for 3 weeks, after which the data was analyzed in JMP to create regression plots. The climate groups fluctuated around their desired temperature range, but an increase in temperature was seen from the coolest climate to the hottest climate group. The cool climate group had the longest survival. As average temperature increased among the climate setups, larvae survival decreased, but average larvae size increased. The two groups with the highest temperatures suffered from aphid infestations. These results show that larvae in the first instar stage are the most vulnerable, and high temperatures cause increases in mortality. Aphids might also be the cause in larvae death due to indirect transmission of parasites. These data indicate that, one, although there was survival in each temperature setup, the larvae in the coolest setup had the longest survival rates, and two, since aphids were found in copious amounts in the hotter setups, parasitic infections were transmitted into the plants and larvae. These data also provide evidence to support the hypothesis that monarch caterpillars in colder habitat setups will develop and survive at higher rates than warmer habitats.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the Ecology Department awarded to Sara Mohammed Nur, University of Minnesota, Minneapolis, MN.

Faculty Advisor: Peter Wragg, wragg004@umn.edu

210
Subcategory: Ecology

Efficacy of White Leghorn Hens for Controlling Insects in Bush Snap Beans

Charles Mungai, Delaware State University
Co-Author(s): Ashley Shelton, Delaware State University

Bush snap beans are among the most productive variety of domestically grown species of beans with exceptional yields and relatively easy management. However, the influx of stink bugs and other detrimental insect species limits the productivity of the beans due to defoliation. The purpose of this study was to assess the efficacy of using Single Comb White Leghorn (SCWL) hens for controlling insect populations in bush snap bean plots. Forty SCWL hens were obtained at 18 weeks old and distributed among four treatment areas measuring 20 x 20 feet for the purpose of replication. The chickens were provided shelter in predator-proof pens and the entire treatment area fenced-in and covered in bird-proof netting to eliminate interaction with other variables. Four control areas were left uncovered and did not contain chickens. Each of the treatment and control areas contained two 16-by-1 foot rows of snap bean plots sown using a seeder that planted a seed every 2 inches. The beans were watered regularly and chickens fed and provided with water daily. All the plots were fertilized once during the course of the experiment to accelerate growth at 4 weeks after plantation. The pests most likely to affect the snap beans are Mexican bean beetles, green stink bugs, brown stink bugs, spider mites, bean leaf beetles, thrips, leaf hoppers and marmorated stink bugs.

These insects were collected once a week using the sweep net method, random leaf sample and yard stick sampling. Their different developmental stages were identified to examine how effectively SCWLs are in pest management. The postulation was that there would be a significant decrease in insects in plots where chickens were allowed to forage compared to areas that the hens did not access. Data collected revealed substantial evidence to support this hypothesis. However, disparities in the defoliation percentage demonstrated that while chickens may be helpful in integrated pest management, they have an adverse effect on bush snap bean plants. Additionally, weather patterns had a negative effect on the mean insect count because they limited the foraging activities of the hens and thunderstorms washed off insects inhabiting the plants. With continued data collection, more information can be obtained regarding feeding habits of chickens in snap bean plots to demonstrate whether they do indeed affect development and production of the plants or this was an experimental anomaly.

Funder Acknowledgement(s): National Science Foundation HBCU-UP: SMILE Undergraduate Research Program at Delaware State University.

Faculty Advisor: Brigid McCrea, bmccrea@desu.edu

211
Subcategory: Ecology

Effect of “Brown Tide” (Aureococcus) on the Survival Rate of Copepods

Abena Okyere Acheampong, University of Maryland Eastern Shore
Co-Author(s): Efeturi Oghenekaro, Ozuem Oseji, and Paulinus Chigbu, University of Maryland Eastern Shore

Copepods feed on phytoplankton and are prey for larval, juvenile, and some adult fish. During blooms of phytoplankton species, copepod survival could increase or decrease depending on the palatability of the food source. The principal purpose of this experiment was to determine the survival rate of copepods in the Maryland Coastal Bay (MCBs) during the occurrence of Brown tide (*Aureococcus anophagefferens*) blooms. The laboratory experiment was carried out at room temperatures (18-23^{0}C) using filtered seawater (27-30 PSU) in culture well plates, each of which contained one copepod. Copepods (*Acartia tonsa*) were exposed to three feeding conditions, each with ten replicates: *Rhodomonas salina* (75,000 cells/ml) as control diet, filtered seawater containing no *Aureococcus* and filtered seawater containing low concentrations (0.1595µg/l) of *Aureococcus*.

Preliminary results show that copepods exposed to low concentrations of *Aureococcus* had the highest mortality rate and copepods fed with the control diet (*R. salina*) had the least mortality rate. *A. anophagefferens* is a poor quality food for *A. tonsa*; its effects on other copepod species remain unknown. Future studies would examine the effects of higher concentration levels of *Aureococcus* on other copepods species in the MCBs.

Funder Acknowledgement(s): This study was supported by a grant from NSF awarded to the NOAA Living Marine Resources Cooperative Science Center and NSF CREST-CISCEP (Center for the Integrated Study of Coastal Ecosystem Processes) program, University of Maryland Eastern Shore.

Faculty Advisor: Paulinus Chigbu, pchigbu@umes.edu

212
Subcategory: Ecology

Variation in Fish Assemblages Among Sites at Cockspur Island and Tybee Island

Zola Roper, University of the Virgin Islands

Estuaries and surf zones are important habitats for fish. Determining what fish assemblages inhabit estuaries and surf zones of sandy beaches can help government organizations make better management and conservation decisions. The purpose of the present study was to determine the fish assemblages among sites at Cockspur Island and Tybee Island in Savannah, GA. Six sites, including two estuarine sites at Cockspur Island and four surf zone sites at Tybee Island, were sampled once a month from March to June 2013 using a seine net during an ebbing spring tide. A total of 61 fish at "Cockspur Bay" and 13 fish at "Cockspur Northeast" were collected. A total of 19 fish were collected at "Tybee Jetty," 20 fish at "Tybee 3rd Street," 61 fish at "Tybee Pier," and only 10 fish at "Tybee Creek." Tybee Pier was the most diverse site based on the Shannon-Weiner Diversity Index (0.84) with a high number of gulf kingfish Menticirrhus littoralis (n=24) followed by Cockspur Bay (0.82) with a high number of spot Leiostomus xanthurus (n=20). The diversity in sites were lower for: Cockspur NE (0.47) with a high number of spot (n=8), Tybee 3rd Street (0.37) with a high number of gulf kingfish (n=24) and Florida pompano Trachinotus carolinus (n=14); Tybee Creek (0.35) with a high number of spot (n=7); and Tybee Jetty (0.32) with a high number of Florida pompano (n=15).

The major finding of this study was that there was a difference in fish assemblages at Cockspur Island and among sites at Tybee Island, GA, thus rejecting the null hypothesis. For example, there was a higher diversity of fish species at Cockspur Bay (13 species) and Tybee Pier (10 species) compared to Tybee Jetty (n=4), Tybee 3rd St. (n=3), and Tybee Creek (n=3). One reason for the high diversity at Tybee Pier might be the fact that the area contains a pier with barnacles, which may provide food for fish. In future studies, other factors that could be looked at are the differences in sediments at the different locations and which fish adapt to certain which specific environments.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF OCE-1156525 awarded to Tara Cox and Christopher Hintz for funding Bridge to Research in Marine Sciences: A Summer REU Program at Savannah State University. This presentation was sponsored by HBCU-UP grant #1137472, University of the Virgin Islands. Research Project Advisor: Carla Curran- Savannah State University and HBCU-UP Faculty

Faculty Advisor: Carla Curran, curranc@savannahstate.edu and Teresa Turner, tturner@uvi.edu

213
Subcategory: Ecology

Removal of Invasive Bullfrogs and their Impact on Ecosystem Trophic Levels

Rebecca A. Vigil, New Mexico Highlands University
Co-Author(s): Jennie Guilez

The Bullfrog (*Lithobates catesbeianus*) is an invasive species residing in many parts of North America that lacks natural predators. Their introduction negatively affects native species via increased competition for habitat, resources and predation pressure. A parallel study involving the dissection of over 400 specimens indicates that invasive Northern Crayfish (*Orconectes virilis*) comprises over 75% of the Bullfrog's diet. Part of this study involved eradication of Bullfrogs from a section of the Mora River located in northeastern New Mexico, while leaving another section as a control where Bullfrog density was not altered. Since Bullfrogs exert a great deal of predation pressure on Crayfish, we hypothesize to find measureable differences in Crayfish population abundance and structure between the experimental and control regions. We looked at the effect of presence or absence of the Bullfrogs on the Crayfish abundance and structure. In order to test this, we performed monthly samplings which consisted of a 6 day period (3 days in control, 3

days in the experimental) where minnow traps (baited with chopped up hot dog) were set in the river for a duration of 24 hours. We took the following measurement of each crayfish: carapace length, total body length, tail width, body mass, and sex. We marked each crayfish in the lateral region of the carapace with nail polish before releasing them. A two tailed t-test was used to statistically compare the experimental and control sites by evaluating the average number of Crayfish caught per trap per night. We also compared Crayfish demographic structure graphically.

Through statistical analysis we were able to conclude that the difference in abundance between the two regions is not significant, and there is a relatively similar average amount of crayfish at both regions. Structurally, however, the two regions are not similar; the control region has a Crayfish population that is larger in size than the experimental region. In order to determine the effects Bullfrogs have on the structure and abundance of the Crayfish population more data will need to be collected. Future work will include mark and recapture of species within the trophic levels of the Bullfrogs' diet as well as a detailed river assessment.

Funder Acknowledgement(s): National Science Foundation, Louis Stokes Alliances for Minority Participation (LSAMP) Program, Natural Resource Career Tracks-New Mexico Program.

Faculty Advisor: Jesus Rivas, Rivas@nmhu.edu

214

Subcategory: Ecology

Termite Behavior and its Role In Ethanol Production

Derek Witherspoon, Morehouse College
Co-Author(s): Duane Jackson, Morehouse College

Ethanol is a biofuel that can be used as a sustainable energy source as opposed to fossil fuel. Ethanol is an aliphatic alcohol formally derived from ethane by replacing one hydrogen atom with a hydroxyl group CH-CH-OH. This type of alcohol can be used as a fuel. Termites become a factor in that they are able to break down cellulose. When a termite ingests cellulose, it is able to break down and digest it. When termites digest the cellulose, they produce simple sugars that can be used in production of ethanol. In our study, we tested how atmospheric pressure affected termite behavior. Prior to conducting our studies, we hypothesized that higher atmospheric pressure would decrease locomotor activity. In contrast, we hypothesized that lower atmospheric pressure would increase locomotor activity.

The behaviors that we tested were movement, location, grouping, touch, and ROV (rapid oscillatory vibration). Movement was calculated by how many squares on the grid the termite crossed. Location is whether the termite is inside the grid or on the outer edges. Touch is contact between one termite and another. ROV is rapid horizontal and vertical movement when a termite is stationary. Termites were collected on the campus of Morehouse College and the Atlanta Outdoor Activity Center located two miles away from Morehouse.

We then used a high vacuum pump to simulate the atmospheric pressure at different altitudes. We randomly selected 35 worker termites and recorded their behavior on camera while they were under different atmospheric pressures. The atmospheric pressures tested were 1026 feet above sea level (Atlanta, GA), 5533 feet above sea level, and 10,743 feet above sea level. There were 12 termites tested at the altitudes of 1026 feet and 5533 feet. At the altitude of 10,743 feet, there were 11 termites tested. We used the Observer XT software program to code the recorded behavior. Based on the results, we found that altitude has little to no effect on behavior except grouping. This could have been due to small sample size and large standard errors. We found that atmospheric pressure had little effect on position in the chamber. However, we did discover that as air pressure decreased, the grouping of the termites tended to increase substantially. In addition, to our lab experiments, we participated in an experiment in which we sent termites into the stratosphere or near space. The termites were filmed on their journey to and from near space. Unfortunately, due to a lighting malfunction, the camera was not able to film their behavior. However, all of the termites did survive the experiment. This shows that when placed under the right conditions, termites can survive high altitudes. In future research, we will feed the termites thermo-responsive cellulose nanofibers tagged with a fluorescent molecule called dichlorotriazinyl aminofluorescence to eat while they are under the air pressure conditions.

Funder Acknowledgement(s): This research is supported by the following grant(s): NSF-HRD-1043330, Morehouse College M-Wise Program.

Faculty Advisor: Duane Jackson, djackson@morehouse.edu

215

Subcategory: Education

Environmental Awareness on a Small Scale

Shereen Bourne, Humboldt State University

Environmental awareness is becoming an important topic more and more these days. Recycling, composting, reducing energy consumption and sustainable living practices are actions individuals partake in when talking about "Going Green". We hypothesized that students residing in the residential halls have a lack of environmental education depending on their particular housing location. An anonymous survey with a sample size of 10% was given to students living on campus at their institution.

The results were taken from six different areas in which students were asked five questions regarding environmental awareness. The information gathered from the survey has helped us diagnose what students perceive to be environmental issues. The data collected from students suggest that there should be an improvement of sustainable practices within the residence halls. These improvements include more recycling containers in convenient locations throughout the campus.

Funder Acknowledgement(s): This study was supported, in part, by a scholarship from NSF/LSAMP awarded to Shereen Bourne, Humboldt State University.

Faculty Advisor: Jacquelyn Bolman, Jacquelyn.Bolman@humboldt.edu

216

Subcategory: Environmental Engineering

Lead Remediation of Contaminated Water by Charcoal, LA Red Clay, Spinach and Mustard Green

Shelby Edwards, Dillard University

Co-Author(s): Shelby Edwards, Lovell Agwaramgbo, Eucharia Agwaramgbo, Chanel Mercadel, Eric Buckles and Ruby Broadway Chemistry Department, Dillard University

Lead is a toxic and naturally occurring substance with documented neurotoxin, toxic, and long-lasting adverse health effects globally. Lead exposure can cause impaired physical and mental development in children. Exposure to high lead levels affects the intestinal tract, kidneys, joints and reproductive system in adults. This study evaluates the removal of 1500 PPM of lead from contaminated aqueous solution using Celite, Louisiana Red Clay, Charcoal, and supernatants from aqueous extracts of Mustard Green (*Brassica juncea*), and Spinach (Spinacea *oleracea*). After shaking triplicate reaction mixtures for each substrate for 22 hours at room temperature, lead removal by the five substrates were analyzed by EPA Method 6010, using Inductively Coupled Plasma-Atomic Emission Spectrometry (ICP-AES). Results suggest that the order of lead removal is Spinach (98%) > Charcoal (96%) > LA Red Clay (88%) > Mustard Green (87%) > Celite (4%). The study concludes that liquid substrates such as the supernatants from pureed spinach and mustard green can effectively remove lead from contaminated water.

Funder Acknowledgement(s): Dr. Lovell Agwaramgbo, faculty advisor

Faculty Advisor: Ruby Broadway, rbroadway@dillard.edu

217

Subcategory: Environmental Engineering

Biosorption of Hexavalent Chromium from Aqueous Solutions Utilizing Soybean and Rice Hulls

Kasey Wilson, Claflin University

Co-Author(s): Anthony Rizzuti and Latoya Cosme, Claflin University

Hexavalent chromium (CrVI) is a toxic element which is present in many aquatic environments. Current CrVI remediation technologies have high costs, may lack efficiency, or produce a concentrated sludge. 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 CrVI biosorption potential of soybean hulls (SH) and rice hulls (RH) from aqueous solutions. Both hull types were mixed with CrVI solutions. The liquid portions of the samples were centrifuged; vacuum filtered; and analyzed for CrVI concentration using an ICP instrument. Additional parameters tested include the absorbent sample dose (0.5, 1.0, 1.5, & 2.0g), contact time between samples and CrVI solutions (2, 24, & 48hrs), particle size (unaltered, 10-20mesh, <20mesh), concentrations of the CrVI solutions (1, 5, 10, 20, & 30ppm), mixing temperature (24, 30, 35, & 40°C), and pH of the CrVI solutions (2-10). Desorption studies were performed to determine if the extracted CrVI could be recycled. In addition, tests were done to determine if the hulls could be reused for CrVI biosorption. Lastly, the hulls were tested for their CrVI extraction potential after going through HCL treatment.

The results of this study indicate that SH and RH worked fairly well at biosorbing CrVI from an aqueous solution. The results also demonstrate that as absorbent dose increased, the percent of CrVI extracted increased as well (SH 28-67%; RH 23-41%). As contact time increased, the percent of CrVI extracted increased after 24 hours (SH 58-67%; RH 37-41%), then decreased after 48 hours (SH 53%; RH 24%). As particle size decreased, the percent of CrVI extracted decreased for the SH (67-57%), while increasing for the RH (23-28%). As the CrVI solution concentration was increased, the percent of CrVI extracted decreased (SH 55-43%; RH 51-10%). As the mixing temperature was increased, the percent of CrVI extracted decreased for the SH (67-48%). Increasing the mixing temperature did not affect the RH CrVI extraction capacity. As the pH of the CrVI solution was increased, the percent of CrVI extracted decreased for the RH (58-33%), while fluctuating but generally decreasing, for the SH (61-56%).

Desorption results showed an 8-12% CrVI recovery rate. Reused hulls were effective at extracting CrVI (with or without going through desorption, although more effective after going through desorption; SH 48% without desorption & 79% after desorption; RH 35% without desorption & 55% after desorption). HCL treated hulls worked better at extracting the CrVI than did the untreated hulls (13-17% better). Overall, both hull types demonstrated a good potential for biosorption of CrVI from aqueous solutions.

Funder Acknowledgement(s): This study was supported by a grant from DOE awarded to Rebecca Dillard, Associate Vice President of Academic Affairs, Claflin University.

Faculty Advisor: Anthony Rizzuti, arizzuti@claflin.edu

218

Subcategory: Genetics

Selection for a Loss-of-Function Mutation in the CpCYC-b Gene in Red-Fruited Papaya

Jamicia Lewis, Alabama State University
Co-Author(s): Meng Wu and Richard C. Moore, Miami University, Oxford, OH

Papaya fruit flesh color is a determined by the presence of the caratenoids β-carotene (yellow fruit) or lycopene (red fruit). The accumulation of lycopene has shown to lower the incidence of cancer and other degenerative diseases. Red fruit flesh color is caused by an interruption in the carotenoid biosynthesis pathway and specifically by a 2-bp loss-of-function mutation in the chromoplast specific lycopene beta-cyclase (CpCYC-b). For this project, we hypothesize that the lack of function mutation is specific to domesticated cultivars and that this allele was subsequently artificially selected in cultivars with red fruit flesh color. If this is true, we expect to see evidence of selection at the CpCYC-b gene in red cultivars, including reduced nucleotide diversity at this gene in red cultivars relative to yellow cultivars and alleles sampled from natural populations.

In order to test our predictions, we sequenced the CpCYC-b gene from domesticated cultivars and from broadly dispersed natural populations in Costa Rica. We found that the 2-bp loss-of-function mutation was present in all red cultivars. It was also found at very low frequencies in natural populations (<10%) and in yellow cultivars in heterozygous individuals. A notable exception was the presence of the allele in natural populations of individuals identified previously as feral escapees. Nucleotide diversity was significantly reduced in this gene in the red cultivars relative to yellow-fruited cultivars and natural populations, suggesting artificial selection for the loss-of function mutation occurred in the domestication history of the red-fruited cultivars. A heterozygous Yy genotype was found in a few various samples throughout all yellow fleshed varieties. Future research includes comparing sequence variation in neighboring genes.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF awarded to Miami University Ecology REU program.

Faculty Advisors: Alain Bopda Waffo, abopdawaffo@alasu.edu; Richard C. Moore, moorerc@muohio.edu

219

Subcategory: Geosciences and Earth Sciences

In situ Production of Methyl Chloride in Antarctic ice Cores

Isis Frausto-Vicencio, College of the Sequoias
Co-Author(s): Kristal Verhulst, Murat Aydin, and Eric Saltzman, University of California Irvine

Methyl chloride (CH3Cl) is a naturally-occurring halocarbon with a global mean abundance of 550 pmol mol-1 and a lifetime of about 1 year. It constitutes about 16% of the total chlorine burden in the stratosphere. The sources of methyl chloride are mainly natural and include tropical vegetation, oceans and biomass burning. Oxidation with the hydroxyl radical is the primary removal mechanism with additional loss via microbial degradation in soils and in the oceans. Previous measurements suggest ice cores from cold Antarctic sites (Dome Fuji, South Pole, Taylor Dome), preserve a record of atmospheric CH3Cl variability during the Holocene. However, measurements at Siple Dome displayed evidence of *in situ* enhancement.

This study involves new CH3Cl measurements in 135 ice core samples from the West Antarctic Ice Sheet Divide (WAIS-D) 06A ice core. Measurements from the Holocene are compared with earlier CH3Cl measurements from Taylor Dome and Siple Dome. In Late Holocene ice (5-0 ky BP), the WAIS-D and Siple Dome show evidence of *in situ* CH3Cl enrichment. The mean level and scatter are both larger than in Taylor Dome ice of the same age. The *in situ* enrichment is not time or depth-dependent. Interestingly, for most of the Early Holocene (11-5 ky BP), Siple Dome and WAIS-D exhibit less scatter and are closer to the Taylor Dome ice core data. *In situ* CH3Cl production may be purely chemical or involve biological reactions. Here, we investigate whether the excess CH3Cl in the Siple Dome and the WAIS-D ice cores can be explained by differences in ice chemistry between the various Antarctic sites. The results of this research will help establish the causes of CH3Cl production in ice cores and provide a basis to assess the possibility of studying long-term atmospheric CH3Cl variability using ice core data.

Funder Acknowledgement(s): Biogeochemistry and Climate Change REU Program was funded by NSF.

Faculty Advisor: Eric Saltzman, eric.saltzman@uci.edu

220
Subcategory: Geosciences and Earth Sciences

Isolation of Lignocellulolytic Microorganisms with Implications for Biofuel

Paul B. Gorrell Jr., Tuskegee University
Co-Author(s): Deloris A Alexander, Tuskegee University

The search for new sources of alternative energy has increasingly become a priority in the last decade, causing the US to make a dramatic change from the complete reliance on petroleum of the 1970s and 1980s, to being able to utilize supplementary sources as energy. The escalating prices of oil and its limited supply have provided an additional imperative to scientists concerned with the production of alternative fuels. Biofuel is a type of renewable energy that is derived from the bioremediation of biomass components, which can then be used as an energy source. The majority of biomass used to produce biofuels comes from crop production and post-harvest residue. In this experiment we sought to identify and characterize lignocellulolytic microorganisms capable of the bioconversion of plant biomass to fuel. The two most recalcitrant substances in the plant biomass are lignin and cellulose. These are also the most abundant components of post-harvest residue. Our approach was to isolate microorganisms from biomass sources (wood shavings, sugar cane husks, etc) where lignocellulolytic organisms might exist. These organisms were then cultured on minimal salts media containing only lignin or cellulose as carbon sources. The isolated organisms were then verified as capable of degrading lignin and cellulose, as well as characterized based on carbon source usage, enzymatic activities and genetic profiles. We report here the isolation of lignocellulolytic organisms with the potential for biofuels application.

Funder Acknowledgement(s): Department of Agricultural and Environmental Sciences, College of Agriculture, Environment and Nutrition Sciences, Department of Pathobiology, College of Veterinary Medicine, Nursing and Allied Health, Tuskegee University.

Faculty Advisor: Deloris A Alexander, dalexander@mytu.tuskegee.edu

221
Subcategory: Geosciences and Earth Sciences

Evaluating the Effects of Organically Grown Herbal Plants on Selected Soil Enzyme Activities

Darryl Howard, Oakwood University

Due to the overuse of synthetic fertilizers in conventional farming and the effects that these fertilizers have on the crops and the environment, there has been a shift to using more sustainable methods of fertilization such as compost, manure, and other organic material. In the conventional farming system, chemical fertilizers are added to produce better crop yield by directly supplying the plant with macronutrients. Over time, synthetic fertilizers have an effect on the activity of the soil enzymes that are naturally found in the soil. In an organic farm system, soil quality is sustained by various methods, which gives the plant its macronutrients while improving soil quality. The objective of the study was to evaluate the effect of herb cropping on soil quality in an organic herb garden. To determine impact to soil quality, soil was assessed for β-glucosidase and alkaline phosphomonoesterase enzyme activity.

Results showed that alkaline phosphatase activity was lowest in the control while β-glucosidase was highest in the control although activity varied amongst different plants for both enzymes. The current results suggest a significant change in the enzymatic activity of soils that host specific herbal plants, potentially impacting organic matter degradation and nutrient cycling differently. With the interaction with other soil biotic and abiotic factors, the soil can create an optimum environment. Future works will be to study the microbial community structure, composition, and function. The structure will use quantize analysis to show the diversity and richness in the community. The composition is found by using DNA sequencing of 16s RNA and subsequent bioinformatics analysis.

Funder Acknowledgement(s): This study was supported, in part, by NSF grant DBI-1263207 awarded to Olga Bolden-Tiller, Director for the Animal Science Program, Tuskegee, Al.

Faculty Advisor: Raymon Shange, Rshange2946@mytu.tuskegee.edu

222
Subcategory: Geosciences and Earth Sciences

A Tracer for Understanding Carbon Dynamics at the Land/Ocean/Air Interface: Investigating the Biogeochemical and Optical Properties of Colored Dissolved Organic Material

Lena Lai, City College of New York
Co-Author(s): Maria Tzortziou, University of Maryland, Earth System Science Interdisciplinary Center
Alexander Gilerson, Robert Foster, and Kaveh Bastani, City College of New York

Dissolved Organic Matter (DOM) and its colored component, (CDOM) are sensitive indicators of environmental pollution, nutrient enrichment, water quality and play a key role in a broad range of processes and climate-related biogeochemical cycles in estuarine and coastal ecosystems. Because of its strong influence on ocean color, CDOM can provide an invaluable optical tool for coastal zone environmental assessment from space. Changes in the source and quality of DOM, related to

changes in climate, hydrology, land-use and human activities are of key importance in regulating estuarine net metabolism and marine ecosystem functioning. In this study, new measurements are presented of the optical characteristics of CDOM collected from the Chesapeake Bay estuarine environment. Measured parameters include absorption spectra, estimated spectral slopes, slope ratios, DOC (Dissolved Organic Carbon)-specific CDOM absorption as well as 3-dimensional CDOM fluorescence emission-excitation matrices, and biogeochemical variables. Such analyses provide insights into the complex process that affect CDOM quality and amount during transport to the estuary and coastal ocean.

Our results show that freshwater and brackish marshes are strong sources of optically and chemically distinctive DOM to the estuary. The marsh-exported DOM is carbon-rich, consists of strongly colored, high molecular weight, highly aromatic compounds, higher DOC-specific CDOM absorption, lower CDOM absorption spectral slopes, and lower spectral slope ratios. New field campaigns have been conducted in August and September in the Chesapeake Bay estuary and the Gulf of Mexico to collect more samples for analysis of CDOM dynamics and link field observations and measurements to satellite ocean color retrievals of estuarine biogeochemical processes. Data from these missions will be useful for maximizing the return of future satellite sensors and ocean color retrieval algorithms (e.g. from future PACE and GEO-CAPE missions). High quality space-based Earth observations can be used in a wide range of practical application areas, including Climate, Water Resources, Ecological Forecasting, Disasters, Oceans, Human Health and Air Quality. Here, we discuss how advanced satellite CDOM retrievals can have substantial applications value beyond basic science and research.

Funder Acknowledgement(s): This project was made possible by the Research Experiences for Undergraduates in Satellite and Ground-Based Remote Sensing at CREST_2 program funded by the National Science Foundation under grant AGS-1062934.

Faculty Advisor: Maria Tzortziou, maria.a.tzortziou@nasa.gov

223

Subcategory: Geosciences and Earth Sciences

Engineering Low Cost Ocean Observation Systems

Gritidach Manakitivipart, Humboldt State University
Co-Author(s): James Manning, NOAA, Northeast Fisheries Science Center, Woods Hole, MA
Colin Sage and Jennifer Troubetaris, Department of Physical Sciences, Massasoit Community College

Global climate change has emerged in recent years as one of the forefront international issues. In order to understand the far reaching effects of climate change, a comprehensive, long-term record of oceanographic data is required. Data sets of ocean processes are commonly collected via sophisticated shipboard, moored, and drifting instrumentation. While effective, these instruments are often too costly for smaller institutions to obtain. The financial barrier has prevented many capable institutions from joining the ocean-observing network. The objective of our project is to provide such institutions and scientists with a reliable, low cost alternatives to collect oceanic data. Presently, our project is focusing on designing and building surface drifters, moored bottom current meters, tide gauges, and large marine animal tags. We designed the units in such a way that others can easily construct them using commonly available materials. Our drifters, for example, are fitted with bamboo frames, canvas sails, and commercially-available GPS transmitters. Originally designed for trucking companies, the transmitters are more affordable than scientific models while offering a near equivalent level of accuracy. The instruments are subsequently tested to ensure that their performance conforms to oceanographic standards. Completed instruments are deployed by volunteer vessels, namely, the local fishermen. Furthermore, blueprints of the low cost instrument can be distributed to schools for use as a practical, yet functional, project in marine science courses. In addition to providing hands-on experience, the school project will contribute new information to the ocean-observing system as well.

Funder Acknowledgement(s): Woods Hole Diversity Advisory Committee, a joint initiative between the Sea Education Association, Woods Hole Research Center, Woods Hole Oceanographic Institution, Marine Biological Laboratory, Northeast Fisheries Science Center, and the United States.

Faculty Advisor: James Manning, james.manning@noaa.gov

224

Subcategory: Geosciences and Earth Sciences

Validation of Microwave Remote Sensing Retrievals of Freeze-Thaw States

Berenice Oseguera, City College of New York
Co-Author(s): Juan Pinales, NOAA CREST Institute and CUNY Environmental Crossroads Initiative, City College of New York
Kyle McDonald, Water and Carbon Cycles Group, Jet Propulsion Laboratory, California Institute of Technology

The freeze-thaw state of the landscape is a good indicator of growing season length, metabolic activity, root and soil respiration, and biogeochemical cycling in high latitude regions like Alaska. The increase in biological productivity and hydrological activity that comes with the arrival of the summer snow- and ice-free period can be estimated by microwave remote sensing systems because of the rise in the dielectric constant during the thawed period, which registers as marked shifts in the time series progression acquired by these data. Our study involves the comparison of high-frequency microwave remote sensing data, such as NASA's QuikSCAT sensor, with daily records of meteorological variables from the National Climatic Data Center's Global Historical Climatology Network (NCDC GHCN-Daily) and Natural Resources Conservation Service's Snowpack Telemetry (SNOTEL) network. These variables include soil temperature profiles, snowfall, and snow depth. A change detection algorithm was used to classify the microwave time series data as frozen or thawed. The station data were then utilized to validate the accuracy of the algorithm's product.

It was hypothesized that the freeze/thaw state can be accurately determined using the seasonal threshold algorithm as our method and the microwave remote sensing retrievals of the QuikSCAT as our input. Our results showed that there was about an average of 60% accuracy of the algorithm's product for the majority of the stations. We concluded that latitude is related to the percent of correct frozen and thawed classifications. In the future, we will be comparing meteorological variables with a second sensor called ASCAT, a C-band sensor.

Funder Acknowledgement(s): This research is supported by the National Science Foundation's Research Experiences for Undergraduates Grant No. AGS-1062934 in collaboration with the National Oceanic and Atmospheric Administration Cooperative Remote Sensing Science and Technology Center under the leadership of Reginald Blake, Janet Liou-Mark, Shakila Merchant, and Chinedu Chukuigwe.

Faculty Advisor: Kyle McDonald, kmcdonald2@ccny.cuny.edu

225

Subcategory: Geosciences and Earth Sciences

Origin of Methane and Other Hydrocarbons in Magmatic Systems

Cristian Virrueta, University of California, San Diego
Co-Author(s): David Hilton, Scripps Institution of Oceanography, UC San Diego

The study of magmatic systems provide scientists an ideal vantage point to peer inside the Earth and help advance the scientific understanding of our home planet. The origin of C-bearing volatile gases, such as methane, can be determined through their isotopic and relative abundance characteristics. Methane production mechanisms are divided into two main classes: biogenic and abiogenic. Biogenic methane can be produced by microbial processes or by thermogenic degradation of organic matter in sedimentary rocks. Abiogenic methane can be formed by gas-water-rock interactions or by magmatic processes.

To gain insight into these mechanisms and processes, geothermal samples were collected from various locations reflecting contrasting geologic settings: these are the Salton Sea Geothermal System (SSGS) in California, the Tengchong Geothermal Province (TGP) in China, the East African Rift (EAR) in Ethiopia, and the Central American Volcanic Arc in Costa Rica. We aim to investigate and characterize the carbon isotopic composition of methane at different plate boundaries utilizing geothermal systems as our means to capture deep-seated gases transferred to the Earth's surface. Primarily, we distinguish between biogenic, thermogenic, and abiogenic methane as the controlling source, or origin, of the gas. In order to study the 13C/12C ratio in methane, a network of glass lines under vacuum pressure are needed to separate, combust, and capture the carbon from geothermal samples prior to analysis using mass spectrometry. Samples collected from the SSGS indicate a strong thermogenic imprint to the methane.

Analysis of the TGP revealed enriched abiogenic signatures, ranging from -14‰ to -23‰. Samples obtained from the EAR illustrate abiogenic properties associated with a lower mantle plume. Gases from Costa Rica demonstrate biogenic/ thermogenic methane and small amounts of abiogenic methane due to subducting marine carbonates. However, δ13C data alone do not offer a consistent and dependable means of differentiating abiogenic and biogenic carbon. Further diagnostic techniques such as C1-C6 hydrocarbon ratios and 3He/4He analysis are necessary to better assess methane origin, especially in cases where intensive mixing occurs. Further work includes analysis of samples (utilizing different diagnostic techniques) collected from Long Valley Caldera in California where methane analysis has not been carried out to date.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF awarded to David Hilton, Geosciences Research Division, Scripps Institution of Oceanography, UC San Diego.

Faculty Advisor: David Hilton, drhilton@ucsd.edu

226

Subcategory: Microbiology/Immunology/Virology

Identifying Microbes Associated with the BP Oil Spill at the LA Shorelines

Tequila Richard, Dillard University
Co-Author(s): Bernard Singleton, James Watson, and Terry Johnson, Dillard University

Millions of gallons of oil were spilled into the Gulf of Mexico on April 20, 2010 from the BP oil rig explosion. It was the worst environmental disaster in the U.S. history. The oil spill has caused an impact on the marine and residential community. Studies have shown that the microbial community of the Gulf of Mexico supported remarkable rates of oil respiration.

The purpose of this study is to identify microbes associated with the British Petroleum Oil Spill in the air and water at the impacted Louisiana Shorelines. Samples of air and water on the coastline of Grand Isle and Elmer's Isle, LA were collected with sterile Impingers and conical tubes. Microbes from the samples were grown on media and isolated to be identified. Identification was based on fatty acid profile analyses and using the computerized Sherlock® Microbial Identification System. An exact match of the fatty acid make-up of the unknown samples was identified.

The predominant microorganisms found in the air samples were *Lysinibacillus sphaericus* , *Micrococcus luteus*, and *Staphylococcus epidermidis*. The water samples carried *Shewanella putrefaciens* and *Bacillus cereus*. *L. sphaericus* is toxic to mosquito larvae. *M. luteus* has the ability to utilize a wide range of potentially toxic substrates such as crude oil and petroleum byproducts. It also can be involved in detoxification or biodegradation of a number of environmental pollutants and is an opportunistic pathogen. *S.epidermidis*, a member of the novobiocin-susceptible coagulase-negative staphylococci, is also an opportunistic pathogen. *S.epidermidis* predominantly colonizes the mucous membranes, groin, and axillar areas, as well as the skin of the human body. *Shewanella spp*. are part of the marine microflora in warm climates and are rarely pathogenic. However, *Shewanella spp*.infections are being increasingly reported. *B.cereus* causes opportunistic infections and is associated with clinical infections such as endophthalmitis and other ocular infections. As expected there are a number of microbes that can be found in the Gulf of Mexico; some can be beneficial and others potentially threatening. The Oil Spill likely changed the balance of the numbers and ratios of anyone or all of the microbes present in that ecosystem. Future consideration would be to continue to monitor the conditions due to the oil still present, the dispersants used, and the effects weathering has on the oil in the ecosystem in the Gulf of Mexico.

Funder Acknowledgement(s): This study was supported, by a grant from NSF/HRD awarded to Bernard Singleton, Associate Professor of Biology, Dillard University.

Faculty Advisor: Bernard Singleton, bsingleton@dillard.edu

227

Subcategory: Plant Research

Salt Marsh Plant Biomass Dynamics and Effects of a Nitrogen Gradient

Veronica Alston, Tuskegee University
Co-Author(s): Jim Tang and Kate Morkeski, Marine Biological Laboratory Ecosystems Center, Woods Hole, MA

In this research I was measuring the relationship between nitrogen pollution and greenhouse gas emissions from salt marshes. We are generating information and tools that coastal decision makers can use to manage nitrogen pollution, analyze the economic impacts of nitrogen focused salt marsh restoration specifically in the context of carbon markets, develop a protocol for bringing salt marshes to carbon markets. There are four study sites. The high nitrogen sites are Great and Eel Pond. The moderate nitrogen site is Hamblin Pond. The site that is used as a reference site because of the low nitrogen concentration is Sage Lot Pond.

This project is a small part of a bigger over all experiment. What I am focusing on is the hypothesized effects that if there are elevated nitrogen levels then the above ground plant biomass would be smaller than it would be in normal conditions. The plant biomass that was measured was *Spartina alterniflora*, *Spartina patens*, *Distichlis spicata* , *Salicornia sp.,* and *Symphyotrichum tenuifolium.* I placed a 25 cm quadrant within 1 m of each gas measurement plot, counted all live plants and measured height of 10 randomly selected stems. I clipped all live plants at sediment surface and collected the dead plants inside the quadrant. These were stored on ice and brought to the lab where the live biomass was separated into the five separate species. The samples were washed with tap water to remove sediment, placed into a drying oven at 70^{o}C for 2 days and then weighed the dry biomass.

The results from the data showed that Nitrogen loading can affect both growth and decomposition of plant biomass. Biomass increased from June to July. The bulk of the biomass comes from the *Spartina alterniflora*. Plant biomass at Sage Lot Pond peaks later in the season than at the other sites possibly because it is not as nutrient rich as the higher nitrogen level sites. Despite having higher live biomass in 2012, Eel and Great Pond show lower dead biomass in 2013. More nitrogen may cause higher rates of microbial and macro faunal decomposition of the dead biomass.

Funder Acknowledgement(s): Partnership Education Program.

Faculty Advisor: Richard Whittington, whittingtonr@mytu.tuskegee.edu

228

Subcategory: Plant Research

Thailand Rubber Tree Plantations and the Environment

Ivy Coggins, Howard University/Chulalongkorn University

Rubber tree plantations are expanding throughout Thailand and are causing negative effects on the environment. Rainforest removal from these plantations and the decrease in water quality are both major effects of the environment, which directly affect people. The present study focused on proving how rubber tree plantations play a direct role in destroying the environment. Mapping experiments are currently in process in order to observe more effects from rubber tree plantations. These experiments will later aid scientists in solving critical questions regarding soil and plant processes, such as "How do rubber tree plantations aid in the destruction of soil?" and "What is the time period in which rubber trees extract nutrients from the soil?" In addition, mapping experiments locate rubber trees for proper data collection, and ecosystem demography models are used today to better predict land use due to rubber plantation expansion. The data collected by mapping experiments along with ecosystem demography information will make it easier for scientists to create the necessary solutions for the future.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Aksara Putthividhya, dr.aksara.putthividhya@gmail.com

229
Subcategory: Plant Research

Corynespora 'Target Spot' in Alabama Cotton

Jenna Platt, Auburn University
Co-Author(s): C. Dale Monks, Austin K. Hagan, Kathy Burch, Auburn University
Shawn Scott, Steven Nightingale, and Greg Pate, Alabama Exp. Station System

The pathogen *Corynespora cassiicola* causes target-like necrotic lesions on cotton, *Gossipium hirsutum*, leaves. It is commonly known as target leaf spot and can also cause a complete defoliation of the plant. A study was conducted during the 2013 growing season to determine the effect of fungicide treatment and variety in target leaf spot management. An irrigated field study was initiated in May of 2013. Field study inputs were supported by a grant from the Alabama Cotton Commission. Treatments were arranged in 2x7 factorial experimental design with main plots being the fungicide treatments (with or without) and the sub-plot treatments being the variety (7 varieties). Treatments were replicated 4 times. The appearance and severity of the leaf spot was rated on the Florida 1-10 scale every 2 weeks beginning after first bloom. Cotton variety maturity was tracked for the fungicide treated plots weekly after first bloom by counting nodes above white flower. Final results will reflect fungicide effectiveness, variety susceptibility or resistance, and maturity effect on the occurrence of this leaf disease. This information can be valuable to Alabama farmers for management of this disease.

Funder Acknowledgement(s): Field study inputs were supported by a grant from the Alabama Cotton Commission. The student researcher was supported by NSF and the AASD-STEM Program.

Faculty Advisor: C. Dale Monks, monkscd@auburn.edu

230
Subcategory: Plant Research

Cell Suspension Cultures Establishment and Transient Gene Expression in *Arundo donax*

Ashlie Santaliz, University of Puerto Rico/Fort Valley State University
Co-Author(s): Sarwan Dhir, Fort Valley State University

Arundo donax is a warm-season perennial grass that has received considerable attention as a potential dedicated biofuel and bio-product feedstock. Genetic improvement of this plant is needed for better cellulosic ethanol production, especially to improve cellulose-to-lignin ratios. Cell suspension cultures offer an *in vitro* system for mutant selection, mass propagation, gene transfer, and cell biology. Toward this end, cell suspension cultures were initiated from embryogenic callus and characterized with different cell type morphologies: sandy, fine milky and ultrafine cultures. Furthermore, we demonstrated transient expression of electroporation mediated DNA uptake in the intact suspension cells by measuring the activity of Green Fluorescent Protein (GFP) gene driven by the maize ubiquitin 1 promoter. The influence of several factors including electric field strength, buffer composition, and time course of transient gene expression, DNA concentration, enzyme, ice/heat and treatment was examined on GFP gene expression (number of green spots/cells). Maximum GFP gene expression (an average of 2250 green cell/clumps using 1mL of fine cell suspension) was observed after 48 h when cells were pre-incubated with electroporation (EPR) buffer for 1 h, followed by electroporation with a single electric pulse of 500 V/cm discharged from a 0.25μF capacitor in the presence of 20 μg DNA/ml. Changing the electroporation buffer conductivity (with low-high salt concentrations), had maximum effect on the number of green cells. Similarly, increasing the amount of DNA from 20-50 μg/mL in the EPR buffer had a slight effect on the expression frequency (from 1080-1295 green clumps/spots). The number of green cells was increased by 30 min pretreatment with an enzymatic solution (1% Cellulase R-S, 1% Macerozyme R-10), as well as heat and ice treatment before electroporation. Our results indicate an efficient suspension cell and transient assay system can be used to facilitate gene expression and transgenic plant regeneration studies.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF DBI REU-Site Program awarded to

Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

231
Subcategory: Plant Research

Volatiles Analysis: Secret Ingredients of Taste in Tomato Commercial Variety

Jeremy Wimes, Fort Valley State University/University of Florida
Co-Author(s): Harry Klee and Denise Tieman

Due to traditional plant breeding techniques, the flavors of tomatoes have drastically declined. Breeding for flavor quality has been replaced by breeding for commercial traits. Certain traits found in the selected commercial variety were useful (i.e. shelf life, firmness). We maintained these useful traits by crossing a commercial variety with a flavorful heirloom variety with an aim of creating a better modern tasting fruit. There are several common methods available, such as Polymerase Chain Reaction (PCR), taste paneling (sensory evaluation) and Gas Liquid Chromatography (GLC) for volatiles analysis. PCR was used to determine the presence of useful genes in the progeny of the crosses. The flavor was measured in weekly taste panels (sensory evaluation). The taste panels were conducted in the lab and tested using lab members. Weekly harvest tomatoes ripening showed the progress of the fruit which correlates with the taste panel results. Soluble solids were measured to determine sugar content, a key factor in tomato flavor. Through gas liquid chromatography, major aroma volatiles were determined, which are key essentials in great taste of tomatoes. Our data supports the ability to produce quality flavored tomatoes with additional commercially important traits.

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.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

232
Subcategory: Pollution/Toxic Substances/Waste

Can Applying Spent Iron and Water Treatment Residuals Decrease Nutrient Runoff from Poultry Houses?

Joseph Nesbit, Fort Valley State University/University of Arkansas
Co-Author(s): Andrew Sharpley, Ray Brennan, Tarra Simmons, University of Arkansas

Northwest Arkansas is home to over 1 billion broilers and is second only to Georgia in annual poultry production. With large numbers of poultry farmers, EPA has determined that dust particles from the poultry house exhaust fans contain high levels of phosphorus (P), which can be washed into streams in surface runoff when it rains. One way to help combat this problem is by applying byproduct residuals from steel and water treatment plants that contain both iron (Red mud-RM) and aluminum (Water Treatment Residuals-WTR) in trays directly in front of exhaust fans to trap the dust as it exits the house. The residuals have a very high capacity to bind P, and stop it from leaving the site. With this being said once the byproduct residuals are applied we will collect them and run tests to see if they release P through surface runoff (rainfall simulation) in order to determine their binding potential and to determine if they release absorbed P overtime.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF DBI REU-Site Program awarded to Sarwan Dhir, Director of the Center for Biotechnology, Fort Valley State University.

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

233
Subcategory: Pollution/Toxic Substances/Waste

Comparison of QuEChERS and Soxhlet Methods for Extraction of Contaminants

Vanessa Santiago, University of Puerto Rico, Rio Piedras
Co-Author(s): Isis Robles and Liz Diaz, Department of Chemistry, UPR Rio Piedras
Yanice Duquesne, Department of Biology, UPR Rio Piedras
Xochitl Pérez and Loretta Roberson, Department of Environmental Science, UPR Rio Piedras

Emerging contaminants are chemicals in the environment that are not commonly monitored and can be potentially harmful to human and environmental health. These chemicals are not necessarily new but have not been monitored due to the lack of rapid and economical analytical methods of detection (USEPA work group, 2008). We have analyzed two different methods, QuEChERS and Soxhlet, to identify emerging contaminants in blue crab tissue and their effectiveness in recovery of different compounds. The blue crab was chosen as an experimental model as it inhabits the San Juan Bay Estuary (SJBE), is exposed to contaminants (e.g., dibutyl phthalate), plays an important ecological and commercial role in the ecosystem (Laureano et al. 2010), and is consumed by humans. The analysis was performed using the Environmental Protection Agency Soxhlet extraction methodology (1966). The QuEChERS methodology was developed by Anastassiades (2003) to rapidly measure pesticide residues in fruits and vegetables. An aliquot of 1 uL of

concentrated sample from both methods were analyzed by Gas Chromatography-Mass Spectrometry with AMDIS/NIST identification of compounds.

Our comparison showed that both methods have their benefits and shortcomings for monitoring emerging contaminants in animal tissues. QuEChERS is quick, uses fewer materials and equipment and also uses a minimum volume of solvent per sample. In contrast, the Soxhlet method is slower, requires many materials and equipment and uses a substantial amount of solvent per sample. QuEChERS is more economical than the Soxhlet method, yet, Soxhlet is more efficient for the extraction of emerging contaminants in the blue crab. For example, the percent recovery of dibutyl phthalate using QuEChERS was 17% while Soxhlet was 38%. The relative standard deviation, expressed as a percent (RSD%) for the extraction with QuEChERS and Soxhlet, were 25% and 33%, respectively. Future research will include testing both methodologies with the same extraction solvent at the same time to see the effect on the percent recovery. Also we will test different reaction times and solvents to optimize recovery of compounds using QuEChERS.

Funder Acknowledgement(s): This project has been supported by the NSF CREST Grant # HRD-1137725 and the Department of Environmental Science, UPR Rio Piedras.

Faculty Advisor: Vanessa Santiago, vsant57@gmail.com

234
Subcategory: Pollution/Toxic Substances/Waste

Phthalate Distribution and Persistence in the San Juan Bay Estuary, PR

Keishla Marie Valentin-Elias, University of Puerto Rico, Rio Piedras
Co-Author(s): Loretta Roberson, Liz Díaz, and Xochitl Pérez, University of Puerto Rico, Rio Piedras

Phthalates are chemicals used in a wide variety of industrial applications and consumer products, including clothing, cosmetics, building materials, medical devices and pharmaceuticals since the 1930s. As a consequence, phthalates are ubiquitous environmental contaminants and can enter the human body through different routes: ingestion, inhalation and dermal absorption. Most of the phthalates are dangerous but more specifically Dibutyl Phthalate (DBP) is suspected to be mutagenic, hepatoxic and carcinogenic. DBP is a stable compound in the natural environment with a hydrolysis half life of about 20 years. This study is an analysis of the annual persistence and distribution of phthalates in the San Juan Bay Estuary (SJBE). With this analysis we can have a better understanding of the ecosystem and the risk to estuary organisms. In summer 2012 and 2013 we used Solid Phase and liquid-liquid extraction methods to screen for organic compounds. Six samples (3 benthic and 3 superficial) were collected per site (Caño Martin Peña (CMP), Quebrada San Anton (QSA), Laguna San José (LSJ), Laguna La Torecillas (LLT), Laguna La Torecillas II (LLTII), Laguna La Torecillas III (LLTIII), Quebrada Blasina (QB), Quebrada Blasina II (QB2), Canal Suarez (CS), and Laguna Piñones) and for the control nanopure water was used. Twenty phthalates have been found with 15 new in 2013. The highest concentrations obtained in 2012 were 229.5 ppb in LLT II and 24.96 ppb in CS in 2013.

The results show that DBP is persistent in the estuary because it appears in all sites. In QBII the concentration of DBP has increased from nearly 0 to 16 ppb in superficial and 9 ppb in benthic waters. In P the concentration decreased from 28ppb to 9ppb in benthic water. Water flow may be responsible for the change in sampling points concentrations because phthalates are insoluble in water, and its moves as the water flows. DBP sampling concentrations were not toxic for humans according to the Environmental Protection Agency (>34 ppm). This study was done in the rainy season but for a better understanding of the distribution and persistence we must sample also during the dry season as well as at additional sites.

Funder Acknowledgement(s): This study was made thanks to the NSF-CREST Grant#HRD-1137725 fund.

Faculty Advisor: Loretta Roberson, loretta.roberson@gmail.com

235
Subcategory: Pollution/Toxic Substances/Waste

Assessing the Toxicity of the BP Oil Spill in the Air at the LA Shoreline

Sean Wilson, Dillard University
Co-Author(s): Bernard Singleton, Joy Semien James Watson, Dillard University

The Deep Water Horizon oil spill was the largest accidental marine oil spill to occur in United States history. As a result of this catastrophe, many of the coastal states were negatively impacted losing over 10 billion dollars economically, 8,000 marine species, and damaging over 16,000 miles of coastal ecology. After three years, ecological damages are still evident today. There is currently no basis to determine the long term ecological damages to the Gulf of Mexico and its shorelines. The oil and the dispersants used to help cleanup seem to both have an adverse effect on the environment.

The purpose of this research is to assess the toxicity levels of the air in the area of the oil spill along the Louisiana coastlines and how time and the weathering is affecting the conditions. Air samples were taken in order to determine if the air shows any signs of significant levels of toxicity. The miniVol and impingers were used to collect the samples. The collection sites were Grand Isle, Port Fourchon, and Elmer's Isle, all of which are areas along the Louisiana Coastline. The samples were analyzed by using the umuC assay. In this assay Salmonella typhimurium bacterium was used to determine whether the air samples were genotoxic. A sample is considered to be genotoxic when the induction ratio is greater than 1.5. All the samples showed levels of genotoxicity. Except for one, all the samples' induction ratios ranged from 1.56 to 4.61. That one dilution ratio was 1.41. The samples collected at the control site in Texas showed no genotoxicity. There are concerns about the oil and the dispersants used having toxicological effects on the individuals who are and have been exposed. Also there is continued concern about what effects the substances are having on the ecosystems.

For the future consideration there is a need to continue to monitor the conditions and study what role the weather is playing in the changes that are occurring in the ecosystem and communities in the areas of concern.

Funder Acknowledgement(s): This study is supported by a grant from NSF/HBCU-UP/HRD awarded to Bernard Singleton, Associate Professor of Biology, Dillard University.

Faculty Advisor: Bernard Singleton, bsingleton@dillard.edu

236

Subcategory: Water

Correlation Between Human Dimensions and Impaired Water Quality for St. Croix, Virgin Islands

Anthonios Doliotis, University of the Virgin Islands
Co-Author(s): Kenisha Pascal, Avram Primack, Kala Fleming, and Wayne Archibald, University of the Virgin Islands

Impaired marine environment near shore waters are associated with many terrestrial subwatersheds in the Virgin Islands. These impairments, including turbidity, fecal coliform, and enterococcus bacteria, are brought into the marine environment via runoff from the land. These impairments may be correlated with land development, improper drainage, and unpaved roads. In order to establish correlations between the human dimension of land development and poor water quality, a comparative study examining demographic data from the Virgin Islands 2010 Census and EPA STORET station data on water quality for 2009 to 2011 is being conducted. The location of each station was plotted using ArcGIS 10.1. By comparing variables such as age, race, income, place of birth, number of housing units, and other related variables within each estate to the location of impaired marine environment near shore waters, common variables among subwatersheds with impaired near shore marine waters will be determined. Future research will involve finding the correlation between human dimensions and impaired water quality for St. Thomas and St. John.

Funder Acknowledgement(s): This research was funded by the Water Resources Research Institute Fund # 205206.

Faculty Advisor: Wayne Archibald, warchib@live.uvi.edu

237

Subcategory: Water

Quality of Supply Water in the New Orleans Metro Area

Joseph Gilbert III, Xavier University of Louisiana
Co-Author(s): Syed Muniruzzaman, Xavier University of Louisiana

The supply of safe potable water has a significant impact on the prevention of water transmissible diseases. Presence of pathogenic bacteria or toxic chemicals in the potable water may have adverse effects on human health. As a result, it is essential to constantly monitor the quality of water used for domestic consumption. Supply water in the distribution system for public consumption should meet certain microbiological and chemical standards. Biological and chemical parameters can indicate the quality of supply as well as natural water resources.

The purpose of this study was to determine the microbiological quality and metal ion concentration of distribution water in the New Orleans metro area. During this study, a total of 200 samples of tap water were collected from Metairie, Kenner, East New Orleans, Central New Orleans and the West Bank area. The water samples were analyzed for coliforms, fecal coliform, *E.coli*, and heteromorphic bacterial counts per 100ml. Our data indicated that 6.25% of the Jefferson Parish tap water samples were coliform positive. On the other hand, in Orleans Parish we found 7.5% samples that contained coliform bacteria. All samples that we analyzed from Jefferson Parish had a zero count for *E. coli* and fecal coliform bacteria per 100ml. However, we found 2 samples out of 120 samples from Orleans Parish that contained *E. coli*. The coliform counts that we found were higher than the counts reported by the water departments of both parishes. In case of aerobic colony count, the number ranged between 100-104 colony forming unit per 100ml. Heavy metal ion analysis indicated that the concentrations of the selected heavy metals (arsenic, cadmium, chromium and lead) were within the EPA maximum contaminant level limit.

Funder Acknowledgement(s): Office of Naval Research (ONR); National Science Foundation

Faculty Advisor: Syed Muniruzzaman, smuniruz@xula.edu

238
Subcategory: Water

An Assessment of Salt Pond Ecological Characteristics in High and Low Human Development

Ayanna Hogan, University of the Virgin Islands

Salt ponds are coastal wetlands formed by the gradual closing of sheltered bays; they are surrounded by mangroves that provide habitat to nesting and foraging wetland birds. More importantly, salt ponds filter upland runoff, trapping sediment and contaminants thereby maintaining the water quality of the adjoining marine environment. Urbanization has led to an increase in runoff rich in nutrients, sediment, and other non-point source contaminants entering salt ponds and the marine environment. Many ponds have been lost or altered through coastal development for resorts and condominiums, which could result in a decrease in contaminants that are prevented from entering the marine environment by these coastal wetland filters. The focus of this study was to examine the relationship between human development and ecological characteristics of salt ponds on St. Thomas, the US Virgin Islands. Seven ponds were selected for sampling: three highly impacted ponds, one intermediately impacted pond and three ponds that receive little unnatural input. The water characteristics of each pond were recorded and water samples collected to measure the nutrient content within the ponds. Nutrients tested include nitrates, phosphates and sulfates. There were differences between impacted and non-impacted ponds in turbidity, total dissolved solids and dissolved oxygen levels, but no difference in chlorophyll. Salinity and pH were highly correlated, and while the salinity of non-impacted ponds was lower than impacted ponds, this may have been more indicative of hydrology than water quality. The ion concentration of the ponds varied even between the ponds classed together.

The results of this study have determined differences in high and low impact ponds in the water quality, but the ion concentration varies and show no relationship. The reason behind this difference will require further study of the ponds' ecological properties. Questions regarding the effectiveness of salt pond contaminant containing ability which protects the marine environment, may lead to future assessments of the relationship between the water qualities of beaches with adjacent salt ponds versus the beaches that lack salt pond.

Funder Acknowledgement(s): Funding for this study was provided by Emerging Caribbean Scientists Honors Program and acknowledgements to the staff of University of the Virgin Islands who assisted.

Faculty Advisor: Renata Platenberg, renata.platenberg@live.uvi.edu

239
Subcategory: Water

Calibration of the SWAT Hydrological and SNTHERM Model in Cannonsville, NY

Benjamin Joseph, New York City College of Technology
Co-Author(s): Jose Corona and Tarendra Lakhankar, City College of New York

The purpose of this research is to provide meteorologists with an accurate, and usable data set from the National Operational Hydrologic Remote Sensing Center (NOHRSC), which can be used for weather forecasting. The science behind hydrology is on the move for major advances in the hydrological measurements, new methods for analyzing data about hydrology, and on the move for new approaches to simulate the hydrological systems. Another approach is to find ways to advance the hydrological science. The main objective is to determine how to develop better hydrological measurements, analyses, and simulate calibrated models in order to get accurate readings. Quantitative amounts of data were collected from the NOHRSC to get a better visualization and under-standing of the data we obtained so we can make it usable for use. Then I imported the data we collected into MATLAB to generate codes only for precipitation and temperature, which were two main parameters used out of 5 for our research. If I use only two parameters for the NOHRSC data, then muc of that data set will be usable for weather forecasting. The two models we implemented into the data sets were the SWAT Hydrological Model and the SNTHERM Snowpack Model, which then were calibrated and validated to see if NOHRSC data set would be appropriate for weather forecasting immediately. After our examination, we realized that NOHRSC data was not appropriate for meteorologists to use for weather forecasting, and the NCDC data set actually provided better use because it had a higher R squared value than the NOHRSC data set. Future research is still needed to improve the results that we got from the NOHRSC data to make it usable for weather forecasting.

Funder Acknowledgement(s): This research is supported by the National Science Foundation's Research Experiences for Undergraduates Grant No AGS-1062934 under the leadership of Reginald Blake, Janet Liou-Mark, and Chinedu Chukuigwe.

Faculty Advisor: Tarendra Lakhankar, lakhankar@gmail.com

240
Subcategory: Water

Defining the Spatial Variability of Hyporheic Exchange in Eagle Creek

Vincent Knox, University of Minnesota - Twin Cities

Co-Author(s): Jessica Kozarek and Amy Hansen, St. Anthony Falls Laboratory, Minneapolis

The hyporheic zone is an active ecotone between groundwater and surface stream water where exchanges of water, nutrients, and organic matter occur. Hyporheic exchange is the bidirectional exchange between stream water and subsurface water within the hyporheic zone. Hyporheic exchange has a significant influence on stream ecosystems by moderating water temperatures, providing flow refugia for benthic macro-invertebrates, and providing ideal conditions for biogeochemical processes, such as denitrification. My hypothesis is that enhanced hyporheic exchange is dictated by structural complexity of stream morphology. Morphologic features such as logs, pools, riffles, islands, and meander bends develop complex three-dimensional flow patterns that can enhance upwelling or downwelling.

To determine the impact that specific morphologic characteristics have on hyporheic exchange I quantified hydraulic gradients using a mini-piezometer to test for patterns of upwelling or downwelling. The four morphologic features I looked at within a stream are riffles, islands, log dams, and meander bends. I tested for other determining factors of hyporheic exchange by measuring flow depth, width, mean velocity, and cross sectional area. Field work was conducted at Eagle Creek in Savage, MN to determine the effect that features such as riffles, islands, log dams, and meander bends have on hyporheic exchange. The mini-piezometer measurements taken at Eagle Creek will be used to characterize hydraulic gradients between surface water and subsurface water near each morphologic feature. I also investigated the influence of flow rate on hyporheic exchange and the influence of individual morphologic features on hyporheic exchange in a controlled environment at St. Anthony Falls Outdoor StreamLab, with and without the addition of a simulated log obstruction. This research will contribute to our understanding of spatial variability of hyporheic exchange in order to predict the impacts of stream morphology on the physiochemical environment.

Funder Acknowledgement(s): I would like to recognize Saint Anthony Falls Laboratory and The Multicultural Summer Research Opportunities Program. I would also like to recognize the Minnesota Louis Stokes Alliance for Minority Participation and North Star Stem Alliance for funding my research. I would also like to recognize the Minnesota Department for Natural Resources for allowing Eagle Creek to be used as a site for my research project.

Faculty Advisor: Jessica Kozarek, jkozarek@umn.edu

241
Subcategory: Water

Anaerobic Treatment of Wastewater--Upflow Anaerobic Sludge Blanket

Etonam Okaikue-Woodi, Cornell University
Co-Author(s): C.P. Fernandez-Baca, W. N. Grimshaw, S. Shanbhag, and X. Zhang, Cornell University

In 2012, WHO and UNICEF Joint Monitoring Program for Water Supply and Sanitation reported that approximately 2.5 billion people lack access to proper sanitation and wastewater management. Subsequently, many people die from diarrheal diseases. The question of proper and effective wastewater treatment needs to be addressed to improve human health. Anaerobic processes are commonly used to treat wastewater because of the low energy requirement, minimal operational and maintenance costs, and the possibility of biogas production, which can be reused as a source of local energy. This project investigated Upflow Anaerobic Sludge Blanket (UASB), an anaerobic technology developed in the 1970s and widely used due the high settleability of the granular sludge used, which allows for high chemical oxygen demand (COD) loading rates. Two different lab-scale UASB reactors--Reactor 1.0 and Reactor 2.0--with a height of 1.0 m and internal diameter of 3.8 cm were constructed and operated to determine their performance in terms of COD and turbidity removal, and biogas production. Both reactors were operated with an upflow velocity of 0.2 mm/s and equipped with pressure sensors controlled by Process Controller software used to monitor the buildup of gas in the gas chamber. The reactors were inoculated with granular sludge obtained from Budweiser Brewery and fed with a synthetic wastewater with a COD of 500-600 mg/L. Daily samples of liquid effluent were analyzed for COD content using an acidic solution of potassium dichromate, and gas measurement was done using Gas Chromatography with a thermal conductivity detector and Helium as the carrier gas.

Preliminary results showed a mean COD removal of 38.92 % for Reactor 1.0 and 41.14% for Reactor 2.0, a methane content in biogas of 56.47% for Reactor 1.0 and 52.75% for Reactor 2.0. The average daily turbidity removal of Reactor 1.0 was 61.98% and 63.98% for Reactor 2.0. Both reactors experienced loss of biomass and regular clogging of effluent gas lines. Future works will focus on designing larger and more effective reactors that will maximize biogas capture. In addition, the reactors will be operated with various loading rates, and some support material (sand, clay) will be added to facilitate granulation. They will be tested for more water quality parameters such as the removal of biological oxygen demand, ammonia, phosphorus, volatile fatty acids, and pathogen indicators.

Funder Acknowledgement(s): This project was funded by the Cornell's Atkinson Center for a Sustainable Future and the

Cornell University Louis Stokes Alliance for Minority Participation.

Faculty Advisor: Ruth Richardson, rer26@cornell.edu

242
Subcategory: Water

Montane Riverine and Wetland Conditions of the Gallinas Watershed

Rose Peralta, New Mexico Highlands University

The dependence on the Gallinas River by the local population increases the importance of the condition of the wetlands within the Gallinas Watershed. Wetlands play a crucial role within a watershed by storing water, filtering water, flood abatement and the support of large diversity of fish, wildlife and plant populations. The Gallinas Watershed supplies the local town of Las Vegas, NM with 90% of its drinking water making it a priority to study the conditions of the wetlands, rivers and streams within the watershed (Hermit's Peak Watershed Alliance, 2013). The land has been gravely altered by humans for agriculture, horticulture, urbanization and ranching. The river has been manipulated and straightened in order to benefit these management plans.

I hypothesize that the land management in the watershed has had a negative effect on the health of the Gallinas Watershed. We identified an inventory of existing and historical wetlands within the canyon through aerial photographs, field verification, plant inventories, historical documentation, US Fish and Wildlife Service National Wetlands inventory, endangered and threatened species inventory and Natural Resources Conservation Service soil maps. We then established landscape characteristics including the geology, geo-hydrology, climate, surface hydrology, water quality, soils, vegetation communities, wildlife habitat, land ownership and land use.

The most altered channelized areas by humans, including urban interface, were the experimental sites, and the protected untouched areas were the control sites. In assessing the river I have used the New Mexico Rapid Assessment Method (NMRAM) from the New Mexico Environmental Department, in order to determine the conditions of individual wetlands and sections of the river related to those wetlands. Each site is calculated with a score from 1.0-4.0 and given a grade, A-D. A = Excellent, B = Good, C = Fair, and D = Poor, based on the data collected. We are seeing a trend in areas that are being used for intensive grazing and have high traffic of humans with a poor score with the NMRAM protocol. Data collection is ongoing and results are incomplete at this point.

Funder Acknowledgement(s): S-STEM; W.K. Kellog Foundation; Edward A. Martinez, New Mexico Highlands University' Hermit's Peak Watershed Alliance.

Faculty Advisor: Edward A. Martinez, eamartinez@nmhu.edu

243
Subcategory: Water

Comparison of Satellite Microwave Data with Ground Based Radiometric Data

Guan Nian Zeng, New York City College of Technology
Co-Author(s): Jonathan Muñoz and Tarendra Lakhankar, City College of New York

The snowpack properties greatly affect the climate and environment of planet Earth. The comprehension of snow properties and snow seasonal variations provide useful information for various hydrological and meteorological applications. Snow is one of the many factors that take a significant role in the seasonal flooding and water resource management. For this reason, accurate information of snow characteristics is required to increase the accuracy of hydrological forecast. The objective of this long term field experiment was to improve understanding of the effect of changing snow characteristics (grain size, density, temperature) under various meteorological conditions on the microwave emission of snow and hence to improve retrievals of snow cover properties from satellite observations. The purpose of this study is to use the time series of microwave brightness temperature of snow covered ground from an extensive in-situ data collected through the winter season for validation and improvement of previously developed algorithm for snow cover and snow emission. Developing an efficient method for processing the data is crucial in the field to solve problems. In this study, we are developing MATLAB codes for automatic correction of missing data observed by meteorological, radiometric instruments and observed snowpack data. Pre-processing is important for obtaining useful data from noisy data. In order to accurately compare in-situ data to satellite data, we must extract the excess data in order to focus on usable data. Satellite (SSM/I) data is used to estimate the snow depth, snow water equivalent, among other important snow properties. We can compare satellite data to radiometer (in-situ) data and determine how they correlate, and then we may have more confidence in our estimations of snow properties.

The study continues as additional investigation is necessary as the effects of sensible heat flux, relative humidity and other meteorological parameters are still not completely understood regarding the changes of snow grain size. We aim to refine our already existing algorithms for more precise analyses. The research conducted will improve the estimation and our understanding of snow pack properties. An Inter-Annual Comparison of Satellite Passive Microwave Data with Ground based Radiometric Measurements will be performed to investigate the effect of changing snow properties on the satellite data.

Funder Acknowledgement(s): This Research Experiences for Undergraduates in Satellite and Ground-Based Remote Sensing at CREST_2 program is funded by the National Science Foundation under grant AGS-1062934.

Faculty Advisor: Tarendra Lakhankar, tlakhankar@ccny.cuny.edu

Mathematics and Statistics

244
Subcategory: Climate Change

Historical Trends and Prediction in Savannah's Temperature

Blessing Enya, Savannah State University
Co-Author(s): Hyounkyun Oh, Savannah State University

Climate change has been a serious issue which has been affecting people and the environment around the world over decades. NOAA's National Climate Data Center indicates that temperatures rose throughout most of the United States at an average rate of 0.11°F per decade and the warmth record was built in the most recent 10-year period. On the other hand, based on the NOAA's data some South and Southeast areas of the U.S, including the state of Georgia, still experienced a very slight temperature change over the past century. This present study aims to build a mathematical model of temperature changes in Savannah, Georgia. Based on the data from the past 60-years, the monthly mean highest and lowest temperatures are investigated. Using the Fourier Approximation, this non-linear discrete approximation is converted to a continuous function so that we predict the future change of temperature in Savannah area. Resultant information may be applied to develop a more accurate predictive system by combining other climate control systems.

Funder Acknowledgement(s): This study was supported, in part by PSLSAMP awarded to Devi Chellu, Program Associate Savannah State University, Savannah, GA 31404.

Faculty Advisor: Hyounkyun Oh, hoh@savannahstate.edu

245
Subcategory: Computer Science & Information Systems

Using Technical Analysis to Predict the Onset of Asset Depreciation

Janica Gordon, Southern University at New Orleans
Co-Author(s): Joe Omojola and Rachid Belmarsour, Southern University at New Orleans

Depreciation is a decrease in an asset's value caused by adverse market conditions. The objective of this project is to utilize technical analysis to avoid unwarranted losses in investments. Technical Analysis is the forecasting of future financial price movements based on examination of past price movements. This project uses data from the year 2010 to forecast losses. Data for six different technical indicators were collected for 15 different stocks to determine the most effective indicator to predict onset of market downtrend. To determine which indicator is more effective, ANOVA was conducted. ANOVA is an analysis of the variation present in an experiment. Furthermore t-tests were performed to determine individual methods that stand out. The outcome of this project should save invertors from unwarranted losses in the market.

Funder Acknowledgement(s): Joe Omojola and Rachid Belmarsour

Faculty Advisor: Joe Omojola, jomojola@suno.edu

246
Subcategory: Computer Science & Information Systems

Data Management and Analyses of the Physical Properties of High Performance

William Hayes Jr., Virginia State University
Co-Author(s): Alfree Conklin, Denzel Harris, and Krishan Agrawal, Virginia State University
Ronnie Moore, Leader Analytical Labs Specialty Products-Advanced Fibers & Composites Honeywell Performance Materials and Technologies, Honeywell, VA

This project is a three phase research effort. In Phase One the goal was to migrate data to a Data Management System (DMS) for easier and faster accessibility of Honeywell test results. Data transformation was also used to develop the DMS. The system achieved in Phase One provides a more flexible search capability of the response of various test results on the physical properties of different high performance materials used in various commercial and non-commercial applications. The data from Honeywell Fiber Physics Testing Lab was collected. This data of various test results are arranged chronologically and organized. The data can be searched by entering specific keywords. These keywords are divided into two categories, Product ID and Test Method. Product ID keywords are made up of a certain series of numbers. Test method keywords are 3 pt. Bend, Lap Shear, Yarn Physicals, and Tensile Strips just to name a few of them. In Phase Two, an efficient search engine was developed using Microsoft Access which provided a faster accessibility to the user of various test results in the data base. Currently there have been files from the 2012-2011 and the bulk of the 2010 files loaded into the database. Moving forward into the future of this project the goal is to improve the search engine by making it more flexible. Also adding an interface that will automatically add real time test results into the database is in the future as well.

References: Steve Lambert, M. Dow Lambert III, and Joan Preppernau, Microsoft© Office Access 2007 Step by Step, 2003; Ashok Bhatnagar, Lightweight Ballistic Composites: Military and Law-Enforcement Applications, CRC Press, 2006.

Funder Acknowledgement(s): This study is supported by HBCU-UP, funded by NSF; W. Hill Provost Virginia State University. Ronnie Moore Leader Analytical Labs Specialty Products-Advanced Fibers & Composites Honeywell Performance Materials and Technologies, Colonial Heights Virginia.

Faculty Advisor: Krishan Agrawal, kagrawal@vsu.edu

247

Subcategory: Computer Science & Information Systems

2013 Summer Research with Dr. Kyle Swanson UWM Chair of Mathematics

Jason Martinez, University of Wisconsin Milwaukee

This summer I was fortunate to conduct research for Dr. Kyle Swanson, chair of the mathematics department at the University of Wisconsin Milwaukee (UWM). The dilemma that UWM has been faced with is that students who test into Math 90 have great difficulty completing the Math 90, Math 95, and Math 105 sequence. In fact during the past ten years only one out of four students will have completed this sequence successfully. Initially I was presented with a spread sheet containing data from all students that attended UWM during the past four years and their initial math course completed, along with their GPA, placement scores, ACT scores, high school credits earned and GPAs, professor name, high school district, and other categories. With this data I was able to convert it into useful information giving us the probability of passing each course and how any given parameters impacted the probability of passing.

Next, I was given data of students who attended UWM for the past ten years but only students who tested into Math 90, Math 95, or Math 105 with the same elements, but this time I was given their entire sequence of math courses completed at UWM. With this data I was able to figure the probability of passing the Math 90-95-105 sequence or the Math 95-105 sequence. I also established a solid argument of where some of the issues lie within this problematic sequence for UWM students. There was positive correlation between students who completed four or more high school credits and being successful with getting through Math 105 and negative correlation for students who completed less than four high school credits and their ability to get through Math 105. The probability of passing Math 105 was noticeably greater if you completed four or more high school credits and was noticeably less likely to pass Math 105 if you completed less than four high school credits. During this process, I used Microsoft Excel and MATLAB to extract information for the data set. I was very excited to work on this project as I am very excited to have the opportunity to present my findings at a conference. My academic goals continue to push me to strive for academic excellence in pursuit of an actuarial science degree while making a positive impact on the community.

Funder Acknowledgement(s): WiscAMP S.T.E.M. Scholar

Faculty Advisor: John Baker, jlbaker@uwm.edu

248

Subcategory: Education

Mathematics: The Universal Language, Or is it?

Candace Gilchrist, Norfolk State University
Co-Author(s): Rhonda Ellis, Norfolk State University

According to the scores from the 2006 Program for International Student Assessment, United States middle school students are ranked 17th in science out of 30 countries[4]. American students fall even further behind in mathematics on the same assessment, 24th out of 30[4]. These alarming statistics illustrate that too few American students are prepared to become engineers, scientists, and physicians as they fall drastically behind global competition in these areas[4]. In an effort to address this issue and improve American knowledge and understanding in mathematics, experts are reevaluating teaching styles implemented in mathematics classrooms at all levels of education throughout the country. Recent studies show that one significant area of concern lies in the relationship between linguistics and mathematics, or the lack thereof. Sociolinguists are working to establish stronger partnerships with STEM educators and students to address key issues in student achievement[2]. In mathematics, many words and expressions have multiple meanings; oftentimes having one particular meaning in Standard English, but another meaning in a mathematical context.

Therefore, the presence of such linguistic ambiguities has led us to design an experiment to investigate the effect of the language of a mathematics problem and a student's ability to solve that problem correctly. A brief assessment is given to a group of high school geometry students with a couple of questions on a specific concept, but each question will be worded differently.

The McNemar test, a statistical test designed specifically for dependent data sets, will be performed to determine if the language of a geometry problem is crucial to mathematical understanding. All of the analyses are conducted using SPSS software. The McNemar test yielded results that suggest a significant difference exists between questions two and three (p=0.027, bonferroni corrected), however more sophisticated methods are needed to control for confounding variables. This preliminary method illustrates that there is a relationship between the language of a problem and the students' response. Future work involving a more complex method will yield precise results that can be applied to strengthen teaching styles across America.

References: [2]Buchanan, Tricia. (2007). The importance of teaching students how to read to comprehend mathematical language. Math in the Middle Institute Partnership Research Project Report. [4]Fisher, D.G., Kaplan, J. J., Rogness, N.T. (2009). Lexical ambiguity in statistics: what do students know about the words association, average, confidence, random, and spread. Journal of Statistics Education, 17.3.

Funder Acknowledgement(s): National Science Foundation Grant #0714930

Faculty Advisor: Rhonda Ellis**,** rdellis@nsu.edu

249

Subcategory: Education

Radio Labeling of Path Graphs to the 6th Power

Cynthia S. Salgado, California State University, San Bernardino
Co-Author(s): Reyna Hernandez, Edward Melendez, and Jesus Mora Sanchez, California State University, San Bernardino

Radio labeling is a process used to model the problem of efficiently assigning channels to FM radio stations to avoid interference. Let *G* be a connected graph. For any two vertices *u* and *v*, the distance between *u* and *v* in *G,* denoted as *d(u,v)*, is the length of the shortest *u-v* path in *G.* The maximum distance between any pair of vertices of *G* is called the *diameter* of *G*, which is denoted by *diam(G)*. A *radio-labeling* of *G* is a function *f* that assigns a label from the set {0, 1, 2, …} to each vertex such that the following holds for any vertices *u* and *v*:

$$|f(u) - f(v)| \geq diam(G) - d(u,v) + 1$$.

The $|f(u) - f(v)| \geq diam(G) - d(u,v) + 1$ *span* of f is defined as $\max_{u,v\in G}\{|f(u) - f(v)|\}$. The $\max_{u,v\in G}\{|f(u) - f(v)|\}$ *radio number* of *G* is the minimum span among all radio-labelings of *G*. The 6*th power* of *G* is a graph constructed from *G* by adding edges between vertices of distance six or less apart in *G*.

Hypothesis: How to make the radio station interference smaller between radio stations? We understood that making the assignment channels smaller would make the radio station interference smaller. Methods that we use to work in this research were graph theory and Conbinatorics tools. In this presentation we will discuss the progress we made towards finding the radio number for 6th power of paths during a 2013 MAA summer research program funded by NSA.

Funder Acknowledgement(s): 2013 MAA summer research program funded by NSA (grant H98230-13-1-0270) and NSF (grant DMS-1156582.) I want to thank Dr. Lo for giving me the opportunity to participate in her research.

Faculty Advisor: Min-Lin Lo, mlo@csusb.edu

250

Subcategory: Geosciences and Earth Sciences

Interactive Multi-Sensor Snow and Ice Mapping System: Snow Depth Validation

Derrick Jones, Mississippi Valley State University

As part of the new product line for the snow data assimilation for the National Centers for Environmental Prediction (NCEP), the National Oceanic and Atmospheric Administration National Environmental Satellite, Data, and Information Service has developed a new four kilometer (4km) snow depth product as part of the Interactive Multi-Sensor Snow and Ice Mapping System Version 3(IMS V3). The IMS V3 4km snow depth product is expected to be operational in October 2013 but currently lacks validation of the accuracy. We applied ArcGIS to compare the new snow depth product from IMS V3 estimates to over 10,000 Global Historical Climatology Network (GHCN)-Daily measurements. The analysis measures the snow depth between January 2010 and February 2010, an active snow season over the contiguous United States. Difference metrics were made for each station over the evaluation period and were summarized to construct a mean, difference, and time series of differences in the products. Spatial maps of the differences were also constructed for each date.

The goal of this project was to contribute to a NOAA Mission Goal: accurate and reliable data from sustained and integrated earth observing systems. Subsequently, informing both NOAA scientists and the general public about the snowfall, ice, and threats on a day-to-day period. Over January 2010, the IMS V3 was within 20 cm of the GHCN-Daily measurements 86.9% in snow covered areas, while February 2010 was within 20 cm 85.1% of the time. Differences were quite small considering wide spatial variability of snow cover within a 4km area, inclusion of mountainous terrain, snow accumulations during time interval, and the removal of any non-snow covered areas in the evaluation.

Further research needs to be done over a larger period of time to get a solid analysis of the IMS V3 product performance. The expanded study will examine over a wider time interval to further evaluate the IMS V3 snow depth performance. Cross-

Comparison of the IMS V3 to Air Force Weather Agency (AFWA) snow depth analysis will also be accomplished shortly. This is a vital step for the application of IMS V3 snow depth at NCEP since AFWA snow depth is currently used to initialize AFWA models. IMS V3 must clearly demonstrate improvements over AFWA for NCEP consider applying the IMS V3 snow depth operationally.

Funder Acknowledgement(s): This research was funded by NOAA Educational Partnership Program.

Faculty Advisor: Constance Bland, cgbland@mvsu.edu

251
Subcategory: Geosciences and Earth Sciences

Improving a Lagrangian Diagnostic: Relative Dispersion Method and the Computation of Coherent Structures

Kendra Kirby, North Carolina A&T State University

We will use a Lagrangian diagnostic, relative dispersion, to compute coherent structures (i.e. manifolds) of several systems. We plan to study the Duffing oscillator in the context of geographics. The Duffing oscillator is described by following differential equations. The Duffing equations introduced the significance of an oscillator, which gives a better description of the systems behavior [AEM1]. We plan to study the Duffing oscillator by concentrating on the following: numerical methods to solving differential equations, analytically solving the Duffing oscillator's system of differential equations, studying dynamical systems techniques and applying them to the Duffing oscillator, studying relative dispersion method, using a numerical integrator in the relative dispersion method to find the coherent structures that govern the velocity field of the Duffing oscillator. The programs we will use to find the manifolds and compute the coherent structures are XPP and MATLAB, respectively. We will use LATEX to document our progress and write up the final results of this project. We will work towards improving the efficiency of the relative dispersion method by selectively choosing the grid points to find the Lagrangian trajectories for Duffing oscillator.

Funder Acknowledgement(s): HBCU-UP/Talent-21

Faculty Advisor: El Moghraby, amoghraby@gmail.com

252
Subcategory: Microbiology/Immunology/Virology

Drug Dosage: Ensuring a Level of Effectiveness, While Not Being Harmful

D'von Jackson, Fisk University

The medical field is quickly expanding. As people attempt to push the assumed boundaries of life longevity, medical research continues to find new cures for once incurable diseases. These cures are only valuable when dosage research is conducted alongside them. In this research study, a pharmacokinetic mathematical model was developed to determine the dosing regimen of a drug that will be administered multiple times with the goal of maximizing the therapeutic effect of the drug while maintaining a safe drug concentration level in the blood stream. Pharmaceutically-relevant parameters for the drug were determined from the experimentally established data of the drug. Computation and simulation was performed using Mathematica.

The study shows that for a drug which is administered multiple times, residual amount in the blood stream during a particular dose is higher than that of the previous one. When the interval between two consecutive doses is quite long, residual quantity is almost absent and dose administrations are almost independent of each other. On the other hand, if the interval between two consecutive doses is too short, there is significant residual drug build up leading to toxic level in the blood stream. In the future, the mathematical models will be refined and other factors such as immunity will be taken into consideration using probability factors.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Sanjukta Hota, sanjuktahota@gmail.com

Nanoscience

253
Subcategory: Biomedical Engineering

Paclitaxel Loaded Nanoparticles for Treatment of Malignant Mesothelioma

Danielle Taylor, Norfolk State University/University of Alabama at Birmingham

Malignant mesothelioma is an aggressive deadly pleural cancer disease that occurs as a result of prolonged inhalation of asbestos fibers. The pleural space is a target for malignant involvements in primary tumors of the pleura such as mesothelioma and in metastatic tumors. Its incidence is increasing worldwide, in part because of past exposure to asbestos. Health care and compensation costs for this disease in the US over the next several years are expected to reach $200B. In our military, exposure to asbestos occurred in shipyards and in exposure to insulating materials.

The purpose of this research is to create nanoparticles loaded with an anticancer drug, paclitaxel, to use with a thoracoscope which is an endoscope that is inserted through a puncture in the chest wall for the visual examination of the chest cavity. Poly (lactic-co-glycolic acid) (PLGA) 50:50 nanoparticles were prepared with a double emulsion solvent evaporation method. Based on the results, we successfully created uniform nanoparticles in nano-range with smooth spherical shape. High loading efficiency of paclitaxel to nanoparticles is achieved. For future works, we plan to optimize the size and cytotoxicity of paclitaxel loaded nanoparticles and proceed with *in vivo* experiments. This project will hopefully have the ability to detect early stages of malignant mesothelioma and kill it.

Funder Acknowledgement(s): Support provided by National Science Foundation (Grant Number 1058974) - Research Experiences for Undergraduates (REU) award to University of Alabama Birmingham.

Faculty Advisor: Venna Antony, vantony@uab.edu

254
Subcategory: Biomedical Engineering

Incorporation of Silver, Diamond and Gold Nanoparticles in Various Organic Solutions

Denae West, Oakwood University
Co-Author(s): Cassandra Dill and Kenneth LaiHing, Department of Chemistry, Oakwood University

Nanofibers have interesting characteristics such as large surface area to volume ratio, flexibility, and superior mechanical performance. For these reasons, these fibers are used in many important applications such as artificial skin as well as tissue engineering. The possibility of incorporating drugs to controllably release to target cells, which will decrease side effects, is intriguing. This will provide an economic benefit to the consumer as well as drug synthesis systems. The most efficient technique for preparing nanofibers is electrospinning.

Nanofibers consisting of poly-lactic acid (PLA) and chitosan with silver, diamond and gold nanoparticles were prepared and characterized using optical as well as scanning electron microscopy (SEM). By varying the concentration, voltage, flow rate, and distance between the needle tip and collector plate of the precursor solutions, one was able to control the diameter and consistency of the nanofibers. It was found that favorable fibers were generated when mixing the polymers and the various nanoparticles. We report results for concentrations between 5-10% polymer mixtures. Nanofibers obtained from these polymers are biocompatible, making electrospinning with inert nanoparticles an ideal method for use in drug delivery to target cells. The biodegradability of the fibers, and characterizing each to discern a time table for the specific polymer used, while also investigating the process and addition of antibiotics into the nanofibers will be presented.

As a result, drugs may be able to be released to target cells controllably which will decrease side effects. This will potentially provide an economic benefit in drug delivery and for the consumer. Further study will involve testing the efficiency of the nanofibers to deliver the antibiotics or other drugs to bacteria or cells.

Funder Acknowledgement(s): This research was funded by the National Science Foundation HBCU-UP Program. Grant No. 811507.

Faculty Advisor: Kenneth LaiHing, laihing@oakwood.edu

255
Subcategory: Cancer Research

PEG-functionalized CNT:Design and Application for Anti-cancer Drug Docetaxel

Brandi Barlow, Alabama State University
Co-Author(s): Akanksha Sood, Daulat Ram College, Delhi, India
Pooja M. Tiwari, Swapnil Bawage, Shree R. Singh, and Komal Vig, Alabama State University

Carbon nanotubes are one of the most commonly studied nanomaterials and are the preferred materials for various biochemical and medicinal applications. Due to their large surface area and impressive physical and chemical properties, single-walled carbon nanotubes (SWNT) have been tremendously exploited for conjugation with a variety of molecules in drugs, proteins, peptides etc. for therapeutic as well as diagnostic purposes. In the present study, SWNT were used as matrix for loading the anti-cancer drug Docetaxel (DOX). SWNTs were first functionalized with PL-PEG amine to increase water solubility and bio-compatibility. These functionalized SWNTs were then conjugated with the drug docetaxel under basic conditions. Since cancer cells have an acidic micro-environment, the change in pH triggers the release of this drug in cancer cells. The functionalization of the SWNT with PL-PEG and the loading of the drug were confirmed using FT-IR technique. Peaks corresponding to amine group, alkyl group and carbonyl group stretch in the SWNT-PEG graph confirmed the PEGylation. Also, the peak corresponding to alkyl group stretch in the SWNT-DOX graph which was absent in the Docetaxel graph confirmed the loading of the drug. It was concluded from the MTT assay that both the SWNT-PEG (PEGylated SWNT) and the SWNT-PEG-DOX (PEGylated SWNT with the DOX attached) were more cytotoxic to HeLa cells as compared to the HEp-2 cells. The SWNT-DOX system can be targeted more specifically by conjugating with peptides that bind to the cancer cell receptors. Hence, SWNT are novel materials that can be fruitfully employed in increasing the efficacy of the presently used cancer treatments.

Funder Acknowledgement(s): National Science Foundation (NSF), Center for NanoBiotechnology Research, Alabama State University.

Faculty Advisor: Komal Vig, komalvig@alasu.edu

256
Subcategory: Materials Science

Effects of Ferroelectric Nanoparticles in a Polymer-based Composite

Edgardo A. Reyes Brondo, University of Puerto Rico at Mayaguez
Co-Author(s): Amarilis Declet, Julián Ortíz, and Marcelo Suárez, UPRM University, Mayaguez

Recently bio-ferroelectric composites have triggered intense interest as a sustainable alternative for processable high permittivity materials and other electronic applications such as capacitors, transistors, actuators, etc. In particular, the biopolymeric matrix improves the necessary flexibility of the composite. The present research involves the development of a bio-ferroelectric composite using a mixture of chitosan-cellulose and ferroelectric nanoparticles with high dielectric constants. The ferroelectric nanoparticles were added to the polymer solution, and the solution was further homogenized to improve the nanoparticles dispersion. The composite was structurally and mechanically characterized. Dielectric strength and dielectric constant measures have also been made to further characterize the composite. Cellulose concentrations were varied to test the hypothesis that for a higher percentage of cellulose in the composite, the mechanical properties (yield, tensile strength etc.) of the composite would be enhanced. Also, for a higher concentration of ferroelectric particles, it was believed that the dielectric strength and dielectric constant values would improve. The data showed that for higher concentrations of cellulose, the composite would lose strength and become weaker. Also, the dielectric strength and dielectric constant values decreased for a higher concentration of ferroelectric particles.

Funder Acknowledgement(s): This study was supported by NSF Award No. HRD 0833112, CREST program.

Faculty Advisor: Oscar Marcelo Suárez, msuarez@ece.uprm.edu

257
Subcategory: Materials Science

Synthesis of Ternary Magnetic Photocatalysts

Esteban Rodriguez-Ariza, Portland State University
Co-Author(s): Simon Fowler and Jun Jiao, Portland State University

Microspheroid iron oxide cores with inorganic oxide nano-shell coatings have been synthesized using solvothermal and sol-gel processes. These particles are composed in ternary structures of Fe3O4/SiO2/TiO2 and exhibit fast magnetic recovery and high photocatalytic activity. These particles are being implemented in a novel water purification system that removes organic contaminants from water and is powered completely by solar energy. The Fe3O4 core, about 234 nm, is responsive to magnetic fields and is coated with an interlayer of SiO2 and a surface layer of crystallized TiO2, which all have adjustable layer sizes through experimental conditions. The SiO2 interlayer, about 22 nm radial thickness, maintains chemical and thermal stability of the Fe3O4 core. The crystallized TiO2 surface layer, about 11 nm radial thickness, is well recognized as a photocatalyst with numerous favorable qualities. These ternary magnetic photocatalysts were synthesized with the intent of fast recovery for multiple cycles of use. The particles were characterized by electron microscopy for confirmation of the composition, size and morphology of each layer. Once synthesized, the particles were used for degradation of known organics using sonic dispersion under a solar spectrum lamp via photocatalytic slurry method. Aliquots of the water were taken at regular time intervals and analyzed using UV/Vis absorption spectrophotometry for measuring the decrease in concentration of the organic contaminant. Magnetic response was qualitatively observed through applying external magnetic fields. Results from characterization and analysis indicate that ternary magnetic photocatalysts of approximately 300 nm in total diameter have been synthesized. These photocatalysts exhibit fast magnetic recovery of approximately four minutes for a distance of one inch from the magnet's surface. In addition, the photocatalysts have successfully broken down organic dyes like methylene blue at 1 mg/L concentration in approximately 200 minutes. Future directions include rigorous material analysis including magnetization, toxicity and crystallinity of the particles. Additionally, HPLC will be used for confirmation of complete removal of organic contaminants once optimization of the desired properties has been achieved. The system will then be studied under rooftop solar conditions with a series of contaminants for a full study of applicability in the field.

Funder Acknowledgement(s): This work is supported by NSF, Portland State University through the Cleantech Competition, and private donor Ken Guenther.

Faculty Advisor: Jun Jiao, jiaoj@pdx.edu

258
Subcategory: Materials Science

On the Fabrication of Biopolymer-based Nanocomposites

Jose Luis Salcedo Perez, University of Puerto Rico, Mayaguez
Co-Author(s): Oscar Marcerlo Suárez, Sujeily Soto, Katiria Esquilin, and Deborah Marty, University of Puerto Rico, Mayagüez

Most biopolymers have limitations due to their poor mechanical, thermal and electrical properties compared with metallic and ceramic materials. Therefore, to expand their range of applications, these properties must be improved. The goal of this work has been to fabricate a nanocomposite material consisting of a matrix made of chitin, reinforced with multiwall carbon nanotubes (MWCNTs) for low-cost aerospace applications. To produce these composites, MWCNTs were dispersed and incorporated into chitin solutions using various techniques. Optical microscopy allowed characterizing the nanocomposites along with differential scanning calorimetry, nanoindentation and thermomechanical analysis. In our preliminary results we demonstrated that chitin films reinforced with MWCNTs possess much higher mechanical strength compared with the bare chitin films. The ultimate tensile strength (UTS) of the bare chitin film was found to be around 0.22 MPa while the nanocomposites showed an UTS of approximately 6.3 MPa, i.e. almost 30 times as high as the plain film. These nanocomposites also showed hardness values of up to 0.31 MPa while the hardness of the chitin film was only 0.04 MPa. Our ongoing work is focused on synthesizing the nanocomposite materials with other proportions of chitin films and MWCNTs and then completing similar mechanical tests to assess how the composition variation affects the nanocomposites' bulk properties.

Funder Acknowledgement(s): This research is sponsored by the National Science Foundation under the Grant HRD 0833112 (CREST Program), as part of the UPRM Nanotechnology Center.

Faculty Advisor: Oscar Marcerlo Suárez, msuarez@ece.uprm.edu

259
Subcategory: Nanoscience

Toxicity of Gold Nanoparticles in Soils and Hydroponics with Tomatoes

Beverly Agtuca, SUNY College of Environmental Science and Forestry
Co-Author(s): Justin McMullen, Wenjun Cai, and Lee Newman, SUNY ESF, Syracuse
Catherine Murphy, University of Illinois, Urbana-Champaign
Jason White, The Connecticut Agricultural Experiment Station, New Haven
Tara Sabo-Attwood, University of Florida, Gainesville

Nanotechnology is known to be an important force of the future economy and of governments and industries worldwide. Using nanotechnology may lead to nanoparticles (NPs) entering the environment through deliberate applications and accidental releases. This creates regulatory concerns, as NPs possess unique chemical and physical properties that can impact living systems. Gold NPs (AuNPs) are being proposed for many applications: 1) they act as biosensors to direct in-field sensing of pesticides, 2) they act as bioconjugates with fungal species to purify contaminated waters, 3) they are currently used in medical applications, as gold acts as a therapeutic agent to treat rheumatic diseases. The use of AuNPs is economically increasing, however, we have not looked at the toxic effects on food crops and the environment. It has been concluded that AuNPs cause biotoxicity as they have the potential to be internalized in the exposed plants by crossing the cell wall and membranes and accumulating within the plant. There are two objectives of this study: to look at the real world bioavailability that occurs in soil-based systems and to determine how different time exposures (4, 12, 24, 48, 72 h) impact the expression of stress response genes to AuNPs by using a model crop, tomato. To understand the toxicity effects, tomatoes were exposed to 3.5 nm AuNPs for increasing times, while the controls were in water. In the soil study, tomato tissues were analyzed by the ICP-MS to determine the take up of AuNPs. In the genetic study, tomato extractions were analyzed for gene expression levels using RT-PCR.

The results showed that difference in soil characteristics does affect the plant's take up; high loam soil limited take up more than sandy soil, while agriculture soil allowed higher take up of AuNPs. For the genetic study, the stress response genes, including actin as the constitutive gene and RuBisCO, showed changes in expression of tomato at different times of exposure. This concludes that tomatoes grown in agriculture fields have the potential to take up AuNPs that caused toxic effects in their cells and can possibly have the same effect when humans eat these treated crop plants. In the future, we will continue on the genetic study using additional stress response genes.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF awarded to Lee Newman, Associate Professor in the Dept. of Environmental and Forestry Biology, SUNY ESF.

Faculty Advisor: Lee Newman, lanewman@esf.edu

260
Subcategory: Nanoscience

Examining Effects of Flow on Sensors Made from Carbon Nanotubes

Erin Berg, Virginia Tech
Co-Author(s): Michael Philen and Abenazer Darge, Virginia Tech

When exposed to flow of an electrolytic liquid, carbon nanomaterial generates a voltage response. It is hypothesized that the induced voltage is proportional to flow rate over the nanomaterial and is due to ion interaction with the nanomaterial. To better understand the flow reponse, sensors were made by coating the nanomaterial in polydimethylsiloxane

(PDMS), a silicon-based organic polymer, which fixes the nanomaterial in its molecular matrix. This prevents the nanomaterial from being washed away in the flow. Electrodes are connected to the nanomaterial to measure the voltage response. The sensor is then tested in a flow tube, which is 1 inch by 1 inch in cross section and about a foot and a half long. The chamber is filled with a 3-molar sodium chloride solution, and flow is regulated via a small pump system. The water chamber cycles through three different flow speeds (14 mL/s, 18 mL/s, and 20 mL/s), exposing the sensor to each flow rate for three 1 minute on/1 minute off cycles. Since the sensor is fabricated in such a fashion where only one side of it was "sensing" (or coated in nanomaterial), its orientation became a variable of testing, as well as the electrode connections.

It is found that the carbon nanohorns perform better than the carbon nanotubes under the three flow speeds, exhibiting a stronger response with each speed. It is also observed that the carbonaceous flow sensors exhibited directionality where the voltage switched signs depending on orientation in flow. The next steps for this research will be to confirm these correlations and continue testing with a greater variety of carbon nanomaterials to determine the most significant correlations and better understand the origin of the voltage signal.

Funder Acknowledgement(s): This study was supported by a grant from NSF (EFRI-REM) under Grant #0938043 awarded to Michael Philen, Associate Professor, Aerospace and Ocean Engineering Virginia Polytechnic Institute and State University.

Faculty Advisor: Michael Philen, mphilen@vt.edu

261
Subcategory: Nanoscience

Polypropylene-Cellulose Nanocrystal Composites

Michael Carlock, New Mexico State University

Cellulose Nano composites (CNCs) are novel materials that use reinforcements added to polymers to enhance performance, making them suitable for new applications which are predicted to play important roles in sustainable markets. Our goal is to use cellulose nanocrystals to enhance the performance of polypropylene composites. The Forest Products Lab is studying both chemical and mechanical methods to produce nanofibers. To accomplish this we will begin to evaluate the effect of cellulose nanocrystals on mechanical and thermal properties of polypropylene. Polypropylene and cellulose nanocrystals will be blended by various techniques, included solvent-and melt-blending, along with a coupling agent, and the blends will be injection molded into dog-bone samples and spun into fibers. The fibers will also be drawn, and the effects of polymer and CNC alignment will be evaluated. Extruded fibers containing CNCs showed modest strength increases and post-drawn filaments were dramatically stronger due to polymer alignment.

Funder Acknowledgement(s): United States Department of Agriculture: Forest Products Lab

Faculty Advisor: Delia Valles, dvalles@ad.nmsu.edu

262
Subcategory: Nanoscience

Enhancing Thermoelectric Efficiency with Gated Silicon Nanowires

Emilio A. Codecido, University of California Santa Barbara
Co-Author(s): Benjamin M. Curtin and John E. Bowers, UC Santa Barbara

Thermoelectric efficiency is proportional to the power factor (defined as the Seebeck coefficient squared times the electrical conductivity) divided by the thermal conductivity of the material. In most materials, the thermoelectric parameters are coupled in such a way that it is difficult to increase the efficiency. However, in recent research silicon nanowires have proven capable of decoupling thermal conductivity from the power factor; they exhibit a reduced thermal conductivity while maintaining a relatively high power factor compared to bulk silicon. This causes silicon nanowires to have an increased thermoelectric efficiency by a factor of roughly 100. Our goal is to further increase this efficiency by enhancing the power factor of silicon nanowires. We fabricated an electrical gate around the nanowires, which allowed us to induce and control the carrier concentration in the nanowires. Then, we measured power factor as a function of gate voltage to find the maximum power factor. Because we also expected our method to work differently in nanowires of different cross sectional areas, we evaluated our technique in nanowires of: 35nm x 41 nm, 35 nm x 35 nm and 35 nm x 27 nm cross sectional areas. We obtained a maximum power factor in the larger cross sectional area nanowires, yielding a power factor of 2 – 2.25 mW/m-K^2. Using our technique, we achieved a comparable power factor to bulk silicon, which had not been accomplished before. This enhancement in efficiency can help make thermoelectrics more commercially viable.

Funder Acknowledgement(s): This research was supported by the Center for Energy Efficient Materials, an energy frontier research center funded by the U.S. Department of Energy, and UCLEADS, an undergraduate research program.

Faculty Advisor: John Bowers, bowers@ece.ucsb.edu

263
Subcategory: Nanoscience

Optimization of CIGS Solar Cells through AFORS-HET Simulation Program

Lafayette TaShon DeRamus, III, University of Arkansas at Little Rock
Co-Author(s): Jingbiao Cui, University of Arkansas at Little Rock

Thin film silicon-based solar cells are limited in efficiency because of the material's low absorption coefficient. Copper-Indium-Gallium-Selenium (CIGS) solar cells may provide greater efficiencies due to the materials' high absorption coefficient. We used the heterojunction solar cell model program, AFORS-HET, to predict the effect on solar cell performance by varying layer thickness and band gap. Our simulations demonstrate the effects on open-circuit voltage (Voc), short-circuit current (Jsc), efficiency (Eff), and fill factor (FF). We found that a peak in Eff and FF occurred with increasing CIGS layer thickness. Increasing band gap gave an overall increase in FF and Eff; however, a regular "fall" in FF and Eff occurred during the increase. The reason for the regular "falls" in efficiencies when increasing bandgap is not yet apparent. Our future work will consist of investigating the source of the "fall" and CIGS core-shell nanowire heterostructures by simulation. CIGS solar cells present a promising avenue of research for developing more efficient solar cells.

Funder Acknowledgement(s): This study was supported by the Arkansas ASSET II Initiative from the Arkansas Science and Technology Authority and NSF EPSCoR program.

Faculty Advisor: Janet Lanza, jxlanza@ualr.edu

264
Subcategory: Nanoscience

Polypyrrole Coated Carbon Nanofiber Electrodes for Use in Ca2+ Detection

Christian Ezeagwu, Norfolk State University
Co-Author(s): Adaikkappan Periyakaruppan and Jessica Koehne, NASA Ames Research Center, Moffett Field, CA

In the area of electrical biosensors, progress is being made to optimize performance for various applications such as diagnostics of infectious diseases and environmental monitoring. One such advancement is in the area of conducting polymers. Incorporation of conductive polymers with traditional electrode materials appears to be highly promising due to their chemical versatility, stability, processability, and low cost. Polypyrrole (PPY) is a suitable conducting polymer due to its ability to serve as a potential vehicle for drug delivery and its polymer matrix may serve as a container for proteins and dopants. PPY is conveniently prepared via electrodeposition from aqueous or organic solutions. After the electrodeposition, the polymer is then doped with the electrolyte anion for the purpose of modifying its electrical properties.

This addition of dopants adds charge-carrying elements to the semiconductor, allowing for the acceptance of calcium ion. The electrochemical properties of bare unmodified CNF chips are characterized through cyclic voltammetry (CV) and impedance spectroscopy (EIS). Through cross-reference of the bare/PPY/doped/Ca+2 electrochemistry results, we can confirm the electrodeposition of the PPY and acceptance of the calcium ion successfully occurred on the CNF/PPY electrode surface. If successful, NASA intends to apply the innovation towards lab-on-a-chip for point of care diagnostics for astronaut health monitoring and applications in environmental controls and life support systems.

Funder Acknowledgement(s): NASA Science and Technology Institute

Faculty Advisor: Govindarajan T. Ramesh, gtramesh@nsu.edu

265
Subcategory: Nanoscience

Hydrofluorinated Graphene and Boron-Nitride Ribbons

Malachi Norman, Morehouse College
Co-Author(s): Darkeyah Reuven, Kelvin Suggs, Alexander Wilson, Eddie Kane, Aaron Rowe, and Christopher Woodward, Morehouse College

Hydrofluorinated graphene and boron-nitride ribbons are systematically investigated experimentally and using first-principles density functional theory (DFT) calculations. The electronic and magnetic properties of these modified nano-materials can be tuned by the novel covalent fluorination and non-covalent hydrofluorination. The electronic transport properties of hydrofluorine doped graphene sheets demonstrate the realization of P-type electronic behavior. In the case of hydro fluoridated absorbed on B sites of boron-nitride nanotubes and sheets moderate P-type behavior was observed. The electronic modification of these materials was only found at moderate doping levels, in which an electronic spin splitting was found. Low HF-doping markedly narrowed the band gap of BN tubes and sheets, while no band gap was observed in graphene sheets. Our results indicate that hydrofluorination of graphene and boron nitride is an effective method to modify the electronic properties of graphene and boron-nitride sheets. Our future research will involve the testing of hydrofluorine/ metal clusters on graphene and boron-nitride sheets.

Funder Acknowledgement(s): This study was supported, in part, by a grant from National Science Foundation/PREM/ Grant No. DMR-0820382.

Faculty Advisor: Darkeyah Reuven, darkeyah.reuven@gmail.com

Physics

266
Subcategory: Astronomy and Astrophysics

Study of Mass Distribution of Matter in Simulated Gravitational Lenses

Ivy Alexander, Tougaloo College

With the creation of the Large Synoptic Survey Telescope (LSST), it has opened a number of new research opportunities on deep space allowing further study and clarification of our universe. One particular phenomenon that requires more study is gravitational lensing. These lenses could potentially be the mechanisms needed in order to further understand dark matter that exists in galaxies. Using LSST images as a blueprint, we create our own images of gravitional lensing as seen in deep space as the telescope would. With knowing input data (mass and distortion algorithms), we reverse and engineer out images in hopes to retrieve the original data. If this process works, it can be applied on real LSST gravitational lensing images.

These gravitational lenses are constructed first from random sampling of "postage stamp" galaxies that have been cut from Hubble Deep Field (hdf) images ranging in various sizes and shapes. With a catalog of over a hundred galaxies, they are randomized and spread across a blank image of 40,000 X 40,000 pixels, that is based on the desired mass (2.5e13, 5.0e13, 10.0e13, 20.0e13 solar masses) and concentration index (2, 4, 6, 8) in the image. Intermediate steps include convolving images and adding background noise in order to further simulate a realistic model image as seen by a telescope. Lenses of various strengths are applied at the center, with the controls being those without lensing.

These images are processed through a source extractor into catalogs that are then processed through fiat mapping, based on the galaxies' apparent flux, to look at the mass distributions indicated. The results are used to help configure the parameters in creating these images to achieve what should be a uniform mass distribution originating from the center before we further increase the complexity and realism of our image generation. The higher the concentration, in general, the better the mass distribution can be seen. Current issues lie in the correcting of the convolution algorithm as the standard distribution of low concentration and less massive images cannot be obtained as of yet, thus not providing usable data. Until this can be achieved, the project is halted on 0th Order simulations, with 1th and 2th order simulations introducing phosim and varying red shift images respectively.

Funder Acknowledgement(s): I would like to thank Brown University Physics Department as well as NASA for funding of this project.

Faculty Advisor: Santanu Banerjee, sbanerjee@tougaloo.edu

267
Subcategory: Astronomy and Astrophysics

Redshift Survey of a Sample of Galaxy Clusters

Emily Q. Finney, Scripps College
Co-Author(s): Mischa Schirmer, Gemini Observatory, La Serena, Chile

Galaxy clusters, among the most massive objects in the universe, provide an excellent context for exploring the evolution of large-scale structure. Historically, galaxy clusters have most been identified by luminosity; however, this introduces bias against galaxies with a high mass-to-light ratio. Mass selection allows galaxy clusters to be studied using the parameter of most interest to physical cosmologists. To this end, I have analyzed data from a sample of mass-selected potential galaxy clusters which were followed up spectroscopically using the ESO Multi-Mode Imager on the New Technology Telescope at La Silla Observatory, Chile. Twelve masks, encompassing nine possible clusters and over 400 spectra, were analyzed, and six of these objects were confirmed as galaxy clusters. These findings highlight the value of using weak gravitational lensing to find galaxy clusters and reveal objects of value to physical cosmology.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Mischa Schirmer, mschirme@gemini.edu

268
Subcategory: Astronomy and Astrophysics

Search for Near Earth Objects

Odelmo Joseph, University of the Virgin Islands
Co-Author(s): David Morris, University of the Virgin Islands

History demonstrates that extra-terrestrial objects have collided with earth before causing great disaster. Relatively recent examples include the Tunguska event of 1908 and the Chelyabinsk event of 2013. The Tunguska explosion knocked

down an estimated 80 million trees over an area covering 2,150 square kilometers (830 sq. mi). In an attempt to better anticipate or prevent these collisions, the search for Near-Earth Objects (NEOs) began. According to the George E. Brown NEO Survey Act, NASA is to detect 90 percent of NEOs with diameter of 140 meters or greater by 2020. NEOs are any objects outside the Earth's atmosphere that orbit within our solar system. NEOs generally consist of comets and asteroids. Comets are composed of frozen gases, rock, and dust and are roughly the size of a small town. When a comet's orbit brings it close to the sun, it heats up, emitting dust and gases into a giant glowing nucleus. Along with comets, asteroids are the next potential hazard that pose a threat to colliding with earth. Individual asteroids are classified by their characteristic spectra, with the majority falling into three main groups: C-type, S-type, and M-type.

These were named after and are generally identified with carbon-rich, stony, and metallic compositions, respectively. A NEO's brightness and variability reveals information concerning the location speed, and whether or not the NEO is rotating as it orbits. The Virgin Islands Robotic Telescope (VIRT) at the Etelman Observatory is planning to help detect and track NEOs. As a first step in the VIRT's NEO tracking program, the sensitivity of the telescope in tracking unknown objects must be determined.

In this work we test whether the VIRT is capable of detecting a known NEO of magnitude M~12. We will observe a known asteroid to determine the VIRT's sensitivity to NEOs. We use the 'blinking technique' to verify that objects detected are N, and it was concluded that the VIRT is capable of finding and tracking NEOs of at least M<12 in reasonable exposure times (t <~30s). Future work now includes using this same technique to search for previously unknown NEOs. New NEOs will be tracked to determine relative velocity, true space velocity, and mass.

Funder Acknowledgement(s): NASA EPSCoR grant NNX13A28A, HBCU-UP, and Emerging Caribbean Scientist.

Faculty Advisor: David Morris, dmorris@live.uvi.edu

269
Subcategory: Astronomy and Astrophysics

Electron-Ion Equilibrium and Shock Precursors in the Cygnus Loop SNR

Amber Medina, New Mexico State University
Co-Author(s): John Raymond, Richard Edgar, and Nelson Caldwell, Harvard Smithsonian Center for Astrophysics
Robert Fesen, Dartmouth College

We present an observational study using high-resolution echelle spectroscopy of collisionless shocks in the Cygnus Loop supernova remnant. Measured H alpha line profiles constrain pre-shock heating processes resulting in narrow component broadening, cosmic-ray acceleration, and electron-proton equilibration. The shocks produce faint H alpha emission line profiles, which are characterized by narrow and broad components. The narrow component is representative of the pre-shock conditions, while the broad component is produced after charge transfer between neutrals entering the shock and protons in the post-shock gas, thus reflecting the properties of the post-shock gas. We observe a diffuse H alpha region extending about 2.5 arcmin ahead of the shock with line width about 29 km/s, while the H alpha profile of the shock itself consists of a broader than expected narrow (36 km\s) and a broad (250 km/s) component. The observed diffuse emission arises in a photoionization precursor heated to about 18,000 K by He I and He II emission from the shock, with additional narrow component broadening originating from a thin cosmic-ray precursor. Broad to narrow component intensity ratios of about 1.0 imply full electron-proton temperature equilibration (equal ion and electron temperatures) in the post-shock region. Broad component line widths indicate shock velocities of about 400 km/s. Combining the shock velocities with proper motions suggests the distance to the Cygnus Loop is about 890 pc, significantly greater than the generally accepted upper limit of 637 pc.

Funder Acknowledgement(s): This work is supported in part by the NSF REU and DOD ASSURE programs under NSF grant no. 1262851 and by the Smithsonian Institution. This work was partially supported by the grant HST-60-12885 to the Smithsonian Institution.

Faculty Advisor: John Raymond, jraymond@cfa.harvard.edu

270
Subcategory: Astronomy and Astrophysics

The Search of Extra-Solar Planets Using the Etelman VI Robotic Telescope

Bonnie President, University of the Virgin Islands

An extra-solar planet, or exo-planet, is a planet that orbits a star other than our Sun. The first extra-solar planets discovered were quite unlike those found in our own solar system, but recent studies are beginning to discover planets more similar to those nearby. Of particular interest is the search for Earth-like planets in the so-called 'habitable' zone, the orbital region around a star where liquid water may exist on the planet's surface. The first extra-solar planet was discovered by Polish astronomer Aleksander Wolszczan in 1990 using the Arecibo radio telescope and to date there are 911 confirmed extra-solar planets with many thousands more planet candidates. Research conducted was to test the hypothesis that the Etelman Virgin Island Robotic Telescope (VIRT) can detect and observe extra-solar planets. The 'transit' or 'eclipse' technique is favoured in the search for this class of exo-planets since it is least biased against their detection. The depth and shape of dips in the stellar light curve provide evidence for the presence of and, in some cases details of, the characteristics of a planet in orbit around the star. We present results of our VIRT observing campaign on the known exo-planet system GJ1214b. Our results are presented as a test of the VIRT's ability to detect exo-planets using this technique.

Funder Acknowledgement(s): UVI – ECS / NASA Grant #NNX13AD28A

Faculty Advisor: David Morris, dmorris@live.uvi.edu

271
Subcategory: Astronomy and Astrophysics

Measuring the Central Mass and Pitch Angle of Type 2 Active Galaxies

Sydney Reynolds, University of Arkansas at Pine Bluff
Co-Author(s): R. Scott Barrows, A. Schilling, J. Kennefick, and B. Davis, University of Arkansas-Fayetteville

An Active Galactic Nucleus (AGN) is the nucleus of a galaxy with higher luminosity. The nucleus is usually the brightest object in the whole galaxy. One of the more obvious differences between a Type I and Type II AGN Is that Type I AGN have broad emission lines and Type II AGN have narrow emission lines. Broad emission lines are believed to help the observer assume that there is activity there, instead of there just being chemicals. Many of these galaxies have a supermassive black hole at their centers which are physical objects that power the AGN. There has been evidence that the evolution of a black hole and a galaxy are linked, but it is not clear which one comes first. This project allows us to investigate the relationship between the pitch angle of a galaxy and the mass of the central super massive black hole in the galaxy at higher redshifts as well as local galaxies. This research project is important because it will tell us about the connection between the structure of a galaxy and the mass of a black hole.

Funder Acknowledgement(s): National Science Foundation; National Aeronautics and Space Association; Arkansas Center for Space and Planetary Sciences

Faculty Advisor: Anissa Buckner, bucknera@uapb.edu

272
Subcategory: Chemistry (NOT Biochemistry)

Effect of Firing Time on YSZ Microstructure for NOx Sensing

Dyamond Williams, Southern University at Shreveport
Co-Author(s): Erica P. Murray, Louisiana Tech University

A method was proposed to determine the effect of firing time on Yttria- Stabilized Zirconia (YSZ) microstructure for NOx sensing. A scanning electron microscope (SEM) was used to take images so that calculations of the porous YSZ microstructure could be made. The SEM images were taken on 5mm X 10mm cut rectangular shape sensor with a porous YSZ structure. Sensor samples were fired over a temperature range of 950°C - 1050°C, for 1, 2, 4, 6 and 12 hours. A box furnace was used to fire the samples and SEM images were collected at room temperature. The data collected was at 3.0kv 4.6mm x 45.0kv on a 1.00µm scale and 3.0kv 4.6mm x 60.0kv, on a 500nm scale. The resolution of the 1.00µm generated more accurate porosity estimates. The YSZ tape was about 50 - 53% porous when fired at temperatures ranged from 950°C - 1050°C. The firing time seemed to have negligible impact on the porosity for the tape. Analysis of Variance (ANOVA) indicated no interaction between temperature and time data, and the P-Values for temperature and time were 0.025907 and 2.27-5, respectively. The ANOVA identified a slight distinction between the time and temperature data suggesting both affected porosity since their p-values were less than, (<) the alpha (α) level of 0.05. Overall, it appeared that the firing temperature had a greater impact on porosity, in comparison to firing time.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under the EPSCoR Cooperative Agreement No. EPS-1003897, with additional support from the Louisiana Board of Regents.

Faculty Advisor: Barry Hester, bhester@susla.edu

273
Subcategory: Civil/Mechanical/Manufacturing Engineering

Electric Propulsion Research Test Stand

Abraham Garcia Lino, California State University, San Bernardino

Hybrid aircraft are the future of air transportation but their design, characterization, and development require several maturation stages in order to produce a feasible replacement for current fossil fuel based aircraft. The Taurus electro-motor system is a new aircraft propulsion system selected for use at NASA Dryden Flight Research Center for this type of research. The system will need to be integrated and tested to understand its functionality and performance. We address several objectives in this effort which include structural mounting design using Auto-CAD, sensor integration using LabVIEW, and post test analysis using MATLAB. Additional tasks include familiarizing ourselves with the appropriate manuals or software required for operating the motor. After the system integration is completed, true RMS readings will be obtained as baseline data. The measurements will help refine the LabVIEW program that will be used to acquire sensor data such as voltage and current measurements of the Taurus electro-motor. Finally, an analysis

of the collected data will be performed using MATLAB in order to characterize the system performance.

Funder Acknowledgement(s): NASA CIPAIR

Faculty Advisor: Yohan Lin, yohan.lin-1@nasa.gov

274
Subcategory: Materials Science

Nanocomposite Piezoelectric Paint for Strain Sensing and Energy Harvesting

Dontrel Reynolds, Alabama Agricultural and Mechanical University
Co-Author(s): Mychal Thomas, Motasim Alomari, and Ashok K. Batra, Alabama A&M University

Structural Health Monitoring (SHM) is important for reducing maintenance cost while increasing safety and reliability of aircrafts, bridges and other structures [1]. Piezoelectric wafer active sensors (PWAS) used in SHM applications that require attachment to material surface. There are critical applications where the rigid and brittle piezoelectric wafers cannot conform to curved surfaces. Thus, the existing ceramic PWAS may not provide the long-term durability desired for SHM as the bonded interface between the PWAS and the structure. However, flexible composite piezoelectric paint-film sensors (or arrayed sensors) can provide a suitable solution with conformability to curved surfaces. Furthermore, among transducers in vibration energy harvesting [2], the piezoelectric transducer has received the most attention due to its simplicity in structure, which makes it a suitable candidate to integrate in a self-powered SHM system. We have fabricated nano-composite paint-films of PZT/Epoxy paint on copper and PET substrates with various concentration of PZT nano-particles using a sponge-brush. The performance parameters for energy-harvesters and strain sensors including infrared sensors will be reported. The pyroelectric performances of obtained films are lower than reported for screen printed PZT films.

1. Nezih Mrad, State of Development of Advanced Sensor Systems for Structural Health Monitoring Applications, NATO-RTO-MP-AVT-144, 29-1 to 29-20 .
2. Shashank Priya and Daniel J. Inman, Eds., Energy Harvesting Technologies, Springer, NY, NY (2009).

Funder Acknowledgement(s): AAMU-NSF HBCU-UP grant from the National Science Foundation
#HRD0928904; DHS grant 2010-ST-062-000034.

Faculty Advisor: Mostafa Dokhanian, mostafa.dokhanian@aamu.edu

275
Subcategory: Materials Science

Open Access Crystallography Database Administration

Justin Shuck, Portland State University
Co-Author(s): Ryan Lerud and Galen Gledhill, Portland State University

Since 2004, Portland State's Nano-Crystallography Group has provided crystallographic resources including five interactive open-access databases (educational subset of the Crystallographic Open Database (COD), Crystal Morphology Database, Nano-Crystallography Database and Wiki Crystallography Database) as well as a mirror to the whole COD, which is the world's largest open-access crystallography database (with currently over 235 thousand data entries of inorganic, organic, and metal-organic compounds as well as minerals). Before information can be stored inside of databases, they must be put in Crystallographic Information Framework files (CIFs), the framework established by the International Union of Crystallography, and the worldwide standard for representing crystallographic information. Recent findings and crystallographic publications will provide a CIF file with the work, however the older publications need their data to be manually entered as a CIF before they can be accessed by the public. Thus, this particular project focuses on generating and uploading an additional four hundred known structures that can be openly accessed through the website hosted by the Nano-Crystallography Group at Portland State University. Further work will focus on adding additional capabilities to the site and to continue to provide valuable recourses to the crystallographic community.

Funder Acknowledgement(s): This work was supported in part by the Ronald E. McNair Scholars program and Educational Alliance via the Portland State Undergraduate Research and Mentoring Program.

Faculty Advisor: Peter Moeck, pmoeck@pdx.edu

276
Subcategory: Nanoscience

Photopatterning of Azo Dye Labeled Phospholipid for Biosensing Applications

Belther Monono, Alabama A&M University
Co-Author(s): Sathyanarayan Rao and Praveen Ranganath, Alabama A&M University

Biosensing industries are experiencing a continuous growth in the global market due to its wide range of application in healthcare and food sciences. Immobilization of biomolecules to fabricate a biosensor is critical and challenging. In this work, we

have demonstrated a novel method to immobilize an azo dye labeled phospholipid biomolecule using visible laser light. We are using a toxic free polybutadiene substrate for immobilizing phospholipid biomolecules. A 2-mW laser light (λ=488) is used to excite the azo-dye, which initiates a photochemical reaction resulting in attachment of phospholipid molecules to the substrate. By using lithographic masks, we have showed that the resulting pattern is an exact replica of light intensity distribution. This method can also be extended to other biomolecules such as proteins. Since our research uses a visible light and a nontoxic substrate, it could be of great relevance to the field of Biosensing.

Funder Acknowledgement(s): This study is supported by Alabama EpScor Project and by the AAMU-NSF HBCU-UP grant #HRD0928904.

Faculty Advisor: Anup Sharma, anup.sharma@aamu.edu

277
Subcategory: Nanoscience

Light Propagation Through a Sub-Wavelength-Hole-Array Metal Film

Oluwasemire Olaniyi, North Carolina Central University
Co-Author(s): Yongan Tang and Branislav Vlahovic, Department of Mathematics and Physics, North Carolina Central University

High optical transmission of light is necessary for improvement in the field of optics. We study the effect of light that propagates through a sub-wavelength-hole in a thin gold film. This study is carried out with wavelengths of visible and near infrared light using Finite Difference Time Domain (FDTD) method. Light propagation through a sub-wavelength hole in a thin gold film is simulated. Our simulations show that the dimensions of the gold film and its air cavity significantly affect the optical transmission of the light. High optical transmission in the spectrum of certain wavelengths is observed.

These research results have possible applications in developing multispectral filters and biosensors. In future research, development of Graphical User Interface for MIT Electromagnetic Equation Propagation (MEEP) will be of importance which will tend to resolve drudgery associated to manual coding of FDTD simulations

Funder Acknowledgement(s): This work was supported in part by NSF: HRD-0833184, NASA: NNX09AV07A and ARO: W911NF-13-1-0165.

Faculty Advisor: Yongan Tang, tangy@nccu.edu

278
Subcategory: Physics (NOT Nanoscience)

Investigation of Stability and Efficiency of P3HT/PC60BM Based Solar Cells

Alayna Fields, Alabama A&M University

Polymer and organic solar cells degrade during illumination and in the dark. This is in contrast to photovoltaics based on inorganic semiconductors such as silicon (1). Long operational lifetimes of solar cell devices are required in real-life application and the understanding and alleviation of the degradation phenomena are prerequisites for successful application of this new and promising technology. In the current article, solar cell is fabricated with one combination of organic materials of pentacene doped PEDOT:PSS film as a hole transporting layer, along with an active layer of P3HT/PC60BM. Since brush coating is considered to be the cheapest solution for a processing method for film fabrication, sizeable efforts were made to accomplish a complete brush coated pentacene doped ITO/ PEDOT:PSS/P3HT:PCBM/Al, and compare its optical, electrical and photovoltaic characteristics.

It was observed that the pentacene-doped P3HT/PC60BM solar cell gives better efficiency than the undoped solar cell. The results of degra-dation studies undertaken under UV-light on the pristine ITO/PEDOT:PSS/P3HT:PCBM/Al solar cell will also be presented.

Funder Acknowledgement(s): This work has been supported, in part, by the AAMU-NSF HBCU-UP grant from the National Science Foundation # HRD0928904 and DHS grant 2010-ST-062-000034.

Faculty Advisor: Ashok Batra, ashobatra@gmail.com

279
Subcategory: Physics (NOT Nanoscience)

Miniature Fourier Transform Spectrometer

Jamar Holmes, Virginia State University
Co-Author(s): Evan Dirksen, Eshan Sheybani, and Singli Garcia-Otero, Virginia State University
Shahid Aslam, NASA Goddard Space Flight Center, MD

Fourier Transform Spectrometer (FTS) is a common tool used by scientists to determine information about an object or substances through the analysis of its light properties. The beam is shone on a planet, perpendicular to its surface, and the different molecular layers are categorized based on their position on the spectrum. Specifically, the spectrometer is being used to measure the pressures, gases and other atmospheric compositions of various planets. The physical properties of instruments that are aboard space crafts are extremely important. The machine cannot weigh too much because that will compromise the energy required to propel the craft. The resulting goal of future planning is to make the instruments smaller, more affordable and more efficient. The miniaturization of the Fourier Transform Spectrometer is an imperative step to gravitate closer and closer to being able to technologically advance it, and to take its usage even farther. This paper presents the results of maximizing the light output for the bends in the chips measured using Miniature Fourier Transform Spectrometer.

Funder Acknowledgement(s): NASA Goddard Space Flight Center

Faculty Advisor: Singli Garcia-Otero, sgarcia-otero@vsu.edu

280
Subcategory: Physics (NOT Nanoscience)

The Analysis of Silver Nanoparticles Using Laser-Induced Breakdown Spectroscopy

Kemet Preer, Alabama State University
Co-Author(s): Cleon Barnett and Komal Vig, Alabama State University

Laser-Induced Breakdown Spectroscopy (LIBS) is a versatile technique with a wide range of potential applications. Some hindrances of the technique are poor reproducibility and rather low figures of merit as compared to other methods such as inductively couple plasma mass spectroscopy (ICP-MS). The emission from the plasma is influenced by the interaction of the laser and the target. In addition, there may possibly be substantial laser-plasma coupling since nanosecond pulses are used to create the plasma. The amount of laser light absorbed by the target and the plasma are influenced by its wavelength. In an attempt to determine if LIBS could be used for quantitative analysis of nanoparticles, a comparison of the analytical performance using a Nd:YAG L were deposited in small amount onto pure aluminum substrates and analyzed using LIBS. We compare the signal to noise ratios as well as the linearity of the calibration curves produced from silver atomic emission lines. We also monitor the temporal evolution of the plasma characteristics, such as excitation temperature and plasma density, for both the 266 nm and 532 nm laser produced plasmas.

The results show that the silver nanoparticles are indeed detectable within the solution. Ag I at 328.07 nm and 338.29 nm are used to create calibration curves. For 328.07 nm, the curve indicates that R^2=0.8231.μg/μlaser operating at 266 nm and 532 nm is presented. For this study suspension of silver nanoparticles ranging in concentration from .01 to .20 for 338.29 nm our curve indicates that R^2=0.8324. In addition, we present preliminary results of the analysis of silver nanoparticles within cells. Our next objective is to explore methods of improving reducibility by means of normalization with aluminum lines and changes to the gate delay and gate width of the detector in order to make our results more reproducible. We will continue our efforts to analyze these wavelengths as well as other emission lines for Ag in future studies.

Funder Acknowledgement(s): This study was supported, in part, by the Alabama State University HBCU-UP program, the Alabama State University Department of Biological Science for providing the Nano particles, and NNSA/DOE.

Faculty Advisor: Cleon Barnett, cmbarnett@alasu.edu

281
Subcategory: Physics (NOT Nanoscience)

4D Tracking the Motility of Biological Cells by Digital Holographic Microscopy

André Spears, Southern University and A&M College
Co-Author(s): Xiao Yu and Myung Kim University of South Florida

Digital Holography is a rising technology in general imaging techniques. It's replacing the photochemical procedures of conventional holography with electronic imaging. With digital holography, a holographic interference pattern is optically generated by a superposition of object and reference beams. This is digitally sampled by a charge coupled device (CCD) camera and is transferred to the computer as an array of complex numbers. The diffraction theory allows for numerical reconstruction of the image as an array of complex numbers that represent the amplitude and phase of the optical field. Motility is a major characteristic of living cells, and includes the form of movement of cells and movement within cells. Understanding the origin of cellular or intracellular motility may provide information about the functional status of cells under normal conditions. Cells such as chilomonas, euglena etc. sense and respond to their surroundings by swimming towards or away from stimuli. Cells such as fibroblasts, amoeba, etc. move by means of crawling over substrates instead of swimming through the environment. In this study we track the motility of euglena cells, a type of fast moving cell, that are independent of substrate. Tracking these cells in 4D provides specific information of a cell's motility: number, size, orientation, speed, and direction. Digital Holographic Microscopy (DHM) has the capacity of recording 3D information on a single hologram. We will record a hologram movie of cell movement and reconstruct the hologram in different planes to apply numerical focusing. Once numerical focusing is applied, we are able to see 3D trajectories of microbes as a function of time at sub-second and micrometer level.

Conclusions drawn from the study is that DHM has been utilized to track the mobility of swimming cells in four dimensions. The combination of in focus propagation distance and axial position allows quantitative three-dimensional object profiling or tracking. The three-dimensional trajectories of cells are measured as a function of time at sub-second and micro level. Three-dimensional profiling and tracking by DHM provide quantitative analysis on the characteristics and dynamic process of cells. In the future, we would like to improve the quality of holograms, add more frames to find more information about cells migration, and gain quantitative measures on the characteristics of cells: velocity, displacement, shape change, etc.

Funder Acknowledgement(s): I would like to thank NSF for funding the Applied Physics REU at the University of South Florida. Also, I would like to thank Myung Kim for allowing me to work in his lab.

Faculty Advisor: LaShonda Franklin, lfranklin2002@aol.com

282

Subcategory: Physics (NOT Nanoscience)

Four-wave Mixing in Photonic Crystal Fiber

Jori Strack, Winston-Salem State University
Co-Author(s): Jafar Gharavi-Naeini, Winston-Salem State University

Due to their high nonlinearity and highly tunable dispersion properties, photonic crystal fibers (PCF) have proven to be unique media for nonlinear interactions at low powers. Using funds provided by NSF-HRD-HBCU-UP-TIP grant, we have acquired a femtosecond (fs) fiber laser from Menlo Systems Inc. The C-fiber-780 fs-laser provides 100 fs pulses at 100 MHz repetition rate, with an output average power near 65 mW at the center wavelength of 780 nm. The laser is used to pump a PCF fiber with the zero dispersion point around the wavelength of the laser (800 nm). One meter of a highly non-linear (NL-2.4-800) with a core diameter of 2.4 µm was purchased from Thorlabs. Pumping with our fs-laser at 780nm, the output of the PCF has provided two new wavelengths (815nm and 755nm) via the degenerate four-wave mixing process. Our preliminary experimental result indicates that the optimum output powers and profiles of the three beams can be obtained using 11cm-long PCF. This experiment served as an excellent example for the integration of research and education in that while the set up serves as an advanced experiment in the Modern Physics Laboratory, it will also serve as the multi-wavelength pump for Coherent Anti-Stokes Raman Spectroscopy (CARS) experiment that we plan to develop during next year of the NSF grant.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant Number 1238795.

Faculty Advisor: Jafar Gharavi-Naeini, naeinijg@wssu.edu

283

Subcategory: Physics (NOT Nanoscience)

Raman Measurements of Nitrates and Other Chemicals

Teika R. Thompson, Stillman College /Alabama A&M University
Co-Author(s): Belther Monono and Aschalew Kassu, Alabama A&M University

The detection and identification of various chemicals and compounds is of large interest to the Army, pharmaceutical industries, law enforcement agencies and airport security. Raman Spectroscopy is a detection method that can identify chemicals within a matter of seconds by using its characteristic Raman spectrum. Previous studies have shown that by using a proper excitation laser, detector, and dedicated Raman analyzer, it is possible to detect and identify chemicals and hazardous materials. Raman spectrum is considered as the optical fingerprint of chemical substances as it represents the vibrational frequencies of functional chemical bonds in molecules.

In this work, Raman measurements of concealed and exposed Ammonium Nitrates, Sodium Nitrates, Perchloric Acid and other chemicals were carried out using Enwave Optronics EZRaman system with 785 nm excitation wavelength from a diode laser source. The laser light was coupled to the sample via two single fiber combination fiber-optic probe with a 100 µm excitation fiber and a 200 µm diameter collection fiber with a 0.22 numerical aperture. The CCD detector thermoelectrically cooled to -50^{o}C records the scattered Raman signal in the spectral range of 250 - 2200cm-1 and with a spectral resolution of 6cm-1. The samples were placed at an optimum working distance of 7 mm from the Raman probe. Typically, two different measurements were taken, a dark scan and a laser scan. In the laser scan, the Raman spectrum is collected; while in the dark, the background signal from ambient light and noise is measured. By subtracting the dark scan from the laser scan, one can reduce the background noise significantly.

The results of our Raman measurements show prominent characteristic peak at ~1065 cm-1 and 1041 cm-1 for Sodium Nitrate and of Ammonium Nitrate respectively. In addition, weak peaks are observed at ~1385 cm-1 and 724 cm-1 for Sodium Nitrate sample and at ~714 cm-1 for Ammonium Nitrate sample, which agree well with literature values.

Funder Acknowledgement(s): This work has been supported in part by the NSF HBCU-UP Grant # HRD-0928904. Alabama A&M University Physics Department.

Faculty Advisor: Anup Sharma, anup.sharma@aamu.edu

284

Subcategory: Physics (NOT Nanoscience)

Measuring the Position Resolution of a COMPASS Drift Chamber Prototype B

Rojae Wright, Alabama A&M University
Co-Author(s): Mathias Perdekamp, University of Illinois in Urbana Champaign

Common Muon and Proton Apparatus for Structure and Spectroscopy (COMPASS) is a fixed target experiment at CERN in Geneva, Switzerland which investigates the quark and gluon structure of protons. The experiment will study the transverse spin and momentum dependent quark structure for the proton through pion-induced Drell-Yan scattering off transversely polarized proton targets. The observed Sivers asymmetries are thought to be indicative of quark orbital angular momentum inside the proton, University of Illinois in Urbana Champaign (UIUC) is responsible for building and designing two drift chambers to replace aging straw chamber stations in the COMPASS spectrometer. UIUC has built two drift chamber prototypes. The current prototype B has 16 anode sense wires in each of two separate planes. Cosmic rays are used to measure the position resolution of the drift chamber. This poster describes the details on the experimental method and steps that will lead to the measurement of the position resolution for the COMPASS drift chamber prototype B.

References: 1.) W.R. Leo, Techniques for Nuclear and Particle Physics Experiments, January 1, 1994.
2.) Bogdan Povh, Klaus Rith, Christoph Scholz , Frank Zetsche, Martin Lavelle, Particles and Nuclei , August 5, 2008.

Funder Acknowledgement(s): This research was supported by NSF Grant PHY-1062690 summer REU program at the UIUC and in part by Alabama A&M University.

Faculty Advisor: Mostafa Mark Dokhanian, mostafa@physics.aamu.edu

285

Subcategory: Physics (NOT Nanoscience)

Vibrational and Electronic Structure of Spinel, FTIR and VUV Ellipsometry

Christian Zollner, Cornell University/New Mexico State University
Co-Author(s): Travis I. Willett-Gies, Department of Physics, New Mexico State University
Sukgeun Choi, National Renewable Energy Laboratory, Golden, CO

Magnesium aluminate spinel ($MgAl_2O_4$) belongs to the cubic Oh7 space group and has two formula units per primitive cell. Of its 39 optic modes, factor group analysis[1] shows that there are only four IR-active modes with T1u symmetry. The lattice dynamics of spinel has long been controversial and differences have been found between natural crystals (which are believed to be fully ordered) and synthetic crystals (which often contain a small amount of Mg/Al disorder). Unlike FTIR reflectance studies (which require a Kramers-Kronig analysis to determine the TO/LO phonon peaks), our FTIR ellipsometry measurements of commercial spinel wafers (often used as substrate materials for oxide epitaxy) allow the direct determination of TO and LO phonon energies as peaks in the dielectric function ε and the loss function 1/ε, respectively. Without curve fitting, we identify TO phonon peaks at 305, 479, 570, and 665 cm-1, plus shoulders at 607 and 800 cm-1, which might be second-order overtone peaks[1]. In the loss function, we find three LO peaks at 310, 610, and 862 cm-1 and a shoulder at 570 cm-1. Since the TO peaks are asymmetric, a factorized expression[2] is needed to describe the dielectric function. Our Raman spectra show four strong and one weak intrinsic Raman peak expected from group theory, plus one disorder-activated peak. NIR to VUV ellip-sometry measurements show a broad Lorentzian absorption peak at 8.2 eV, masked by surface roughness (1.4 nm) at lower energies. Temperature-dependent ellipsometry measurements at 2 eV from 80 to 700 K find $d\varepsilon/dT \sim 3\times10^{-5}$/K. Future work will include study of other Spinel materials such as nickel ferrites, and especially thin films grown on spinel substrates.

[1]A. Chopelas and A.M. Hofmeister, Phys. Chem. Minerals 18, 279 (1991).
[2]F. Gervais and B. Piriou, J. Phys. C 7, 2374 (1974).

Funder Acknowledgement(s): This work was supported by the National Science Foundation (DMR-1104934) and performed, in part, at the Center for Integrated Nanotechnologies, an Office of Science User Facility operated for the U.S. Department of Energy Office of Science by Sandia National Laboratory (Contract DE-AC04-94AL85000). We thank S.G. Choi (NREL) for assistance with the Raman measurements and N. Singh (J.A. Woollam Co.) for assistance with VUV ellipsometry.

Faculty Advisor: Stefan Zollner, zollner@nmsu.edu

286

Subcategory: Pollution/Toxic Substances/Waste

Sensing and Characterization of Oil Films by Holographic Interferometry

Angelicia Thomas, Alabama A&M University

Co-Author(s): Tatiana Kukhtareva, Alabama A&M University

Although there are several methods of remote detection of crude oil in water and on the solid surfaces, there is still a requirement for more efficient and reliable methods. Spectroscopic methods allow characterization of oil composition but give little information about spatial distribution of oil. All of the existing detection schemes have several disadvantages, such as poor reliability, high power consumption, high cost, difficulties in maintenance, and complexity. We suggest combining several optical methods of remote sensing and characterization of crude oil films: coherent fringe projection illumination and holographic in-line interferometry.

The suggested method allows determination of the drop size and slicks of petroleum products accurately from a remote distance by illumination of an object using its plane-parallel interference pattern[1]. We have tested two-color method of oil film characterization using green and red lasers. Illumination of the oil-in film by a spot of expanded red laser produces on the screen spot. Oil-film islands were seen as dark spots with interference fringes. When we applied unexpanded CW green beam to the red illuminated spot on or near the oil film spot, we saw fast rearrangement of the oil island shape. The reflected green beam showed fast changing “blooming” interference patterns. When oil-in-water sample was replaced by the organic solution, illumination by the pump green laser did not produce noticeable changes in the probe red beam reflected pattern.

These preliminary results show that two-color, pump-probe technique is a promising method for distinguishing oil from colored organic dispersed materials. Determination of oil thickness films on the sea requires pulse laser application to overcome the effect of wind and wind stress on the water. The measurements can be carried out remotely (ship and aircraft) using a parallel laser beam and semi-transparent plane-parallel plates. Structured light illumination can be used for oil spill containment and as alternative means for decontamination.

[1]Chirita A., Kukhtarev N., Kukhtareva T., S. C. Gallegos, “Remote sensing and characterization of oil on water using coherent fringe projection and holographic in-line interferometry” Optical Engineering ,52(3), 035601, (2013).

Funder Acknowledgement(s): This work has been supported in part by the NSF HBCU-UP Grant #HRD-0928904.

Faculty Advisor: Tatiana Kukhtareva, tanja.kukhtareva@aamu.edu

Science and Mathematics Education

287
Subcategory: Education

Using Common Core State Standards in the Application of NXT LEGO® Robotics

Ricky Dixon, Mississippi Valley State University
Co-Author(s): Darnell Johnson, Malcolm McConner, Linda B. Hayden, and Jessica Hathaway, Elizabeth City State University

In 2010, Common Core Standards included critical content for all students in American education for forty-five states. Previously, every state had its own set of academic standards and students in each state were learning at different levels. In the new global economy, all students must be prepared to compete on a global basis. Students are expected to develop a deeper mastery of content and demonstrate what they know through writing and other projects.

This research was designed to focus on mathematical processes of the Common Core Standard in mathematics lesson plans for seventh grade students. A group of seventh grade students from two middle schools of Elizabeth City Public Schools in north-eastern North Carolina were selected for this research at Elizabeth City State University (ECSU) for the Center of Remote Sensing of Ice Sheets (CReSIS). Pre and posttest data were collected through student assessments and teaching observations to evaluate student growth in content knowledge, understanding and application. The REU Mathematics Teacher Team used mathematics strategies to teach various scientific, mathematical, and design concepts, through designing and by programming NXT LEGO® Robotics for the seventh grade level. The students received hands-on experience for robotics construction and programming with application of mathematics, motion, and problem solving in a collaborative group setting. The RET team divided students into three research groups to assemble and program NXT LEGO® robots to compete on an obstacle course using basic applications of seventh grade mathematics. Along with classroom observation, data was collected from the students’ scores on the pre and posttest. The numerical range was between thirty-three and seventy-three on the pretest, and the posttest had scores of sixty-three to ninety-three. The mean score of the students improved by twenty points per student with a mean improvement percentage of thirty-eight percent per student.

This research resulted in significant improvement in understanding of seventh grade mathematics content. The CReSIS staff will continue to search for highly qualified students to participate in future CReSIS summer programs at ECSU and monitor career interests in STEM related majors and their college choice.

Funder Acknowledgement(s): This research was funded by CReSIS.

Faculty Advisor: Constance Bland, cgbland@mvsu.edu

288
Subcategory: Education

Teaching Children Sustainability Using Video Games

Jordan Earls, Morehouse College
Co-Author(s): Kinnis Gosha, Morehouse College

Sustainability education plays a key role in the conservation of the earth's natural resources. Video games have been found to be an effective way to teach a variety of subjects, especially with children. Currently few games exist that explicitly teach gamers about sustainability, especially for gamers between the ages of 8 -12. This paper highlights "Apples For Everyone", a modification created for the multi-platform game Minecraft that implements sustainability concepts within its own. The goal of the game is to maintain social, environmental, and economic equilibrium in a virtual environment while completing tasks of increasing difficulty. In this virtual environment the player must maintain this balance through the allocation of subsistence, capital, and laborers. Each of these requirements will be represented as apples, coins, and characters respectively. For example, an apple is used to either increase capital or to feed laborers, while laborers are needed to increase subsistence, and the decrease of the player's capital. A study will be conducted to collect data on the modifications of gameplay elements in addition to measuring the learning outcomes produced. A group of elementary and middle school students will be randomly selected as participants in the study upon institutional permission. Upon acceptance into the study, all participants will answer an initial questionnaire in order to gauge their understanding of sustainability in lieu of experimentation. The experiment will consist of participants playing Minecraft before and after modification until all tasks are complete. After or between both sessions a Likert survey will be administered to assess the utility of the game's structure. A final questionnaire will be given in order to reflect the participants understanding of sustainability post experimentation. The data from the questionnaires will be the basis of all conclusions as well as observations documented while students play. It is expected that children who play "Apples For Everyone" will enjoy playing the game while learning about sustainable energy concepts. It is also expected that the data received from the study will give insight into developing interactive approaches to teaching sustainability.

Funder Acknowledgement(s): HBCU-UP; National Science Foundation

Faculty Advisor: Kinnis Gosha, jordanearls.92@gmail.com

289
Subcategory: Education

TeraScan Curriculum Development and Integration of SeaSpace Technology into the Classroom

Kalyx McDonald, Mississippi Valley State University
Co-Author(s): Courtney Farmer, Elizabeth City State University

Founded in 1982, SeaSpace was one of the top remote sensing companies of that time. Their work of receiving images and analyzing them using TeraScan paved the way for further research. TeraScan was a widely compatible system that could send final imagery to numerous satellites for further review. This allowed not only the military, but emergency response and research teams to use TeraScan also. With the use of technology in the classroom, and the use of SeaSpace, it would greatly enhance the teacher to motivate students to learn more about environmental changes within today's society. The group began their research by first dissecting the MOU signed by both Elizabeth City State University (ECSU) and SeaSpace. The required ground station systems, available data products, and target audience were expanded to meet find the needs of the ECSU training site. The target audience was expanded to include K-12 teachers and administrators with the goal of creating a curriculum that would allow student learners to attain a CEU. The American School Counselor Association specified the requirement for the CEU as a ten-hour training course. At this point the development of the course curriculum began. Sources for the curriculum included the SeaSpace TeraScan Training Guide and coursework from the Introduction to Remote Sensing course taught at ECSU. Time for both pre and post assessment tests were included in the curriculum schedule. In order to integrate the curriculum modules into the undergraduate/graduate courses at ECSU, course descriptions were analyzed individually.

The current (2012-2013) ECSU course catalog was obtained from both the Admissions and Graduate Education department. Each course description was scrutinized and debated for possible integration with TeraScan data products and image processing techniques. Selected courses were then categorized by tentative module topics related to the subject matter. Once completed module generation began. The modules selected for initial development were "Introduction to Remote Sensing" and "Introduction to TeraScan". Deliverables for each module included a self-running PowerPoint with voice-overs, an assessment, and a basic study guide for student learners. The remote sensing module included topics such as history, sensors, platforms, electromagnetic spectrum, and imagery resolution. The TeraScan module topics included, TeraScan organization, system specifications, command line functions, key features, and various imagery formats. Once the curriculum was developed, analyses of current courses available at ECSU were completed to determine suitable integration of SeaSpace collected data and image processing techniques. Tentative

suggestions as to which modules would best apply to targeted courses were then made. The curriculum was then used to generate a schedule which would conform to the CEU time requirements as outlined by the American School Counselor Association and ECSU Distance Learning department.

Funder Acknowledgement(s): Principal Investigator Linda B. Hayden; Je'aime Powell, my mentor.

Faculty Advisor: Constance Bland, cgbland@mvsu.edu

Social, Behavioral, and Economic Sciences

290
Subcategory: Physiology and Health

The Effects of Body Mass Index on Cholesterol Levels

Julisha Batieste, Virginia State University

Obesity is a known risk factor for cardiovascular disease. While obesity rates do not significantly differ among African-American men and White men, African-American women have the greatest prevalence of obesity of any ethnic group in the country. The purpose of the present study was to examine the effects of body mass index (BMI) on cholesterol concentration. It was hypothesized that obese participants would have greater cholesterol levels than normal weight and overweight participants. Ninety-three African-American college students between the ages of 18 – 30 participated in the study. BMI was calculated from measures of weight and height. A blood sample was taken from each participant after twelve hours of fasting. The blood was drawn from a nurse practitioner in the University's Student Health Center. The fasting blood sample was enzymatically assayed for total serum cholesterol, low-density lipoproteins, high-density lipoproteins and triglycerides. Participants with total serum cholesterol levels of 200 mg/dl or above, low-density lipoprotein levels of 130 mg/dl or above, high-density lipoprotein levels of 40 mg/dl or above and/or triglyceride levels of 150 mg/dl or above were considered to be at risk for cardiovascular disease. The results revealed that BMI had a significant effect on triglycerides, $t(29) = 2.30$, $p = .029$, and high density lipoprotein, $t(29) = 2.08$, $p = .047$. The results revealed that obese participants had higher triclycerides than normal weight participants. In addition, normal weight participants had higher high density lipoproteins than obese participants. The findings indicate that normal weight participants may be as susceptible to cardiovascular disease as their obese counterparts. Future studies should examine factors that influence cholesterol levels in normal weight participants.

Funder Acknowledgement(s): This research was funded in part by the Virginia State University HBCU-UP program.

Faculty Advisor: Vernessa R. Clark, vrclark@vsu.edu

291
Subcategory: Physiology and Health

The Effects of Perceived Stress on Cholesterol Concentration

Savianna Chance, Virginia State University
Co-Author(s): Montel Williams, Virginia State University

Stress contributes to the etiology of diseases/illnesses by eliciting excessive cardiovascular reactivity (Karmarck, et al., 1997; Matthews, Tucker & Whooley , 2006). Understanding the mechanisms by which stress affects cardiovascular disease is vital. Therefore, the purpose of the present study was to examine the effects of stress on cholesterol concentration. It was hypothesized that participants with high levels of perceived stress would have greater cholesterol levels than those with low levels of perceived stress. Ninety-three African-American college students between the ages of 18 – 30 participated in the study. Perceived stress was measured with the Perceived Stress Scale, a self-reported questionnaire used to measure the amount of stress a person perceived within the last month (Cohen & Williamson, 1988). A blood sample was taken from each participant after twelve hours of fasting. The blood was drawn from a nurse practitioner in the University's Student Health Center. The fasting blood sample was enzymatically assayed for total serum cholesterol, low-density lipoproteins, high-density lipoproteins and triglycerides. Participants with total serum cholesterol levels of 200 mg/dl or above, low-density lipoprotein levels of 130 mg/dl or above, high-density lipoprotein levels of 40 mg/dl or above and/or triglyceride levels of 150 mg/dl or above are considered to be at risk for cardiovascular disease.

The results revealed that perceived stress had a significant effect on high-density lipoproteins, $t(46) = 2.03$, $p = .049$. Specifically, participants with high levels of perceived stress had higher levels of high-density lipoproteins than participants with low levels of perceived stress. This finding indicates that high-density lipoproteins mediate the relationship between stress and cardiovascular disease. Perceived stress did not have a significant effect on the other measures of cholesterol.

Funder Acknowledgement(s): This research was funded in part by the Virginia State University HBCU-UP program.

Faculty Advisor: Vernessa R. Clark, vrclark@vsu.edu

292
Subcategory: Physiology and Health

The Effects of Smoking on Cardiovascular Responses to Stress

Christopher Harrington, Virginia State University

Co-Author(s): Persephone Rogers, Virginia State University

Heart disease is the leading cause of death in the United States. One out of 4 deaths in this country is due to heart disease. The primary preventable cause of heart disease is smoking. According to the Centers for Disease Control and Prevention, 18.9 percent of adults, between the ages of 19- 24, smoke cigarettes and 19.4% of Blacks smoke cigarettes. Understanding the mechanisms by which smoke affects cardiovascular disease is imperative. Therefore, the purpose of the present study is to examine the effects of smoking on cardiovascular responses to stress. It was hypothesized that participants who smoked would have greater cardiovascular reactivity to the stressor than those who did not smoke. Ninety-three African-American college students between the ages of 18-30 participated in the study. A Hypertension Diagnostics cardiovascular profiling instrument was used to non-invasively assess body mass index and cardio-vascular responses (heart rate, cardiac output, stroke volume, mean arterial pressure, systolic and diastolic blood pressure). Cardiovascular activity was measured as the participants viewed a racially noxious scene on videotape. Measurements 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 40 seconds into the period. Smoking was measured with a demographic questionnaire that asked participants if they smoked cigarettes. The results revealed that smoking had a significant effect on cardiac output (the amount of blood pumped by the heart each minute) during the stressor period, $t(91) = 2.28$, $p = .025$. Specifically, the heart of participants who smoked pumped more blood than participants who did not smoke. This finding indicates that smoking causes that heart to work hard especially during times of stress. Future studies should examine the effects of smoking on cardiovascular activity to stress in various ethnic groups.

Funder Acknowledgement(s): Virginia State University HBCU-UP program.

Faculty Advisor: Vernessa R. Clark, vrclark@vsu.edu

293

Subcategory: Physiology and Health

Body Mass Index, Waist Circumference and Cardiovascular Reactivity to Stress

DaVonna Scott, Virginia State University

In 2009 through 2011, 36% of adults in the United States were obese and 49.5% of African-American adults were obese. While obesity is becoming one of the most preventable causes of cardiovascular disease, there is a debate over which measure of obesity is better, waist circumference or Body Mass Index (BMI) or waist-to-hip ratio. To this end, the purpose of this experiment was to investigate the relationships among BMI, waist circumference, waist-to-hip ratio and cardiovascular responses to stress. It was hypothesized that there would be a positive correlation between BMI, waist circumference, waist to hip ratio and heart rate and blood pressure. Ninety-three African-American college students between the ages of 18 – 30 participated in the study. A Hyper-tension Diagnostics cardiovascular profiling instrument was used to non-invasively assess heart rate and systolic and diastolic blood pressure. Cardiovascular responses were measured as the participants viewed a racially noxious scene on videotape. Measurements 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 40 seconds into the period. BMI was calculated from measures of weight and height. Waist circumference was measured at the level of the umbilicus by a standard tape measure. To determine the waist-to-hip ratio, measurements were taken at the hip (around the buttocks) and around the waist just above the belly button.

The results revealed that BMI was significantly correlated with systolic blood pressure during the pre-stressor period, $r = .320$, $p = .001$. Waist circumference was also significantly correlated with systolic blood pressure during the pre-stressor period, $r = .220$, $p = .020$. As expected, participants with higher levels of BMI and waist circumference had higher systolic blood pressures than their counterparts. Unexpectedly, waist-to-hip ratio was not significantly correlated with any of the cardiovascular measures. Future research should examine the contribution of this measure of obesity to the prevention of cardiovascular disease.

Funder Acknowledgement(s): This research was funded in part by the Virginia State University HBCU-UP program.

Faculty Advisor: Vernessa Clark, vrclark@vsu.edu

294

Subcategory: Social Sciences/Psychology/Economics

ADD/ADHD Prescription Stimulant Use and Potential Addiction

Morgan Dorr, Auburn University

In the past 10 years, as the number of ADD and ADHA stimulant medication prescriptions have dramatically increased, the prevalence of use of these medications for reasons outside what is prescribed and by people who are not prescribed the stimu-lants at all has increased dramatically as well. My research believes that it can put together a questionnaire, similar to one used to evaluate alcoholism, in order to indicate if someone is using, abusing, or dependent on prescription stimulants. This research is important because it will provide insight into the evolving usage of drugs and potentially indicate predictors of what can lead to problems. Our research uses questionnaires to evaluate history, severity, duration, and other factors related to prescription stimulant use. Our subjects are people who have used prescription stimulants with or without a prescription in their lifetime. Research is ongoing.

Future application of our findings can be used to prevent addiction by discovering some characteristics of users and their drug cycles, and applying what we find to prevention and recovery programs. Future research may aim to examine the effects of prescription stimulant use on the brain and the difference between the short and long term effects these drugs have on people with and without ADD or ADHD.

Funder Acknowledgement(s): AASD-STEM

Faculty Advisor: Chukwudi Chidume, chidugc@auburn.edu

295
Subcategory: Social Sciences/Psychology/Economics

Is China Taking the Lead? Examining the Purchase of Smithfield Foods

Ivahna Evans, Virginia State University

In a $4.7 billion deal, China’s number one pork producing company and the largest shareholder of China's biggest meat processor, Shuanghui International Holdings Ltd., recently bought Smithfield Foods. While Smithfield Food remains the US major pork producer and processing company and a leader in the global market, this sale has raised some questions about its effects on US agriculture and the structure of the global pork industry.

This study examines the structure of the global pork industry, before and after this development, and evaluates the implications of this purchase on US and Chinese markets. The null hypotheses are that the trade will negatively affect US consumers and that it will negatively impact global consumers. Critical indicator factors are identified using available data over the past ten years and forecast of future trends are made, based on appropriate statistical methods. Findings from the study are expected to provide insights into the effects of the purchase on the US pork market specifically, and US agriculture in general. Results will also address the effects of the purchase on global pork market. The strategic implications of this purchase are evaluated and critical recommendations are proffered.

Funder Acknowledgement(s): HBCU-UP

Faculty Advisor: Oluwarotimi Odeh, oodeh@vsu.edu

296
Subcategory: Social Sciences/Psychology/Economics

Intersection Traffic Safety: Red Light Violation Analysis

Javier Garcia-Mendoza, New Mexico State University
Co-Author(s): Hansuk Sohn, New Mexico State University

The goal of this research project is to assess the impact of the Safe Traffic Operations Program (STOP) on road safety. Our study includes a total of 38,169 red-light violation records collected between March 2009 and February 2012. The hypothesis consists in the fact that the placing of cameras at main streets-intersections would significantly lower red-light violations. Two levels of data analysis were conducted--one is using trend analysis and the other is using statistical analysis such as the Kruskal-Wallis test and the Mann-Whitney test. Descriptive statistics suggest that a majority of the red-light violations occurred during daytime with two peak hours at 12pm and 4pm, and that the highest red-light violations occurred on Friday.

The highest volume of the violations occurred within 1 second after the onset of the red-light signal, whereas the second highest volume of violations occurred more than 3 seconds after the red-light signal. No actual decreases were observed with either analysis in the number of red-light violations, but only increases or no changes. Therefore, negative preliminary conclusions were obtained towards the program. Future research may include understanding the correlations between red-light violations and crashes, drivers, and environmental factors.

Funder Acknowledgement(s): City of Las Cruces under grant #11-12-334; NSF with a grant to New Mexico Alliance for Minority Participation (AMP) under grant HRD# 135-011.

Faculty Advisor: Hansuk Sohn, hsohn@nmsu.edu

297
Subcategory: Social Sciences/Psychology/Economics

What Lies Beneath: The Role of Theory of Mind in Lying Behavior

Alecia Lane, University of the District of Columbia

One of many key components in child development and learning is modeling. Studies have shown that parents admit to telling lies to their children. To date, no studies exist that analyze whether lying to children will in turn affect their inclination to lie. One factor that might influence whether lying to a child will lead them to be more likely to lie is their social cognitive capacity. In developmental psychology, the classification of social cognition focuses on the study of Theory of Mind (ToM), the awareness that others have different beliefs and desires than that of our own. ToM development begins in children between the ages of 3 to 5 years old.

This study utilized five theories: knowledge access belief, diverse belief, explicit-false-belief, content-false- belief and temptation resistance to measure the development of TOM in preschool and school aged children. Children were placed in a situation where they could peek at a toy after being told not to look, after which the children were given the opportunity to either admit their transgressions or conceal them by lying. It is believed that in most instances, the child would lie, rather than admit their transgression. Preliminary data indicates that telling a lie to a child increases the likelihood that the child would also tell a lie after having been lied to by an adult.

Funder Acknowledgement(s): MARC -NIH/NIGMS; 1T34GM087172-01A1.

Faculty Advisor: Freddie Dixon, fdixon@udc.edu

298

Subcategory: Social Sciences/Psychology/Economics

Parental Speech Styles and Language Abilities in Toddlers with Autism

Suzanna Osuna, University of California, San Diego
Co-Author(s): Karen Pierce and Elizabeth Worcester, University of California San Diego

Autism Spectrum Disorder (ASD) is a condition characterized by communication deficits that often persist throughout the lifespan. In typically-developing children, parent speech styles influence the child's verbal abilities (Hart & Risley, 1992). This study examined the language trajectories of toddlers with ASD in relation to their caregiver's speech. Children with ASD whose caregiver's speech featured more initiations and narrative dialogue were predicted to have greater linguistic proficiency. Participants were three-year-olds with ASD ($n = 80$), with language delays ($n = 80$), or typical controls ($n = 80$). Currently, a total of 81 toddlers have participated. In a longitudinal study, they were assessed in standardized and experimental paradigms.

Information about the children's language was gathered from videos of play interactions between the child and caregiver. The speech of both was transcribed and coded. For children, utterances were coded for degree of successful articulation, initiation or responsiveness, and echolalia. Parental speech was coded as an initiation, response, narration, praise, or discipline. Analyses examined correlations between caregiver speech and the linguistic abilities of their children, as measured by standardized assessments.

Preliminary analyses demonstrate a strong positive correlation ($p<0.02$) between frequency of parent initiations and the child's score on the verbal sections of the Mullen Scales of Early Learning. A positive correlation ($p<0.01$) between parent initiations and frequency of child initiations was also found. Child-directed speech that persistently attempts to redirect attention toward a common focus or that includes repeated prompts for engagement may be favorable in developing verbal skills of children with ASD. Future analyses should examine these data in relation to biological data such as that from brain imaging and genetic samples.

Funder Acknowledgement(s): National Institute of Health; Ronald E. McNair Program.

Faculty Advisor: Karen Pierce, karen2pierce@gmail.com

299

Subcategory: Social Sciences/Psychology/Economics

Camp Ramapo: An Evaluation of an Education and Behavior Modification Program

Jamon Pulliam, Tuskegee University
Co-Author(s): Vivian Carter, Tuskegee University

This study will compare pre and post evaluation of participants at Camp Ramapo, compiled by trained counselors. The evaluations are based upon a guide entitled: "Skills for Social Success, A Guide for Children with Special Needs" that consists of 6 categories with a total of 44 likert-scale items of specific skills by which participants are evaluated. We hypothesize that the pre and post test results will show significant behavioral change in all six categories. In addition, participant entry level evaluations include participant clinical diagnosis and profiles, which were supplied by the parents/guardians. A comparative analysis of the pre and post-camper guide surveys of the 23 youth using SPSS will be used to determine the level of effective -ness of the behavior modification plan implemented by the camp.

Preliminary evaluation results indicate 48% of the participants were diagnosed as altruistic and of that group 18% were classified as low functioning on the altruistic spectrum. The highest scoring category for participants was "Self Help" (75%), indicating they were capable of maintaining their own personal hygiene, could clothe themselves and care for their personal belongings. While the lowest rated category was "Attitude" (50%), indicating they exhibited antisocial behaviors which included lack of group participation, lack of enthusiasm, and resistant to assistance. The camp activities were constructed in a manner to assist each participant in developing or strengthening the six category items identified in the assessment instrument. Future research includes continuing the analysis of the data from the pre and post camper guide to evaluate more categories in more depth.

Funder Acknowledgement(s): This research was supported by the Department of Psychology and Sociology, but no funding was necessary or provided.

Faculty Advisor: Vivian Carter, vlcarter@mytu.tuskegee.edu

300
Subcategory: Social Sciences/Psychology/Economics

Non-Parametric Data Analyses for Observational Before-and-After Studies

Janette Torres, New Mexico State University
Co-Author(s): Hansuk Sohn, New Mexico State University

The Safe Traffic Operations Program (STOP) in the City of Las Cruces, NM was introduced in March 2009 in an attempt to improve traffic safety. The goal of this research project is to assess the impact of the STOP on traffic safety. Our study includes a total of 12,400 speeding violation records collected from five camera sites in the city between May 2010 and April 2012. Two levels of data analysis were conducted--one using trend analysis and the other using statistical analysis such as the Kruskal-Wallis test and the Mann-Whitney test. Descriptive statistics show that after the STOP activation, the number of speeding violations was significantly decreased in four of five camera sites. Also, during the study period, none of the camera sites experienced an upward trend on the number of speeding violations. Therefore, we may conclude that the STOP operation has a positive impact on decreasing the speeding violation. However, it should be noted that the speeding violator's average speed at the time of violation has not been changed. For future research, updating and collecting more speeding violation data will be essential to update the analysis and give rise to new conclusions, also to understand the correlations among speeding violations and types of traffic accidents, different ways of driving, environment and unpredictable events.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the National Science Foundation to the Alliance for Minority Participation at New Mexico State University, #HRD-135011.

Faculty Advisor: Hansuk Sohn, hsohn@nmsu.edu

Technology and Engineering

301
Subcategory: Air

Progress Toward a Truss-Braced Wig Aircraft with Increased Speed

Cynthia Claudio, Syracuse University

The Truss-Braced Wing (TBW) initiative provides many benefits to modern day progressive aircraft. The particular configuration of the TBW produces a decrease in induced drag due to its larger aspect ratio, allowing for freedom in design and improved performance. Computational Fluid Dynamic analysis and design methods have been applied in attempt to increase the speed of a TBW aircraft originally designed to cruise at a Mach number of 0.7. To enable this design activity, it was necessary to modify a design rule known as the Korn equation for better accuracy at higher lift coefficients present for this aircraft. The new equation was developed using 2-D CFD design applied to multiple airfoils and confirmed in a 3-D design of the TBW aircraft. Revising the Korn equation proved to be an integral part of reaching an increased aircraft cruise speed of 0.8 Mach number. Pushing the aircraft Mach number just a tenth higher required a decreased thickness to chord ratio, according to the revised Korn equation. This not only allowed the increase of aircraft speed but also maintained minimum values of wave drag and flow separation over the outboard portion of the wing. The design approach using MSES, USM3D and CDISC codes with the guidance of the revised Korn equation appeared to be a promising strategy for fully eliminating flow separation and reducing wave drag at a higher Mach number. Future work would explore applying this design approach to the entire wing.

Funder Acknowledgement(s): Aeronautics Research Mission Directorate - National Aeronautics and Space Administration.

Faculty Advisor: Thong Q. Dang, tqdang@syr.edu

302
Subcategory: Air

Wind Turbine

Sanusi Conteh, Howard University
Co-Author(s): Nadjitade Badeje, Howard University

Wind energy has become an increasingly important sector of the renewable energy industry, and may help to satisfy a growing worldwide demand for electricity (Pasqualetti et al. 2004; GAO 2005; Manville 2005). In utilizing wind energy, the environmental benefits are proven to be superior when

compared to more volatile industries (e.g.fossil fuels, nuclear fuels, etc) in that they replace the energy created by such means and reduce the adverse environmental effects caused by these types of energy. (Keith et al. 2003). The presence of wind power in Senegal dates back to2001, but there is always room for improvement. We came up with the idea of increasing the number of revolutions in the copper rolls (55 revolutions to 110 revolutions). By increasing the copper content, this allows for the actual output that is absorbed to increase. Ultimately the power efficiency is increased, as the output of the turbine grows, but the power to have the turbine operational stays stagnate. The rotor that was built to the new specification was tested on a windmill planted at Mbawane (Senegal), and it produced about twice the amount of energy than the old rotor. An increase of 50 watts was observed in 10min time difference. This is an indication that there is room for EOLSenegal to improve lives in the rural areas by providing a cleaner and cheaper source of energy. In the future, research should strive towards renewable energy as a substitute for fossil fuels.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Teneisha Mclntyre, tmcintyrev@gmail.com; Dr.Kamara/binetak@yahoo.fr

303

Subcategory: Astronomy and Astrophysics

The Functionality of a Solar-Cell System in Near Space Conditions

Caleb Xavier Bugg, Morehouse College
Co-Author(s): Matthew Mullens, Morehouse College
H. B. Mihiri Shashikala, Clark Atlanta University

The Sustainable Energy Team is one of the six research teams experimenting on the High Altitude Research Platform (HARP), which tests experiments in near-space environments. The group's objective is to develop a sustainable, light-weight source of energy that can serve as the power source for the payload's flight. Therefore, the group worked towards the implementation and betterment of a solar-cell system aboard the HARP. The group hypothesized that with an increase in elevation, the resulting increase in solar intensity would lead to an electrical output equal to or greater than those recorded in any ground tests. On a larger scale, this experiment will work towards the elimination of heavy battery systems on near-space experimentation systems, allowing more research to be conducted. Experimentation was initiated when the team tested small, individual solar panels to determine their capabilities of producing electric power (Greentech, 2010). The preliminary test was run in order to determine the maximum potential of a small-scale solar panel, thus providing a control. Later, the solar panels were connected in both series and parallel circuits, in order to test their ability to produce and sustain electric power. Although the series circuit produced more voltage, the parallel circuit was the best option based on the consistency of the current produced. Thus the Sustainable Energy team developed a circuit that ran the solar panels connected in parallel to a rechargeable battery. The rechargeable battery was used to maintain a constant voltage and a relatively consistent current. In order to maximize the intensity of the sunlight on the system, the group elevated the panels horizontally at an angle of 34˚. The flight provided adequate data to deem the system a success, including a charge of 1.65V for the battery, a voltage output of over 6.5 volts, and periods of consistent currents. The implementation of a larger system (e.g. 12V panels and batteries) should prove efficient enough to power the HARP in future launches. The group sought to capture the process that leading engineers have implemented in the International Space Station. Further research into the intricacies of this system will prove fruitful for the HARP and all other near-space experimentation vessels.

Funder Acknowledgement(s): This research is supported by the following grant(s) NSF-HRD-1043330, Morehouse College M-WISE Program.

Faculty Advisor: Lycurgus L. Muldrow, lmuldrow@morehouse.edu

304

Subcategory: Biomedical Engineering

Patterned Biofilm Formation of *Escherichia Coli*

Anastasia A. Budinskaya, Syracuse University
Co-Author(s): Suzanne De Tore, Xiangyu Yao, and Dacheng Ren, Syracuse University

Biofilms are multicellular structures of bacterial cells embedded in an extracellular matrix, attached to surfaces. Biofilms affect people in their daily lives, from slime on a shower curtain to life threatening drug resistant infections. Thus, it is important to understand the mechanism of biofilm formation, especially the function of key genes and the roles of cell-to-cell signaling in biofilm formation. Recently, we developed a method to control biofilm morphology using patterned surface chemistry. We hypothesize that by reducing structural heterogeneity in biofilms, the interaction between cell clusters can be specifically investigated. In this study, a reporter strain of *Escherichia coli* was constructed with a GFP gene controlled by the promoter of luxS gene, which encodes a protein for the synthesis of the quorum sensing signaling molecule AI-2. Culturing this strain on patterned surfaces allowed us to monitor the activity of cell-to-cell signaling in real time. It was found that *E. coli* labeled with unstable GFP were dimmer than *E. coli* containing the stable GFP at 24 hours after inoculation. The interactions between cell clusters increased over the period of 2, 6, and 24 hours during biofilm formation while the GFP signal decreased in that time frame.

These results suggest that cell-to-cell signaling may be required before physical contact is made between adjacent cell clusters. In addition to gene expression, these patterned surfaces were also used to investigate biofilm formation of co-cultures of the wild-type *E. coli* and its luxS mutants. The data show that the luxS mutant has defects in colonizing these surfaces compared to the wild-type strain. Beyond research work, this research platform was also used in science projects involving local high school students. The findings will be discussed.

Funder Acknowledgement(s): This study was supported by a grant from NSF-EFRI/REM program.

Faculty Advisor: Dacheng Ren, dren@syr.edu

305
Subcategory: Biomedical Engineering

Viscoelastic Studies of PEG Solutions Using Single Particle Tracking

Lennea Davis, Delaware State University
Co-Author(s): Qi Lu, Delaware State University

Macromolecular crowding in cytoplasm has been increasingly appreciated as an important factor affecting the diffusion and interaction of macromolecules. Poly (ethylene glycol) (PEG) is a nontoxic synthetic polymer often used as a crowding agent in rendering volume exclusion to other macromolecules. This study aims to characterize the viscoelastic hindrance of PEG on diffusion of macromolecules. We prepared aqueous solutions of PEG at molecular weights 1500, 3350 and 8000 of different weight concentrations including 10%, 20%, 30%, 40%, and 50%. The Brownian motion of fluorescent polystyrene nanospheres in PEG solutions were tracked with confocal fluorescence microscopy. The time sequence of the fluorescence images tracking the movement of single particles was then processed by Metamorph software and the diffusion coefficients were calculated based on the mean square displacements of the tracked particles. The viscosities of PEG at different concentrations were deduced from the diffusion coefficients of the particles using Stokes-Einstein Equation. The results obtained from PEG 1500 and 3350 indicate that the diffusion coefficients of the particles decrease as concentrations of PEG increase, while the viscosities of PEG solutions increase exponentially with concentration. The results from PEG 8000 are still under work and will be presented at the conference.

Funder Acknowledgement(s): This study was supported by grants from NSF SMILE program (#HRD0928404) and NSF CREST program (# HRD1242).

Faculty Advisor: Qi Lu, qilu@desu.edu

306
Subcategory: Biomedical Engineering

Developing iPS Derived Cells for Cardiac Tissue Regeneration

Vivian Le, University of California, Santa Barbara/University of California, Berkeley
Co-Author(s): Kevin E. Healy, Sylvia Natividad-Diaz, and Amit K. Jha, University of California, Berkeley

Heart failure from myocardial infarction (MI), caused by coronary artery blockages, is one of the leading causes of death globally. Currently, the only treatment to restore cardiac function after MI is heart transplantation, which is a risky procedure and limited by donor organ availability. One potential alternative treatment is the use of induced pluripotent stem (iPS) cells to regenerate damaged cardiac tissue. Progenitor cells that express CD105, a cell surface marker for pro-angiogenic endothelial cells, have the potential to form vascularized networks when seeded in an appropriate 3D matrix, such as hyaluronic acid (HyA) hydrogels, a natural substance found in the extracellular matrix of human tissue.

Our goal was to generate a suitable iPS cell-derived population of cardiac progenitor cells (CPCs) for use in cardiac cell transplantation therapy. The WNT pathway is an important regulator of iPS cell differentiation. We treated the iPS cells with IWP4, a WNT pathway inhibitor, at various concentrations to identify a protocol for generating a population of cells expressing CD105. Treatment with 5 uM IWP4 resulted in the greatest number of CD105+ cells, but lower doses of the Wnt inhibitor (2 uM IWP4) was sufficient to a population of CD105+ cells with a spindle-shaped morphology, which is characteristic of the CPC cell type. Magnetic activated cell sorting (MACS) was used to isolate this CD105+ sub-population of differentiated iPS cells, which were encapsulated into HyA-based hydrogels to verify their viability and compatibility in the HyA hydrogels. In our future work, we will evaluate the suitability of these CD105+ iPS cells to promote mechanisms of cardiac tissue repair.

Funder Acknowledgement(s): UCSB UC LEADS Program

Faculty Advisor: Kevin E. Healy, kehealy@berkeley.edu

307
Subcategory: Biomedical Engineering

Tattoo Potentiometric Ion Selective Sensors for Epidermal pH Monitoring

Alexandra Martinez, University of California, San Diego
Co-Author(s): Amay J. Bandodkar and Joseph Wang, University of California San Diego
Vinci W. S. Hung, University of Toronto

We present on the fabrication and characterization of novel tattoo-based solid-contact ion-selective electrodes (ISEs) for non-invasive potentiometric monitoring of epidermal pH levels. The new fabrication approach combines commercially available temporary transfer tattoo paper with conventional screen printing and solid-contact polymer ISE methodologies. The resulting tattoo-based potentiometric sensors exhibit rapid and sensitive response to a wide range of pH changes with no carry-over effects. Furthermore, the tattoo ISE sensors endure repetitive mechanical deformation, which is a key requirement of wearable and epidermal sensors. The flexible and conformal nature of the tattoo sensors enable them to be mounted on nearly any exposed skin surface for real-time pH monitoring of the human perspiration, as illustrated from the response during a strenuous physical activity. The resulting tattoo-based ISE sensors offer considerable promise as wearable potentiometric sensors suitable for diverse applications. The tattoo ISE sensors were able to tolerate the complex mechanical deformations experienced by the human skin during exercise. The tattoo ISE sensors thus exhibit substantial potential as practical, body-worn devices for continuous physiological monitoring. The new potentiometric sensing concept can be readily expanded towards epidermal monitoring of other clinically relevant sweat electrolytes such as sodium, potassium, calcium, or magnesium.

Funder Acknowledgement(s): Qualcomm, NSF, NSERC Canada, NIH IMSD

Faculty Advisor: Joseph Wang, josephwang@ucsd.edu

308
Subcategory: Biomedical Engineering

Time Series Analysis of Pupillometry Data to Estimate Daytime Sleepiness

Mitch Mikami, Kapi'olani Community College
Co-Author(s): Roberto Ramilo

A time series is a sequence of data points typically measured at a specific uniform interval of time. Such series may be recorded from physical as well as physiological systems, and analyzed to extract meaningful statistical information or to characterize a system in various controlled conditions. When conducting sleep studies, time series is used to record electrocardiographic, electromyographic, encephalographic or even pupillometric data. Pupillometry consists of the measurement of pupil diameter as a function of time and may be used to estimate daytime sleepiness--a condition that may have significant and negative consequences on college students' performance. The purpose of this research is to develop and apply time series analysis tools such as standard deviation and frequency decomposition onto pupillometry data in order to differentiate sleepy from alert subjects. The time series analysis was entirely conducted using a high-level language environment for numerical computation called MATLAB.

The analysis includes both the filtering and the processing of the raw data measured from the pupillometry equipment at a rate of 60Hz. First, data interpolation is necessary to account for subject blinking and is performed using the spline function. Once the filtering process is completed, the fifteen-minute data time series is truncated into fifteen one-minute segments; the standard deviation of pupil diameters is computed for each segment, and analyzed for patterns. On the whole fifteen-minute segment, a frequency decomposition treatment is applied and a power spectrum is computed. Results show that the standard deviation values increase at a steady rate for sleepy subjects and decrease for alert subjects. Furthermore, a shift of relative power towards higher frequency bands is identified in the power distribution of sleepy subjects as compared with alert subjects. Correlating outcomes from the time series analysis with qualitative surveys that estimate daytime sleepiness suggests that both standard deviation and shift of relative power in higher frequency bands through a frequency decomposition analysis of pupillometry data represent valuable indicators to identify human subjects with daytime sleepiness. Further research will involve a confirmation of the current findings using zero crossing and singular value decomposition (SVD).

Funder Acknowledgement(s): National Science Foundation, TCUP

Faculty Advisor: Herve Collin, herve@hawaii.edu

309
Subcategory: Biomedical Engineering

Magnetorheological (MR) Fluid Brake for Prosthetic Knee

Vicente J. Munguia, California State University, Fresno
Co-Author(s): The M. Nguyen, California State University Fresno

Current prostheses rely on high current output from electrical motors to sustain a fixed position. The advantage of using Magnetorheological (MR) fluid is that it requires less current and can have a variable braking torque. MR fluid consists of micron-sized iron particles in a fluid typically oil, silicon or water. When the fluid is exposed to a magnetic field the particles line themselves up with the magnet lines. Thus, you can solidify MR fluid in a braking or clutch system and in effect attain a variable yield stress. It's the variable yield stress that creates the braking torque on the rotating discs. This technology has the potential to manufacture lighter prosthetics, extend the life of the product and create a more natural gait for patients.

The research was conducted in four phases: investigation, theoretical modeling, prototype fabrication, lastly testing and analysis. Investigation included literature review of magnetor-heological fluid clutches and brakes, existing prosthetics, and human biomechanics. Professional opinions on the mentioned fields were also collected. In the theoretical modeling phase, SolidWorks was used to develop 3D CAD models of the designs. Furthermore, MATLAB Simulink was used to develop the control system and FEMM 4.2 software was used for the electro-magnetic circuit analysis.

Subsequently, the prototype was fabricated with the support from Fresno State facilities and technicians. Data was collected from the experiments with the prototype. The final prototype was tested under cyclic loading and put through extensive trials. Collaboration with Fresno State Physical Therapy department was carried out to develop testing and analyzing methods. The success of this MR fluid prosthetic knee might potentially result in a patented product that patients would be benefited from.

Funder Acknowledgement(s): This study is supported by the generous grant from Associated Students, Inc. & Undergraduate Studies.

Faculty Advisor: The M. Nguyen, then@csufresno.edu

310
Subcategory: Biomedical Engineering

Properties of a Bone Scaffold Using Frontal Polymerization

Zackari Murphy, Louisiana State University
Co-Author(s): Nick Tortaro and Daniel Hayes, Louisiana State University

Our scaffolds focus on correcting defects within the human skeletal system caused by trauma or deterioration. The commercial product, Bone Cement, has been used as a scaffolding material for the past 20 years. Our lab has formulated a new scaffold material, Bone Foam. While each of these scaffolding materials has its own individualized strengths and weaknesses, they share a common drawback. The polymeri-zation begins upon mixing and gives time constraints to be shaped and placed within the body. We hope to correct the problem by using a type of polymerization referred to as frontal polymerization. Frontal polymerization is characterized by the free flow and movement of energy as the polymer steadily solidifies. This would allow for the user to take as much time as needed to mold the polymer, and when ready, provide the necessary catalyst, in the form of heat, to start the reaction and poly-merize. A biocompatible, biodegradable synthetic material is now available to possibly replace intrusive structures such as plates, braces, and screws thus minimizing discomfort and complications. In order to truly test if these types of scaffolds were a viable alternative to the previously mentioned products of bone foam and bone cement, we set up several studies to investigate properties deemed relevant and suitable to the scaffolds practicality.

Studies investigated were mass loss, mechanical properties, porosity, metabolic activity, cytotoxicity, temperature distribution, and front velocity. For each test we used scaffolds of 10:1, 5:1, 3:1, and Acrylate only ratios of a tri-functional acrylate to a tri-functional thiol. The scaffolds are 12 mm in height and 6 mm in diameter 3, and are prepared ahead of time using a full metal mold heated until approximately 300°C.The scaffolds consist of four main components which include two monomers, a filler and initiator. Pentaerythritol Triacrylate: (PETA): Monomer Hydroxylapatite: (HA): Filler Trimethylol-propane Tris(3-mercaptopropionate): (TMPTMP/Thiol): Monomer Benzoyl peroxide: (BPO): Initiator 10:1, 5:1, 3:1, and A only refer to the ratio of PETA to TMPTMP by mass accordingly Mass Loss: To perform this test three replicates of each ratio were pre-weighed then submerged and rocked in media (DMEM with 10% FBS) for a seven day period at 37°C. The scaffolds were re-weighed to calculate degradation. 1 Compression: Shows the mechanical strength of the scaffolds structure. Using an Instron device, all samples were the same dimensions with three replicates of each ratio. 1 Stress = load/cross-sectional area Strain = change in height / original height (deformation) Porosity: Found via MatLab from MicroCT visualization. Cytotoxicity/Metabolic Activity: To examine these properties a 96 well plate was prepared with three samples from each polymer.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Nick Tortaro, lsu_ntortaro@yahoo.com

311
Subcategory: Biomedical Engineering

Electrically-Conductive, Polymer Scaffolds for Cardiac Tissue Engineering

Benjamin Spearman, Auburn University
Co-Author(s): Alexander Hodge, John Porter, and Elizabeth Lipke, Auburn University

Heart disease is the primary cause of mortality in the US, accountable for 25% of all deaths. Current therapies for heart disease do not regenerate damaged heart tissue. Developments in tissue engineering (TE) are leading to novel cell treatments to augment tissue repair. Using pluripotent stem cells it is possible to generate contracting heart cells, called cardiomyocytes (CMs). However, current approaches result in CMs which have heterogeneous, immature electrical properties. We hypothesize that by growing CMs on an electrically-conductive material, which mimics the electrical properties of native heart tissue, the cells will be more homogeneous and have improved electrical properties. To test this, polypyrrole (PPy), an electrically-conductive polymer, was coated on polycaprolactone (PCL) to form PPy-PCL. PPy-PCL has shown promise in neural TE applications. PCL was prepared by solvent-casting in DCM, flattened with a melt press, and punched into 20mm diameter scaffolds. PCL samples were then either treated with NaOH (3M; 0, 24, or 48 hours) to modulate hydrophobicity or coated with PPy. PPy-PCL was prepared via chemical polymerization of the PPy using ferric chloride as an oxidant. Materials were character -ized through SEM, electrical-resistivity tests, and water contact angle (WCA) measurements. Mouse CMs called HL-1s were grown on PPy-PCL or NaOH-treated PCL and cell viability, spread, and morphology were characterized using LIVE/DEAD assay and nuclear stains. PPy-PCL has a resistivity of 1.0 ± 0.4 kΩ while the uncoated-PCL has infinite resistance. PCL that underwent 0, 24, and 48 hours of NaOH treatment had a WCA of 77 ± 3°, 35 ± 5°, and 24 ± 5° respectively. PPy-PCL had an effective WCA of 0° due to the super-hydrophilicity of PPy. Adherent cells per area were 290,000 ± 20,000 cells/cm2, 160,000 ± 14,000 cells/cm2, 360,000 ± 30,000 cells/cm2, and 400,000 ± 40,000 cells/cm2 for 0, 24, 48 hours of NaOH treatment and PPy-PCL respectively. Results indicate that PPy-PCL may offer a suitable, electrically-conductive, polymer substrate for use in cardiac TE.

Future work will focus on characterization of cell-communication through analysis of electrical wave propagation, protein expression, electrical stimulation of cells on the materials, and the effects of the materials on stem-cell differentiation into fully-functioning homogeneous CMs.

Funder Acknowledgement(s): AASD-STEM Summer REU NSF-HRD-0929268; AL-EPSCoR GRSP Fellowship and NSF EPSCoR/AU-CMB Fellowship; AU Undergraduate Research Fellowship; NSF-CBET-1150854.

Faculty Advisor: Elizabeth Lipke, eal0003@auburn.edu

312
Subcategory: Cancer Research

Beating the Curse of Dimensionality through Manageable Experiments

Kasandra Ramirez-Rojas, University of Puerto Rico, Mayaguez

Modern computer and biological experiments require the simultaneous manipulation of hundreds of variables for characterization, modeling and–ultimately--optimization purposes. Most experimental design software packages are able to prescribe experimental arrays, however, the number of variables is usually limited to a few dozen. This work describes the first ideas on the generation of experimental designs involving a large number of variables with clustering techniques. The aim is to formulate a generation strategy that is implementable in a desktop computer with initial target applications to polymer computer simulations and microarray analysis for cancer characterization. A first experiment is presented here with nine variables. A full factorial experiment with nine variables sampled at three levels each entails 19,683 experimental runs. The target number of runs in this work is 60, which would provide the 55 minimum number of degrees of freedom to estimate a complete second order regression.

Three strategies were tested to generate 60 runs. A k-means clustering procedure was performed with k=60 to then prescribe the 60 runs using the centroids on each strategy. A second experiment consisted of using the design generated with the strategy selected as the most attractive from the first experi-ment to assess its capability on estimation in presence of gradually induced noise. The two experiments were evaluated by the capability to estimate a known regression equation´s coefficients.

Of the three strategies, only one resulted in a feasible design that explored all nine dimensions and estimated all 55 terms perfectly, and moreover, it provided some control over the structure of the resulting design. In the second experiment, the design generated with the best strategy showed a remarkable performance by keeping prediction levels above 90% in all cases in spite of not all coefficients being determined perfectly. In the first study, it was possible to estimate all coefficients of a second order regression model using 60 runs generated using a clustering procedure instead of the 19,683 needed with traditional methods. Moreover, the 60-run design performed very competitively in presence of noise.

These first results are very encouraging and motivate the exploration of experiments involving a lot more than 9 variables. If successful, the methods would indeed constitute a way to beat the curse of dimensionality in modern experiments.

Funder Acknowledgement(s): National Science Foundation under Grant HRD 0833112 CREST Program; National Institutes of Health MARC Grant 5T36GM095335-02 'Bioinformatics Programs at Minority Institutions'

Faculty Advisor: Mauricio Cabrera-Rios, mauricio.cabrera1@upr.edu

313
Subcategory: Cell and Molecular Biology

Mechanosensitive Biomolecular Networks

Katherine Guillen, Virginia Polytechnic Institute and State University
Co-Author(s): Eric Freeman and Michael Philen, Virginia Polytechnic Institute and State University

Biomolecular networks, created through a crate substrate and the droplet interface bilayer technique, have recently become a focus for biologically-inspired smart materials. This is largely dueto their ability to mimic many of the same abilities of the natural cell. In this study, two or more aqueous droplets containing phospholipids are initially deposited in an oil bath inside nonadjacent slots or "crates." The droplets are then brought together after lipid monolayers are formed at the oil-water interface, creating a lipid bilayer as they come into contact. One droplet is then mechanically oscillated at specific frequencies through a piezoelectric shaker and the current is recorded for clamped voltages. The focus of the study is the characterization of the generated sensing current through modifications to the bilayer properties and geometries, providing a proof of concept for the development of mechanosensitive biomolecular networks.

Funder Acknowledgement(s): This study was supported by a grant from NSF (EFRI-REM) under Grant#0938043 awarded to Michael Philen, Associate Professor, Aerospace and Ocean Engineering, Virginia Polytechnic Institute and State University.

Faculty Advisor: Eric Freeman, ecfreema@vt.edu

314
Subcategory: Chemistry (NOT Biochemistry)

Development of a Fabrication Process to Improve the Efficiency of Dye-Sensitized Solar Cells

Hector Gomez, California State University, Long Beach
Co-Author(s): Sergio Mendez, California State University of Long Beach

Dye-sensitized solar cells (DSSC) have been extensively studied in the past decade because of the relatively high ratio of energy efficiency to fabrication cost as compared to the established silicon-based solar cells. The challenge of making DSSC commercially feasible is to increase the electrical energy production while maintaining low costs. With technological advances and breakthroughs, there is the potential that DSSC can be a reliable and economical source of power. If DSSC can be efficient enough to be commercially feasible, it would be of great importance to society as a better form of alternative energy to reduce pollution and greenhouse gas emissions and for business to increase employment in the U.S. The challenge remains to make DSSC efficient enough to be industrially profitable.

The main objective of this project was to develop a fabrication process to try to improve the DSSC efficiency. The anode glass slide was drilled with two holes to serve as electrolyte infusion ports. We applied a thin film of porous titanium dioxide nanoparticles onto the anode. This calcined film was then stained with an organic dye that can absorb photons of light. The cathode was coated with a thin layer of graphite. A thermosetting plastic foil called Surlyn was used as a resistance spacer and sealant to hold the electrolyte between the anode and cathode. Once fabricated, we placed the DSSC under a lamp and measured the electrical output by plotting the current-voltage curves. We expect that the drilled infusion ports and Surlyn gasket will improve the transport of electrons through the DSSC anode and cathode, therefore increasing the conversion of light to electrical energy.

In this work, we compared current-voltage curves of our DSSC with and without the Surlyn. We found that the power decreased with the Surlyn spacer in contradiction to our original hypothesis. This is an ongoing process in which we still believe the Surlyn will improve electron flow, hence, increase efficiency. In our ongoing efforts, we are benchmarking our DSSC with a state-of-the-art ruthenium dye and performing inorganic chemistry to synthesize nanoporous titanium dioxide powders with incorporated carbon nanotubes. Our goal is to utilize these engineered nanomaterials to further improve the DSSC efficiency and reliability.

Funder Acknowledgement(s): This project is supported by the National Science Foundation Louis Stokes Alliance for Minority Participation Grant number: HRD-0802628.

Faculty Advisor: Sergio Mendez, sergio.mendez@csulb.edu

315
Subcategory: Chemistry (NOT Biochemistry)

Nickel Titanium to Epoxy Adhesion

Johan Antony Von Behr, Southern University at Shreveport
Co-Author(s): Barry Hester, Southern University at Shreveport
Tiffany Williams, NASA, Cleveland, Ohio

This study explores the adhesion properties of Nickel Titanium alloy with epoxy resins, one being rubber toughened and the other lacking rubber toughening. Nickel Titanium (also known as Nitinol or NiTi) is in the unique class of shape memory alloys (SMAs). SMAs can undergo large pseudo-elastic deformations (typically 4 -6%) in the low temperature martensite phase at low stresses [ref: Dayananda, GN (2008) NiTi Super Elastic Shape Memory Alloys for Energy Dissipation in Smart Systems for

Aerospace Applications]. These deformations are completely recovered upon heating to the high temperature austenite phase. A 0.003 inch diameter NiTi wire was cleaned by sonication in hexane, isopropyl alcohol and ultra-pure water solvents. The wire was embedded in two different epoxies--rubber toughened epoxy and non-rubber toughened epoxy. The interfacial adhesion of all specimens was characterized using Dynamic mechanical analysis (DMA). In the preliminary portion of the experiment, results were found to be random. This was found to be caused by the design. In a portion of the experiment, holes were drilled in the resin in order to separate the wire that is within the resin with the attachment head of the DMA. With careful observation, the wire was intermittently being pulled by the drill bit therefore nullifying the integrity of the pull during the stress phase utilizing the DMA. Due to time restraints, these corrections were not able to be put in place. Therefore, we will be conducting this experiment with corrections in place. This experiment is presented as a preliminary portion of the whole experiment. This shows that with careful observation, critical thinking and refining of planning, results can be refined objectively.

Funder Acknowledgement(s): NASA

Faculty Advisor: Barry Hester, bhester@susla.edu

316
Subcategory: Civil/Mechanical/Manufacturing Engineering

Analysis of Soil Temperatures in the Long Island Solar Farm

Ricky Bhola, City College of New York

The Long Island Solar Farm (LISF) is a 32MW, clean energy generator, producing enough energy to power approximately 4,500 homes annually. The LISF supports the United States Department of Energy's mission of seeking renewable energy and reducing our dependence on fossil fuels. While we seek clean energy alternatives, the LISF sits on a site whose ecology consisted of pine and oak variants, invasive species, and a host of animals. The installation of the solar panels has changed the local environmental conditions. The panels shade the ground in some areas and not others. This can provide microclimates that are beneficial or detrimental to local flora and fauna. This project investigated the temperature variation of the soil (at 18" depth) under the panels to soil in the open walkways between panel rows. Using the data recorded for the year 2012 (March-December), time plots were created to illustrate the differences. It was observed that the temperatures of the soil under the arrays were higher than soil in the walkway for most parts of the year. The mean temperatures were inverted starting in September and continued through winter; that is, the temperatures under the arrays were now lower than in the walkways. December's difference plot indicated that only 8 of 10 collection stations were inverted. Future work includes understanding why the trends are inverted in winter. This would involve acquiring solar irradiance data for winter months. Irradiance data can tell us how much sunlight is reaching under the panels and walkways and if the winter solstice is responsible.

Funder Acknowledgement(s): United Stated Department of Energy, Office of Science; Brookhaven National Laboratory.

Faculty Advisor: John Heiser, heiser@bnl.gov

317
Subcategory: Civil/Mechanical/Manufacturing Engineering

Strength of Metals

Trent Demeritte, Jr., Savannah State University
Co-Author(s): Bryan Knakiewicz, Department of Engineering, Technology & Mathematics, Savannah State University

There are many structural strength properties that every metal possesses, making them unique in their own way. These properties include compression, tensile and axial strength. A MTS Servo Hydraulic Wedge machine may be used to test the compression and tensile strength of any particular metal in a round bar shape according to the requirements stated in ASTM A370 - 12a Standard Test Methods and Definitions for Mechanical Testing of Steel Products. Experimental laboratory testing of one of these strength properties, compression strength, has been performed upon five different .5 inch diameter metals bars: stainless steel, copper alloy, aluminum, carbon steel, and brass using the MTS Servo hydraulic Wedge machine. Test data for each sample was produced by TestWorks® 4, the software used in conjunction with an MTS frame system (MTS Systems Corporation, 2011, p. 17). The data has been analyzed and compared to the strength properties determined from previous academic research. These comparisons will validate the strength properties produced by the MTS Servo Hydraulic Wedge machine. In addition, the MTS Servo Hydraulic Wedge housed by Savannah State University has yet to be operated and a detailed operation manual has not been provided by the manufacturer. Therefore, an operation manual that will describe the step-by-step procedures of operating the machine and analyzing the data using TestWorks® 4 will be constructed. This manual will be extremely beneficial to future research performed at Savannah State University using the MTS Servo Hydraulic and the associated software, Test Works®4.

Funder Acknowledgement(s): NSF-HBCU-UP (MAGEC-STEM Plus) Grant #HRD-0928454

Faculty Advisor: Bryan Knakiewicz, williamsk@savannahstate.edu

318
Subcategory: Civil/Mechanical/Manufacturing Engineering

The Design, Launch, and Recovery of a High Altitude Research Platform

William Dula, Morehouse College
Co-Author(s): Blake Benyard, Vinton Wolfe, Lycurgus Muldrow, Equel Easterling, Austin Benton, Jay-lind Williams, and Dakari Franklin, Morehouse College
Amy Oyenuga, Atlanta Public Schools

The Design, Launch, and Recovery Team was tasked with designing a payload module that would protect the carried experiments while being light enough to allow the High Altitude Research Platform (HARP) to reach the expected altitude. The Team also enacted the launch sequence and the recovery of the HARP. The engineering design process was used to analyze the previous payload designs done by members of the HBCU-Undergraduate Program and then design two new payload modules that would carry other experiments, which included robotics, bio-materials, graphene, and a lithium air battery. The payloads had to be within the weight limit of 12 lbs. according to the the federal regulation (CFR 2013, Title 14, Part 101). This is a very important regulation because it governed the Team's design and restricted the launch in weight and launch conditions. The balloon was made lighter than air. The Team used a helium filled balloon and filled it 1.5 times the weight of the remaining HARP assembly to have enough resist force to carry the payloads into near-space. The payload was recovered by a parachute that carried the weight of the assembly once the balloon busted in air.

The Team was divided into three sections: Balloon Technicians, Payload Specialists and Trackers. To track the HARP, two separate cars with tracking software and antennae were used in order to verify its location. The tracking system was accurate with both sets of tracking equipment finding the HARP, however, problems occurred during the flight. The tracking crew lost telemetry because the tracking antennae and command module were not in line of sight radio communication. The module had to be within a mile or two of the antenna in order to not lose connection. The HARP reached a height of 88,000 feet and traveled a path that measured close to 46 miles starting in Laramie, WY. When we recovered the HARP platform, the payload secured the lithium air battery and the termite experiments. The other payload containing the robotics, graphene, and bio-materials experiments was detached from the HARP assembly because the swivel on the line broke. For future reference, the Design Team decided that in order to secure the payloads, you should use bigger swivels that can withstand greater forces enacted on the tether lines by the strong pulls of the the wind. The launch sequence should also be modified to accommodate unplanned events such as an airplane approaching the launch site or high winds that will not allow a hand-over-hand release and instead require a quick release approach. The Team concluded that there should be a requirement to not use individuals who have not been trained or properly instructed as to the modified launch sequence.

Funder Acknowledgement(s): Funding provided by National Science Foundation (NSF) Historically Black Colleges and Universities Undergraduate Program grant award 1043330 and the NSF Partners for Research and Education in Materials grant 0934142.

Faculty Advisor: Vinton Wolfe, wolves@mindspring.com

319
Subcategory: Civil/Mechanical/Manufacturing Engineering

Implementing Safe Cooking Methods in Senegal

Mame Fall, Howard University

Citizens in rural areas of Africa have been cooking over open fires for hundreds of years; however, recent studies have revealed the harmful, and sometimes fatal, effects that cooking over open fires can have on the women who cook over them and the children who are not far off. Current methods of cooking in Senegal mostly involve the burning of biogas, biomass, charcoal, coal, ethanol, liquefied petroleum gas, and kerosene. Research has been conducted in Senegal with the goal to design a stove that emits less toxic chemicals into the environment and decreases health hazards on women and children. There were two stages of research: (A) the first stage involved an in depth literature review of the relevant impacts of existing methods of cooking in Senegal; (B) the second stage involved an investigation of materials found in Senegal appropriate for the construction of a safer cooking stove. The literature review aided in the complete design of a stove entitled "La Nouvelle Cuisine" which is intended to be built using the Tchiky and Sebikotane refractory clays. The stove has five key components: (1) the chamber of pyrolysis, (2) the nozzle, (3) the combustion chamber, (4) the exchanger, and (5) the chimney. Recommendations for future research involve building and perfecting the prototype of the stove, implementing several stoves throughout Senegal in order to research its usefulness among Senegalese people, and finally, mass-producing the product. Ultimately, this stove has the potential to improve the quality of life in Senegal as households will have access to a safer method of cooking.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation (NSF) under Grant No. 1052861. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of NSF.

Faculty Advisor: Lorraine Fleming, lfleming@howard.edu; Cheikh Fadel Kebe, cmkebe@gmail

320
Subcategory: Civil/Mechanical/Manufacturing Engineering

Smart Road Sign

Shaneé Ferguson, Savannah State University
Co-Author(s): Fredrick Fluker, Savannah State University

One important element in a transportation system is the control system, which includes vehicular and flow control. The flow control system consists of a means that permits efficient and smooth operation of streams of vehicles and the reduction of conflicts between them. It includes various types of signing, marking and signal systems. This research is focusing on the signs that provide drivers with critical information about upcoming driving conditions. One of the most important elements that affect the reliability of roadway signs is their visibility. One common problem that prevents adequate visibility of these signs is the lack of appropriate maintenance at the appropriate time to address issues such as tree limbs overshadowing signs, vandalism, etc.

The objective of this research is to design a system that would communicate with the road maintenance department to alert them of the need for maintenance on a particular road sign. To achieve this goal we will develop a prototype system that communicates with the maintenance department through a message system to display that "maintenance needed Immediately" when the view of the sign is in violation of the code requirements and the sign is a critical sign such as school zone signs, stop signs...etc. The proposed prototype system will consist of a prototype STOP sign, prototype roadway, and a sensor. The sensor will be attached to the prototype STOP sign to measure the visibility distance from the driver. The type of sensor that will be used is called the Ping Sensor, which will be programmed using basic stamp. The prototype STOP sign and the prototype roadway will be designed using 3D modeling software packages. In addition a smart phone app will be designed to allow drivers to report deficient signs to the maintenance department.

Funder Acknowledgement(s): PSLSAMP Scholarship Program (Savannah State University)

Faculty Advisor: Mohamad Mustafa, mustafam@savannahstate.edu

321
Subcategory: Civil/Mechanical/Manufacturing Engineering

Modeling of Micro Air Vehicles Through Biomimicry of Bumblebees

Dwight Hanson, Arizona State University
Co-Author(s): Michael Thompson, John Burnett, Daniel Lopez, Ruby Gomez, Deyzi Ixtabalan, and Shiba Biswal, Arizona State University

The creation of a micro-air vehicle capable of sustaining flight through flapping of its wings like a bumblebee, is new ground that is being looked over at the moment. The current micro-air vehicle (bumbler) at hand is theoretically capable of hovering in flight and achieving movements in the 6 degrees of freedom. These six degrees of freedom include the x,y,z directions, and rotations about the x,y and z axis. In order to create equilibrium, a PID controller along with an accelerometer is installed onto the bumbler to help it achieve equilibrium. At the moment, the main concern is creating a SIMULINK model capable of creating flight equilibrium in the bumbler. This Simulink model is to be modeled after Katherine Shiegokas master's thesis "Velocity and Altitude Control of an Ornithopter Micro Aerial Vehicle." In order to understand Shigeoka's methods, her research is recreated and then applied to the bumbler. Much of the data still needs to be validated by applying a fourier fit to such plots. Shiegoka's s-functions and Simulink plots lacked data and to this point are still being worked.

Funder Acknowledgement(s): Western Alliance to Expand Student Opportunities (WAESO)

Faculty Advisor: Armando Rodriguez, aar@asu.edu

322
Subcategory: Civil/Mechanical/Manufacturing Engineering

Thermohydraulic Testing of the High Flux Test Module

German Ibaceta, University of Wisconsin-Platteville
Co-Author(s): Yuming Chen, Christina Klein, and Frederik Arbeiter, Institute for Neutron Physics and Reactor Technology, Karlsruhe Institute of Technology, Germany

In the context of fusion nuclear technology and engineering, the International Fusion Material Irradiation Facility (IFMIF) has been launched in order to generate a material data base for future fusion application in fusion nuclear reactors. As a part of this project, the High Flux Test Module (HFTM) is the experiment that will host the selected materials for testing, and it will replicate an environment needed for the studying of irradiation nuclear damage on the surface of the tested materials. This unique experiment is intended to analyze the hydraulic and thermal behavior of the HFTM to validate the hypothesis that the apparatus design stimulates the development of turbulence flow, and that the computational fluid dynamics CFX Gamma model 180 is capable to forecast transitional flow. The importance of the experiment is to accurately measure the damage to the irradiated tested material in order to determine what type of strong materials are suited for the construction of a fusion nuclear reactor. At the same time, by validating the CFX Gamma model 180, it can be a start to understanding the behavior of the unpredictable nature of transitional flow. The IFMIF thermo-hydraulic experiment (ITHEX) was used to carry out the experimental measurements by utilizing a helium loop canister for the HFTM. The parameters controlled by the ITHEX were: geometry of the inlet nozzle, absolute pressure, temperature, gas flow, heater intensity, and time. After the density of the helium, flow velocity, mass flow, pressure drop and heat transfer related units were obtained, the optimal measurement for this experiment set up were: 6 to 10 g/s helium flow, Reynolds number between 3000 to 8000 and Nusselt number between 15 and 24. These values are supported by extensive data and plotted in graphs comparing the experimental to the computer simulated model results. The results demonstrated that the experimental data is comparatively close to the calculated simulated data. These satisfactory results validate the hypothesis that the HFTM design allows a consistent turbulence flow development and that the computational CFX Gamma model of 180 is able to predict an increase in the Nusselt number during transitional flow. However, given the difference in Nusselt number, adjustment must be done before calculating the average temperature from the HFTM and local temperature from CFX Gamma model. Future studies must be done in order to fully understand the nature of transitional flow and improve the materials used in fusion nuclear applications.

Funder Acknowledgement(s): The financial support by German Ministry for Education and Research (BMBF: Bundesministerium fur Bildung und Forschung) under the grant No. 03FUS0008.

Faculty Advisor: David Kunz, kunzd@uwplatt.edu

323
Subcategory: Civil/Mechanical/Manufacturing Engineering

High-Throughput Photovoltaic Efficiency Testing System

Jote Jinfessa, University of the District of Columbia
Co-Author(s): Brian Collins, National Institute of Standards and Technology, Gaithersburg, MD

Flexible organic solar cells are a promising technology to harvest renewable energy that can be manufactured at high speed and low cost using patterning and coating methods borrowed from the graphic arts. The processing of an organic solar cell can dramatically impact the materials structure that develops at the nanoscale, with significant impacts on the solar cell efficiency. To understand the effect of material structure on device performance, a large set of processing parameters must be explored, requiring a high-throughput testing facility.

We have developed a multiplex testing system that will evaluate the solar power conversion efficiency of a large batch of organic solar cells in an automated fashion. This involved designing and constructing the physical setup to make electrical contact with up to 24 devices simultaneously. Additionally, we have written the control software for automated testing of all devices. The final task will be to fabricate and test organic solar cells using our new testing system.

Funder Acknowledgement(s): This research is partly funded by STEM Center-NSF/HBCU-UP - HRD-0928444 and NIST SURF Directory.

Faculty Advisor: Brian Collins, brianAkiraCollins@gmail.com

324
Subcategory: Civil/Mechanical/Manufacturing Engineering

Design Optimization of Micro Aerial Vehicles by Bio-Mimicry of Bumblebees

Daniel Lopez, Arizona State University
Co-Author(s): Michael Thompson, John Burnett, Dwight Hanson, Ruby Gomez, Shiba Biswal, and Deyzi Ixtabalan, Arizona State University

Dynamic flapping micro unmanned aeronautical vehicles categorically fall into two classes: (1) flapping wings requiring constant forward velocity flight like birds, and (2) flapping vehicles that hover like hummingbirds and bumblebees. Due to the articulation and behavior of dynamic wing vehicles, specifically the rigid bee wing types, indicate easy transition from hover to high-speed forward velocity.

Our research focuses on modeling, analyzing, and designing a bumblebee-like ornithopter. The current ornithopter model was designed through SolidWorks and fabricated using 3D printing, therefore, replicating a bumblebee utilizing its articulation and aerodynamic attributes. The current ornithopter prototype has a six winding brushless motor with a maximum capacity of 8750 rpm per volt to provide hovering equilibrium which presented a constant challenge for the previous prototypes. Analysis of power consumption relationships indicates that the bumblebee ornithopter has sufficient power to weight ratios to negate the gravity effects required to hover. The bumblebee ornithopter is capable of maintaining equilibrium due to the incorporation of a weight shifting abdomen, feathering and lagging capabilities which allow re-location of both the aerodynamic centroid and center of mass. The weight of the redesigned ornithopter was kept under 100 grams to meet the predicted thrust requirements and maintain Micro Aerial Vehicle (MAV) standards.

A study is being conducted to minimize the dimensions and overall weight to approach Nano Aerial Vehicle (NAV) regulations of 20 grams. A figure of merit at .727 confirms the expected good hovering performance based on standard rotary wing aerodynamics models. Past analysis of both rotary power and figure of merit however are no longer a good measure of power for hover on the ornithopter due to large discrepancies in predicted data. A new power algorithm in Berman and Wang's publication will be used in all future power versus thrust to weight models. Upon completion of the first designed prototype, rework was applied on several components and assemblies in order to minimize vibrations that were causing failure.

Funder Acknowledgement(s): Western Alliance to Expand Student Opportunities.

Faculty Advisor: Armando Rodriguez, aar@asu.edu

325
Subcategory: Civil/Mechanical/Manufacturing Engineering

Ergonomic Analysis of Innovative Sustainable PACE Vehicle Design

Anita I. Martinez, New Mexico State University
Co-Author(s): Ruben Arauz, Fernando Perez

This research project is based on designing and developing a personal mobile vehicle which will carry one passenger and his/her cargo. This project is mainly focused on solving a mobility problem within a student community. Our design needs to be able to be ultra-light weight and must be powered or power assisted with a clean power source. The focus is on investigating the optimal ergonomic parameters for this vehicle. The design of this device is based on forces and fatigues on specific body parts such as wrists, lower back, and rump. The analysis is based on the ergonomic factors of posture and reach-ability in correlation with the steering, seat, and pedals of the vehicle. Although ergonomics for traditional two and three wheeled vehicles have been understood, this specific vehicle design deviates from a standard model, so special care must be taken to understand how the forces experienced by the user are different from a traditional one. The methodology consists of modeling the device in a CAD software which in this case Siemens Unigraphics 8.0, then determine the design of experiment, identify each input factor of experiment, each varied by tolerance parameters taken from literature reviews. Input findings from the design of the experiment are introduced into Siemens Technomatix Jack 7.1 ergonomics software to manipulate the human model for optimal comfort in ease in reaching the pedals and steering for the 5 percentile female and 95 percentile male. The study began with the most comfortable seated pre-selected posture provided in Jack 7.1 and arranged the female and male models on the vehicle.

The conclusions of this study are focused on the adjust-ability of the pedals and steering mechanisms to fit a range of users' sizes. Future research includes quantifying and measuring fatigue produced on the wrists, lower back, and rump, calculating ranges for the steering and pedals, considering the effects of short term and long term riding on the joints and specific body parts, and incorporating our findings into the design and making of the vehicle.

Funder Acknowledgement(s): New Mexico Alliance for Minority Participation, National Science Foundation.

Faculty Advisor: Delia Valles, dvalles@nmsu.edu

326
Subcategory: Civil/Mechanical/Manufacturing Engineering

The Selection of a Smart Material for a Biologically Inspired Hydrobot Tail

Danielle Moore, Virginia Polytechnic Institute and State University
Co-Author(s): Alhaji Janneh, Hampton University
Michael Philen, Virginia Polytechnic Institute and State University

The Galileo spacecraft has found evidence that a thick layer of ice exists on top of a deep ocean on Europa, one of the moons of Jupiter. It is of great interest to determine whether life exists on this moon since it would change the way humans think about themselves and the whole universe around them. Underwater gliders are an existing technology that is already being used to explore the oceans of Earth and could potentially be adapted to explore the ocean on Europa. As a result of the high efficiency and low power requirements for interplanetary exploration, a dolphin inspired approach for creating an underwater glider is proposed. This dolphin-inspired glider or hydrobot builds upon the traditional underwater glider but is modified to operate on Europa. Part of this modification includes the addition of a biomimetic tail onto the underwater glider in order to assist in propulsion and steering.

In this research it was necessary to determine both the optimal shape of the tail and the best way to actuate it. For actuation, we investigated many different smart materials, which are materials that change shape or generate a force under an applied stimulus such as voltage. The Analytical Hierarchy Process was employed for determining the best actuator. The traits that we analyzed were maximum force, maximum strain, and speed; the smart material that obtained the highest score was the Flexible Matrix Composite (FMC) actuator. The furthering of this research would require the development of a prototype in the shape determined by the research conducted by Alhaji Janneh and Danielle Moore using FMCs and then evaluating the prototypes in an underwater environment.

Funder Acknowledgement(s): This research was funded by grant number EFRI 0938043 from the National Science Foundation awarded to Michael Philen, Virginia Polytechnic Institute and State University, Blacksburg VA.

Faculty Advisor: Michael Philen, mphilen@vt.edu

327
Subcategory: Civil/Mechanical/Manufacturing Engineering

Magnetorheological Shock Absorber

Christopher Pineda, Fresno State University

Magnetorheological (MR) is a fluid classed as a “smart” material, having the ability to change from liquid state to a solid within micro seconds. The state of the fluid can be reversed just as quickly. The MR fluids contain iron particles that when exposed to a magnetic flux assemble together, changing the viscosity of the fluid. Applying a magnetic field to the fluid transforms its viscosity and becomes a stiff damper when needed. Then when a soft damping is desired, it can be done by reducing or taking away the magnetic flux. These dampers/shock absorbers are rarely seen outside a few high performance car suspensions. Its main job is to minimize the bouncing of vehicle going through rough terrains. In order to achieve a much better dynamic response and riding control during abrupt impulses induced by the road surface, the damper’s damping coefficient will undergo various changes. This adjustment will give the correct values for the MR fluid’s viscosity and yield stress. The micro-controller Arduino will be used in the involvement in the fluid damper’s damping ability. The process will to take the motion input, i.e. large displacements, velocities and acceleration due to bumps and apply an output sending a signal to activate the viscosity.

As a current active member of Fresno State’s Baja team, I plan on testing this shock absorber on our vehicle. At the moment the vehicle is still being assembled, so I haven’t been able to do any testing yet. However, our team goal is to be done with the vehicle before the end of December and thus giving time to do so. I am confident by the end of my research, not only will I be more familiar with the MR fluid characteristics applications, I will also have a unique design suspension for Baja to show off at the competition.

Funder Acknowledgement(s): Associated Students, Inc. and Undergraduate Studies

Faculty Advisor: The Nguyen, then@csufresno.edu

328
Subcategory: Civil/Mechanical/Manufacturing Engineering

Prediction of the Efficient Frontier of a Bicriteria Optimization Problem

Melanie Sifuentes Rodriguez, University of Puerto Rico, Mayaguez
Co-Author(s): Vyrmarie Ramos Torres, Rolando Rivera Montes, and Mauricio Cabrera-Rios, University of Puerto Rico

Previous work in our group approached the prediction of the efficient frontier of a bicriteria optimization problem using artificial neural networks (ANNs). The first results proved the idea feasible by competitively predicting part of the efficient frontier. The next step in this line of research is undertaken here and includes predicting the entire efficient frontier. The reason behind attempting to predict the efficient frontier is that of providing quick and competitive estimates for decision-making without having to solve the actual optimization problem. When it comes to portability and transferability, an approximation is almost always computationally lighter in both aspects than an optimization task. In this project, ANNs were selected for their proven approximation capabilities. Ideally, this work will result in a general solution to the bicriteria optimization problem with two decision variables.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant HRD 0833112 (CREST program), as well as the National Institutes of Health MARC Grant 5T36GM095335-02 “Bioinformatics Programs at Minority Institutions”.

Faculty Advisor: Mauricio Cabrera- Rios, mauricio.cabrera@gmail.com

329
Subcategory: Civil/Mechanical/Manufacturing Engineering

Modifying Commercial Biomechanic Sensors to Monitor Ozone Pollution

Brandon Speed, Morehouse College/University of Virginia
Co-Author(s): Jiaqi Gong and Emilio Esteban, University of Virginia

This work presents a design of an ozone sensor module for body sensor networks to achieve environment monitoring and potential medical applications. We chose to study ozone because when at ground level, it has a dangerously high oxidizing factor that can cause damage to the mucus and respiratory systems. The goal of this research is to develop a sensor-node-compatible ozone sensor module to detect the ozone concentration of air. We chose Shimmer sensor node as our fundamental design element. Shimmer is an off-the-shelf biomechanical sensor node that is becoming the leading edge of sensing technology because of its versatility and flexibility. Then, we chose to use a MiCS-2610 O3 electrochemical sensor because of its low-cost and low power properties. In order to combine the sensor and Shimmer node, we designed the sensor daughterboard with a connection node that will connect to the top of the main board. When designing the sensor daughter-board, we used PADS Logic to design the schematic, PADS

Layout to create the layout of the daughterboard, and ShimmerConnect to view the sensor's data that is being collected. We created a graph that projects the sensor's potential reading at high and low internal resistance. Then we took primarily data around campus to see if this data matches our potential readings. In the future, we will calibrate the ozone sensor using the sensor data from an ozone chamber. We believe that this study will help people with asthma.

Funder Acknowledgement(s): University of Virginia, ASSIST Program, National Science Foundation, Morehouse College, John H. Hopps, Jr. Defense Research Scholars Program.

Faculty Advisor: Jeffrey Handy, jahandy@morehouse.edu

330
Subcategory: Civil/Mechanical/Manufacturing Engineering

Applying Multicriteria Optimization in Fa-nS Concrete Mix at Early Age

Giovanni Torres Suarez, University of Puerto Rico, Mayaguez
Co-Author(s): Nitza M. García, Department of Industrial Engineering, University of Puerto Rico Mayagüez
Luís Zapata, Department of Civil Engineering and Surveying, University of Puerto Rico Mayagüez
Mauricio Cabrera, Department of Industrial Engineering, University of Puerto Rico Mayagüez
O. Marcelo Suárez, Department of General Engineering, University of Puerto Rico Mayagüez

Ever wonder how the crack on your wall or ceiling got there? If there is ever an earthquake or another natural disaster, will your house be able to resist it? That crack you are worrying about most probably got there due to the quantity of materials selected in the concrete mix used to build your house. The compressive and tensile strength of any concrete structure is based on how one selects our coarse and fine aggregates, cement, water ratios, chemical and mineral admixtures. By focusing on the concrete mix itself, it is possible to help alleviate multiple problems that affect our houses as well as every bridge, building and road that has been built with concrete. Construction projects, however, always require considering multiple criteria such as cost, manageability, time to delivery and ecological impact. It is expected that multiple trade-offs arise in this performance measures. In this project, formal multiple criteria optimization techniques will be used to characterize trade-offs and viability in construction projects involving fly ash-nanosilica concrete mix at early age to determine if there is a particular mix that will perform better than a conventional mix considering all important performance measures simultaneously. Preliminary results indicated that favorable trade-offs can be found when replacing Portland cement with fly ash and nanosilica, as the concrete's compressive strength is better than average. Future research will take into consideration material cost, strength to weight ratio, safety and ecological aspects.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant No. HRD 0833112 (CREST program). Additional support was provided by the US Dept. of Education through Grant No. P120A120097 (MSEIP program).

Faculty Advisor: Mauricio Cabrera Rios, mauricio.cabrera@gmail.com

331
Subcategory: Civil/Mechanical/Manufacturing Engineering

Analysis of Storm Event Characterstics for Washington Metropolitian Region

Elias A. Workie, Univerisity of District of Columbia
Co-Author(s): Pradeep K. Behera, Civil Engineering Department, School of Engineering and Applied Sciences, University of the District of Columbia

It has been recognized that climate change has a strong relation with extreme weather related events which ultimately impacts on our water resources and urban infrastructures. For example, extreme precipitation events can have severe impact on the society and infrastructure systems (i.e. bridges, culverts, drainage and transportation systems, etc.). Climate change can be analyzed through meteorological parameters such as precipitation, temperature; humidity. This project is designed to conduct an analysis of long-term precipitation data. In order to understand the climate change at a specific location based on the precipitation data, the long-term rainfall records are analyzed based on defined statistical events which are based on the inter-event time definition. The storm event characteristics such as event volume, event duration and event intensity are analyzed to see the trend over the last half century. Statistical methods were used to analyze the storm event characteristics. Different storm event characteristics have different significance in design. The results are presented to understand the climate change scenarios of the Metropolitan DC region. Such analysis has a strong practical application for civil engineers and water resources professionals who are responsible for analyzing, designing, maintaining the urban infrastructure systems.

Funder Acknowledgement(s): I would like to acknowledge the STEM Departement for funding me throughout the research.

Faculty Advisor: Pradeep K. Behera, pbehera@udc.edu

332
Subcategory: Computer Engineering

Raspberry Pi Architecture and Capabilities

Erick Barros, New York City College of Technology

The purpose of this research is to evaluate the hardware design aspects as well as the Python programming language and IDE of Raspberry Pi, and compare its attributes to the Atmel ATmega 328, Arduino Microcontroller system. The Raspberry Pi starter pack is used to approach this study because aside from the Pi (included), there are components that become a great accompaniment and there is everything needed to get a distro image loaded and running. Raspberry Pi setup takes quite some time because unlike the Arduino microcontroller it needs a Linux distribution in order for it to work. The Linux distribution must be installed into an SD card which will then be inserted into the Raspberry Pi. Like a computer it also needs a monitor screen, mouse and keyboard.

However, it was later discovered that the Pi can be controlled through SSH (SecureShell) or Serial communication; monitor, mouse and keyboard were no longer needed. Wi-Fi connection allowed updates and downloads to be made which later became necessary for GPIO pin setup and to use the Pi's Web IDE (Web Integrated Development Environment). Furthermore, the python programming language was used in several small projects involving LED, servo and photocell sensor control. It is already known that the Arduino microcontroller and the Raspberry Pi are capable of controlling other devices but unlike Arduino, the Pi does not have a blinking program. One of the goals was to create one for it with the python programming language and then make comparisons with Arduino's blinking program which is written in C programming language. With access to the Pi's Web IDE, the blinking program created was put to the test and debugged for any errors. The same was done for the other small projects involving servo and photocell sensor control. Future work will allow for the development of a blinking program that will run endlessly. It will also give more time to replace the servo and photocell sensor used with something more accurate and precise. Results will surely be enhanced.

Funder Acknowledgement(s): Louis Stokes Alliance For Minority Participation

Faculty Advisor: Edward Morton, emorton@citytech.cuny.edu

333
Subcategory: Computer Engineering

Sandwich Node: A New Wireless Sensor Node Architecture for Real-Time Data

Darlene Espiritu, Virginia State University

Earthquakes are inevitable and cause a lot of damage and destruction. Sensing networks are installed on infrastructure components such as bridges, structures, and pipelines to detect damage caused by earthquakes, winds, or other extreme events. Sensors can measure displacement, acceleration, pressure, temperature and a variety of other environmental characteristics from multiple locations on a structure and send the data to a central location for collection and processing. Wireless sensor networks (WSN) are used for structural health monitoring, in other words, estimating the state of structural health, or detecting the changes in a structure that affect its performance. A WSN needs to be able to collect data samples in real time while the loading event is taking place. This paper focuses on the challenges that the current WSNs face and discusses a proposed solution called the sandwich node architecture. This architecture consists of two Imote2s (sensor node) electrically connected via Universal Asynchronous Receiver/Transmitter (UART) and a sensor board called SHM-A. Tests were conducted in a computer laboratory environment and on a three-dimensional shaking testbed to evaluate the consistency of the performance of the proposed sandwich node architecture. The tests resulted in a significantly shorter response time, allowing the sandwich node to quickly switch from collecting data to a higher priority task such as an ongoing earthquake. With the addition of an extra mote as opposed to the traditional WSN that does not support a dual-mote capability, this architecture has an extra computing power that successfully allows the network to collect data in real-time. It is suggested that the sandwich node continue to be further developed to completely replace the use of the current wireless sensor network.

Funder Acknowledgement(s): National Science Foundation through the Research Experience for Undergraduates program (EEC-1263155); George E. Brown Jr. Network for Earthquake Engineering Simulation (NEES) Cooperative Agreement CMMI-0927178.

Faculty Advisor: Ali Ansari, aansari@vsu.edu

334
Subcategory: Computer Engineering

Robotic Engineering and Data Processing

Calvin Fitts, Jr., Elizabeth City State University

The Robotic Engineering and Data Processing project is focused on the design of an autonomous vehicle with a limited budget. The allocated prototype budget was under $1000.00 for all parts and programming requirements. The new autonomous vehicle entitled Autonomous Vehicle Beta (AV Beta) consists of both used and new parts. The objectives of this project were to physically reconfigure mechanical components, program on-board Field-Programmable Gate Array (FPGA) with hardware cores, and write software to accept commands and send telemetry. In this project, a robotic autonomous vehicle was assembled to perform a power efficient development plan to communicate data over areas via Wireless Fidelity (Wi-Fi). Wi-Fi enables networking capability that allows computers and other devices to communicate over a wireless signal. The Robotic Engineering and Data Processing project will essentially reconfigure an existing autonomous vehicle. Reconfiguration would be applied to the existing robot to run commands such as directional navigation and scanning of terrain regions to collect data. The robots are designed to complete tasks that allow the operator to understand the data processing procedure. Several autonomous vehicles were assigned to us in order to break down and become familiar with the different parts. The autonomous vehicles were purchased from a third party company for utilizing on previous NASA projects. For this project, those autonomous vehicles were dismantled to reuse parts such as ultrasonic sensors, microcontrollers, Wi-Fi capability, camera, tires/wheels, engines, battery packs, and chassis. The framework of this project such as the functionality of tires, batteries, camera as well as electronic components has been tested for proper functioning in robot. For future work, an effective autonomous vehicle should be fabricated to utilize advanced programming and hardware technology.

Funder Acknowledgement(s): This project was supported by a grant from NASA-NSTI awarded to Akbar Eslami a faculty member in Department of Technology at ECSU.

Faculty Advisor: Akbar Eslami, aeslami@mail.ecsu.edu

335
Subcategory: Computer Engineering

RFID Technology

Arthur Wesley, Savannah State University

RFID technology is based on the simple idea that an electronic circuit or tag, self powered or powered intermittently through radiation from a distance, can transmit information in air that can be read by a reader located at a distance. These tags are nothing but plain antennae bonded to a silicone chip kept inside a plastic or glass case. The principal goal of his project is to successfully design, implement, and test a low power, low frequency (125 kHz) RFID tag reader for the passive RFID tags in Savannah State University ID cards. The tag reader system will be based on the Arduino and Parallax based Embedded System. The project was implemented in the following stages: Analysis of Design, Design Implementation, and Testing. The combination of hardware and software design is beneficial to understanding the basics of microcontrollers in both platforms and most important RFID Technology. The main goal of the project was achieved, both Aurdino and Parallax boards were successfully responding with the RFID reader. To accomplish this each board had to be programmed in its respective language code. For Aurdino the code language was C++ and the language code for Parallax was P Basic. Certain code function allowed me to save specific information about each ID card such as name and the declared major of the student. The hardware aspect was making the right connections between the board, the RFID reader, and computer in order to get the right communication levels of each component. I found out that response time was not a factor of comparison. A better comparison factor is which board was less complex to design. This is determined by the program the code was implemented on, the actual code, and the hardware connection. Between the two, I concluded that the Parralax Basic Stamp Board was relatively easier to design than the Aurdino board. RFID Technology is used in different aspects of every day life. Its used for neighborhood access gates, book barcoding, packaging barcoding, and passport barcoding. RFID Technology is starting to be implemented in schools for tracking and attendance purposes. Some parents like the idea of their child being tracked and some do not. In the future the use of RFID does not have to stop at students but can be used by everyone. Each individual could have a RFID Chip embedded inside as a substitute for a driver's license or ID. This would allow the government to know where you are at all times. There are certainly pros and cons.

Funder Acknowledgement(s): PSLSAMP

Faculty Advisor: Chellu Devi, devic@savannahstate.edu

336
Subcategory: Computer Science & Information Systems

Programming Lego Mindstorms NXT Robots for High Altitudes

Austin Little, Morehouse College

Although Lego Mindstorms NXT robots have been previously sent to altitudes via high altitude weather balloons, using them to conduct experiments at these high altitudes is scarcely documented. The task given was to create and program a robot to open three vials for the graphene research group, as well as a petri dish for the biomaterials research group. The biomaterials petri dish contained PVCL fibers, and their purpose was to understand the properties of the PVCL fibers at 90,000 ft for the High Altitude Research Project (HARP). Each vial for the graphene group contained small samples of graphene in order to understand the properties of graphene at different altitudes in the atmosphere. To fulfill these tasks, we used a lifecycle approach and divided the robotics group into three teams: build and design, data logging, and programming. The programming team's objective was to understand the request of the bio-materials and graphene research groups and design a program that was compatible with the design of the robot. The program for the biomaterial group used a barometer sensor to measure the air pressure until 90,000 ft to activate the NXT motor that opened the petri dish containing the PVCL fibers. The program also included a timer to reverse the motor to close the petri dish after twenty minutes. The graphene program included multiple timers to activate motors that rotated a platform and opened and closed three vials at six-minute intervals. The data logging team developed a programmed that logged the completion of each task. Prior tests show the tasks given were executed appropriately and that the robot was fully functional at the time of the launch. For future tests, a triangle based infrastructure should be considered as well as supplementary materials for support. Further logic needs to be developed to adjust to the altitudes the weather balloon reaches as well as simultaneously running programs.

Funder Acknowledgement(s): This research is supported by the following grant(s): NSF-HRD-1043330, Morehouse College M - WISE Program.

Faculty Advisor: Alicia Thomas, athomas@morehouse.edu

337
Subcategory: Computer Science & Information Systems

Development of Secure Web Browser To Protect Smartphones From Malicious Web-based Attacks

Ian Miller, Tennessee State University
Co-Author(s): Sachin Shetty, Tennessee State University

Recently, the smartphone and tablet industry has seen tremendous growth due to the widespread adoption of devices based on Google's Android and Apple's IOS platforms. Evidence shows that 190 million Android based smartphones are used in 130 countries. The worldwide market penetration of Android based smartphones and lack of a secure platform has attracted the attention of malware developers. The Juniper Global Threat Center reported a 472% increase in Android malware samples between July and November 2011. Android users typically use web-based apps and web browsers to display web contents or interact with web applications. The web-based apps and web browsers acquire contents from web servers using the standard HTTP protocol, display the web contents, and allow users to interact with the web servers. Thus, both web-based apps and web browsers are susceptible to web-based attacks.

This research is being conducted with the belief that a detection system can be implemented on Android smartphones to detect malicious URLs. The aim of this research is to create a secure Android web browser application that will detect malicious URLs and prevent malware attacks, thereby decreasing the vulnerability of Android systems. The browser monitors the user's Internet activity to ensure safety, while also maintaining the functionality and performance that smartphone users expect. When the user selects a website, the browser sends the desired URL (Uniform Resource Locator) to the detection system located on a Cloud server that cross-checks the URL to determine if the website is malicious. If it is determined that the website is malicious, the browser prevents the user from accessing the website; however, if it is found to be non-malicious, the user can proceed to the desired website. In addition to maintaining the performance and functionality of standard Android web browsers, the developed browser consumed the minimum amount of battery life. This is because if the browser consumes an excessive amount of power, it will seriously detract from its usefulness, deeming it essentially obsolete.

The results of the research were as expected. The detection system was able to detect a vast amount of malicious websites. The browser, which was designed to consume a minimal amount of power, consumed less power than the default Android browser, even while mainitaining constant communication with the detection system housed on the Cloud server.

Funder Acknowledgement(s): This study was funded by the NSF Research Initiation Award awarded to Sachin Shetty, College of Engineering, Tennessee State University

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

338
Subcategory: Electrical Engineering

Fetching Objects with Robots

Patrick Dean, Jr., Savannah State University
Co-Author(s): Asad Yousuf, Savannah State University

Robotics technology is used in all sectors of engineering and other areas such as manufacturing. With Robots we can achieve precision and control through hardware and software interfacing. The purpose of this project is to learn the design and implementation of major components of a Robotic System using Hardware and Software interfacing concepts. The objectives of this project are to: 1) Learn the major components of Robotics Systems, 2) Learn fundamental concepts of Robotics Navigation and transportation of objects, 3) Learn how to use PBASIC for modeling basic building blocks of Robotics system, and 4) Learn microcontroller technology and impact of using microcontrollers in robotics system design. The design will be carried out using the Parallax Integrated Development Environment.

The project will be implemented in the following three stages: Analysis and Design, Design Implementation, and Testing and Verification. The combination of software and hardware design makes this platform an excellent choice for summer under-graduate student projects in both design and research aspects. Understanding the basics of PBASIC programming language and

the hardware associated with the Robotic system was a requirement of this project. In the end, the goal of the research was to program the robot to maneuver towards an object, pick the object up, pivot 180 degrees and return to its starting position.

Funder Acknowledgement(s): Funded by the National Science Foundation MAGEC-STEM Plus Program.

Faculty Advisor: Asad Yousuf, hansenl@savannahstate.edu

339
Subcategory: Electrical Engineering

Development of Nano-Neural Sensing and Stimulation Devices and System

Hae Seong Kim, College of William & Mary
Co-Author(s): Chris Hill and Brannon Floyd, Norfolk State University

In the Nano-Neural Sensing and Stimulation System that is under development, there are three major components: Wireless Power Transmission, Supercapacitor and Optical Sensing. Wireless Power transmission is the transfer of electrical energy from a power source to an electrical load wirelessly. Wireless transmission is useful in cases where interconnecting wires are inconvenient, hazardous, or impossible. Wireless power transmission is chosen for the system for its convenience in charging the transplanted device in a rat's brain and for eliminating disturbance by the rat's movement from wires. By using magnetic resonant coupling, power will be transmitted between the coils over a range of a few times.The wireless power network will be used to charge a micro-controller unit and a supercapacitor. A supercapacitor is a device that is able to store and deliver a large amount of energy. A supercapacitor is ideal for the system for its high energy discharge and a great number of charging cycles which provides a long life.

The immediate objective of this research is to power electronics and a laser diode for the purpose of neural stimulation and sensing. In neural sensing, Surfaced-enhanced Raman scattering (SERS) will be applied to amplify the signal of neurotransmitter activity. SERS is a phenomenon in which the intensity of Raman scattering is remarkably enhanced when a molecule is bound to rough metals such as silver, gold and copper. With SERS, more precise detection of neurotransmitteractivity can be achieved.

Funder Acknowledgement(s): NSF-CREST (CNBMD) HRD 1036494

Faculty Advisor: Hargsoon Yoon, hyoon@nsu.edu

340
Subcategory: Electrical Engineering

Design and Stress Analysis of a Load-Carrying Hanger Using SolidWorks Simulation Softwawre

Maleek Montgomery, Savannah State University
Co-Author(s): Mir Hayder, Savannah State University

In this study, the static analysis of a load-carrying hanger was performed using SolidWorks Simulation software. The study was carried out in two stages. In the first stage, a suitable 3D model of a load-carrying hanger was developed, and in the next step, stress analysis was conducted keeping one side of the hanger fixed to a wall. The main focus was to understand where the maximum stress is developed when the load is applied from the top of the hanger. In addition to the stress data, displacement and strain data was analyzed to develop a better understanding. Results show that for all loads applied to the hanger, the maximum stress was developed on the upper horizontal part where it is attached to the wall. None of the three parts failed/yielded due to loads tested in the study.

Funder Acknowledgement(s): Funded by the National Science Foundation (NSF-MAGEN-STEM Plus Program).

Faculty Advisor: Mir Hayder, hansenl@savannahstate.edu

341
Subcategory: Electrical Engineering

Body Area Networks: Challenges and Opportunities

Cassandra Stanford, University of the District of Columbia
Co-Author(s): Sasan Haghani, University of the District of Columbia

Advances in wireless communication technologies have enabled novel approaches in ubiquitous healthcare with biosensors allowing various functions to be monitored from the surface of the skin, sub-dermally, or internally ingested. Electronic systems that integrate with the body provide powerful diagnostic and therapeutic capabilities. This burgeoning industry is flourishing due to miniaturization of hardware elements, energy harvesting techniques and technologies, and the evolution of RF devices. Multiple observations may be analyzed in real-time, acting as a mutually beneficial adapter between patients and doctors. These intelligently designed systems provide a multitude of medical applications that promote quality of life improvements for those under critical care, and for those looking to adopt preventative lifestyles. This paper aims to provide a comprehensive overview of progressive application scenarios, issues, and challenges prevalent in deploying Body Area Networks (BAN). Existing challenges in the design of BAN including power consumption, cost efficiency, and ease of use and wear-ability are investigated. Communication protocols, sensor/actuator systems, and radio technology aspects are explored extensively.

This paper examines current state-of-the-art breakthroughs in the area of BAN and explores the development of new BAN where nanotechnology and tissue friendly material designs allow a seamless interface between body and technology.

Funder Acknowledgement(s): This research was supported in part by the grant NSF/HBCU-UP-HRD-0928444.

Faculty Advisor: Sasan Haghani, shaghani@udc.edu

342
Subcategory: Electrical Engineering

CZTS (CZCELL)

Danielle Williams, Southern Polytechnic State University

Throughout many vigorous weeks, Southern Polytechnic State University's cohesive team of students has been researching to find the best possible combination for the renewable, low cost, highly efficient Copper, Zinc, Tin and Sulfur. Known as CZTS the solution (combined correctly with heat, temperature and element combination) will effectively give large uniform grains with all of the elements annealed onto soda lime glass producing a thin film. CZTS (Cu_2ZnSnS_4), polycrystalline, is a thin film prepared by a non vacuum, liquid base coating method. Before research, we predicted to make alterations/adjustments to the copper, zinc, tin and sulfur by percentages(%) rather than doubling or tripling the elements to test its absorption and grain size. We predicted to time the annealing process in the range of 30mins to 4 hours with an annealed temperature between 450-560 degrees Fahrenheit.

During observations we have noticed temperature, time and the element combination has to all combine together perfectly to give the desired results of larger uniform grains, a thick solution which produces better absorption for the thin film we are producing. For instance at 3 hours and 450F, sulfur drops from the CZTS so there is constant adjustments by a percentage to give enough to remain while temperatures increase.

After a few tests, trials and error we noticed we only altered copper by decreasing it by percentage but did not work with the remainder (ZTS) the same. When we decreased copper, increased Tin and Sulfur and kept the remainder of the compound (Zinc) the same, we received the best large uniform grain pattern when the solution was annealed for four hours and the temperature was around 485/500F. CZTS's purpose is to provide a thin film that can be used in the manufacturer of products like solar panels, cell phones, etc. CZTS is on the rise as it is vital due to its abundance, usability, high efficiency and low cost. Based on characteristics associated with good absorption, we know uniform large grains and thick solution will produce a thin film that consumers will appreciate in the future.

Funder Acknowledgement(s): We thank a few organizations for making this happen. They will be announced during our presentation.

Faculty Advisor: John Hart, jhart2@spsu.edu

343
Subcategory: Electrical Engineering

Gas Emissions Monitoring System

Latoya Williams, Virginia State University

The objective of this study is to create an emission gas monitoring system which will monitor the amount of noxious gases released while a vehicle is running. Noxious chemicals including carbon dioxide and nitrogen oxides are released into the air from the automobiles even though an evaporative emission control system limits the discharge of noxious gases from the internal combustion engine and other components. I am designing and constructing an emission gas monitoring system to monitor the level of gases from the car.

This system will consist of sensors, an interface system, data inquisitor and a fixture to hold the system. The oxygen and carbon dioxide sensors will be used to measure the amount of gases released from the car. An interface system will be located between the sensors and the data inquisitor. The interface system is used to transfer the collected data through the sensors to the data input for the data inquisitor system. After the data is collected, a statistical analysis will be applied to test the reliability of the system. This emission gas monitoring system could help develop a new technology to improve the level of gases released in the environment.

Funder Acknowledgement(s): Jinmyun Jo, Virginia State University

Faculty Advisor: Jinmyun Jo, jjo@vsu.edu

344
Subcategory: Electrical Engineering

Development of Room-Temperature Radiation Detectors

Kefyalew Zergaw, Alabama A&M University
Co-Author(s): Stephen Babalola, Center for Irradiation of Materials, Alabama A&M University

Radiation detectors are devices that detect the presence of radioactive materials. These devices are in demand for heightened border security to deter illicit trafficking of nuclear materials. Si and Ge detectors have excellent energy resolutions but due to their small energy band-gap (0.67eV and 1.1eV respectively) require cryogenic cooling, resulting in bulky, usually stationary and expensive devices. There is a need to develop smaller, portable detectors that will operate at ambient temperatures, are rugged and compact for field operations with the potential of being incorporated in to existing electronic devices for covert operations.

CdZnTe [1,2] has emerged as the most promising material due to its excellent properties, including wide, tunable band-gap, high mobility-lifetime (μT) product for electrons, high resistivity and good electron transport properties. CdZnTe is a direct band gap material that is obtained by alloying CdTe and ZnTe. CdTe has a band gap energy of 1.5eV, and with the addition of Zinc, Zn atoms substitute Cd atoms in the lattice thereby increasing the band gap energy to ranges of 1.6 - 1.8 eV. Charge transport calculations predict an excellent energy resolution of less than 1% FWHM at 662 KeVgamma for CdZnTe based detectors but in reality much lower resolutions (6-3% FWHM) are achieved. The deterioration in detector performance is attributed to defects in crystals as well as defects induced through device-fabrication.

This research is focused on identifying and characterizing the defects that limit the performance of CdZnTe crystals. Extensive material characterization and defect analyses were performed using IR microscopy, internal electric field imaging (Pockels Electro-Optic Effect), Etch-pit analysis, AFM, Micro scale X-ray response 3-D mapping, These studies resulted in better understanding of the formation of crystal defects such as Te inclusions and precipitates, voids, twin boundaries and grain boundaries.

References: A.J. Dabrowski, J. Chwaszczewska, J. Iwanczyk, R. Triboulet, Y. Marfaing, IEEE Trans. Nucl. Sci., NS-23 (1976), p. 131.

Y. Eisen, A. Shor, C. Gilath, M. Tsabarim, P. Chouraqui, C. Hellman, E. Lubin, Nucl. Instrum. Methods A, 380 (1996), p. 474.

Funder Acknowledgement(s): These studies resulted in better understanding of the formation of crystal defects such as Te inclusions and precipitates, voids, twin boundaries and grain boundaries. This research has supported in part by the NSF HBCU-UP grant #HRD0928904.

Faculty Advisor: Mostafa Dokhanian, mostafa.dokhanian@aamu.edu

345
Subcategory: Environmental Engineering

Fractal Nature of Viscous Fingers Formed During Oil-Water Separation

Claudio M. Calderon, University of New Orleans/Michigan State University
Co-Author(s): Volodymyr Tarabara, Michigan State University

Following the Deepwater Horizon oil spill disaster, environmental agencies have focused their attention on oil spill cleanup. In order to address the challenge of cost-effective high flow rate oil-water separation, this research focuses on the improvement of hydrocyclonic separation. Understanding how water flows through oil films will give this project a good start on how to design a membrane to retain oil and allow water to pass through. The intrusion of a low density liquid into a higher density liquid produces formations called viscous fingers. These formations expand from the point of intrusion radially and form intricate patterns that under some conditions obey simple scaling laws.

Our study focuses on the dynamics of finger formation and patterns produced during the injection of oil-in-water dispersion into an oil film. In order to study viscous fingering, we designed a Hele-Shaw cell consisting of two plexiglass plates separated by a gap; the top plate has an orifice diameter for injecting the “intruding” fluid (oil-in-water emulsion) into the “defending” fluid (oil).To determine the presence of fractal structure in the fingers, image processing software (Image J) and simple built-in numerical algorithms were used. The fractal dimensions for different injection rates were determined. The results we obtained suggest that as the injection increases, fractal dimension of the viscous formation decreases and aspect ratio increases. Also, an increase in oil concentration produces a slower decrease in fractal dimension as injection rate increases.

Funder Acknowledgement(s): MSU Summer Research Opportunities Program; Environmental Protection Agency STAR.

Faculty Advisor: Volodymyr Tarabara, tarabara@egr.msu.edu

346
Subcategory: Genetics

Intelligent Detection of miRNA by Competitive Strand Displacement

Esmarline De León Peralta, University of Puerto Rico at Mayaguez/Ohio State University
Co-Author(s): Carlos Ernesto Castro, Ohio State University

Micro-RNAs (miRNAs) represent a major class of small non-coding RNAs (19-25 nucleotides) that regulate gene expression post-transcriptionally. miRNAs generally function through a process known as RNA interference (RNAi), in which miRNAs base pair with messenger RNA (mRNA) in a complementary manner. This results in either mRNA degradation or translation inhibition ultimately silencing gene expression. They control almost one third of all the human genome and play an important role in many cellular processes, such as proliferation, apoptosis, differentiation, and stress response. Furthermore, the diversity of miRNAs is remarkable, particularly for their role in malignancy, functioning as tumor suppressors and oncogenes. Dysregulation (over- or under-expression) of miRNAs has been implicated in a variety of devastating diseases, including many cancers. In the majority of these cancers, it is not a single miRNA that gets dysregulated but rather a combination of multiple miRNAs that may result in or serve as a marker for specific types of cancer. Because of this, novel approaches to miRNA detection have been widely pursued; however, there is currently no technology capable of detecting specific combinations of miRNAs inside cells. The goal of this work is to design a novel platform for fluorescence-based detection of multiple miRNAs using a logic based approach. The initial goal of this work is to design a DNA origami structure capable of detecting pair wise combinations of miRNA in AND and OR logical configurations. Initial proof-of-principle experiments will be performed using DNA targets. We currently have developed an initial design to detect miR-21 and miR-155, which are miRNAs dysregulated in cancer that function as diagnostics and prevention markers in several different diseases, particularly in breast cancer. Our findings will help advance the diagnosis of cancer with novel miRNA detection technology.

Funder Acknowledgement(s): This project was supported by a research grant from the National Science Foundation: The Nanoscale Science and Engineering Center (NSEC), under Grant #0425626, Department of Mechanical and Aerospace Engineering and Nanoengineering and Biodesign Lab.

Faculty Advisor: Carlos Ernesto Castro, castro.39@osu.edu

347
Subcategory: Geosciences and Earth Sciences

Lag-correlation Analysis Between Precipitation and Soil Wetness Variation

Jhonatan Alvizurez, New York City College of Technology
Co-Author(s): Simon Kraatz and Kibrewossen Tesfagiorgis, New York City College

Floods are one of the major causes for property damages and loss of life around the world. The ability to globally monitor flood events as they unfold makes it possible to assess their impacts more accurately, even if the floods occur in remote regions. In a recent flood event in Argentina, which occurred during April 2013, it caused about 530.4 million pesos ($104 million) in damages, (DyN, 2013), and at least 51 deaths, (Gilbert 2013). This study is hypothesizing that the severity of flood events mainly depends on precipitation and soil moisture primarily focusing on lag correlation. To prove this hypothesis we analyze two data sets. Soil Wetness Variation Index (SWVI) (Lacava et al. (2006, 2008)) which is data use for flooding observation. SWVI is initially calculated from data (Brightness Temperature) collected by Advanced Technology Microwave Sounder (ATMS), on board of Soumi-NPP. For this study the data is collected from a daily global flood observation system developed by Scientist at NOAA-CREST. And precipitation data obtain from Tropical Rainfall Measuring Mission (TRMM) 3B42v7, TRMM-adjusted merged-infrared precipitation data set. Results indicate a lag of 4 days to be the highest correlation, and a lowest negative lag correlation of 0 day. Future work will include analyzing lag correlation in Argentina and different locations to examine the accuracy and consistency of these findings.

Funder Acknowledgement(s): This project was made possible by the Research Experiences for Undergraduates in Satellite and Ground-Based Remote Sensing at CREST_2 program funded by the National Science Foundation (NSF) under grant AGS-1062934. Its contents are solely the responsibility of the award recipient and do not necessarily represent the official views of NSF. Also a special thanks to Simon Kraatz and Kibrewossen Tesfagiorgis for their mentorship in this project, and Reginald Blake, Janet Liou-Mark, Shakila Merchant and Mr. Chinedu Chukuigwe for the opportunity to conduct this research. Also a last thanks to The New York City College of Technology Foundation for founding this project.

Faculty Advisor: Kibrewossen Tesfagiorgis, kibrewossenb@gmail.com

348
Subcategory: Materials Science

Thermal Cycling Life of Gadolinium-Zirconate (GZ) And Yattria-stabilized-zirconia (YSZ) Double Layer Thermal Barrier Coatings (TBCs)

Uchenna Agu, Southern University and A&M College, Baton Rouge
Co-Author(s): Stephen Akwaboa, Ravinder Diwan, and Patrick Mensah, Southern University and A&M College

Thermal barrier coatings (TBC) are protective coat components of aircrafts and industrial gas turbine engines to extend the performance limits of super alloys. 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 the adverse effect of sintering. Due to sintering effects, the strain tolerance reduces along with an increase in the Young's modulus which leads to higher stresses in the coatings and thus leads to reducing the thermal cycling life. Rare- earth Zirconates with general formula "M" _"2" 〖"Zr" 〗_"2" "O" _"7" shows promising thermo physical properties, i.e., lower thermal conductivity than YSZ and high therma,l however, its greatest weakness is that its coefficient of thermal expansion (CTE) is lower than that of YSZ which results in high thermal stresses. The primary objective of this study investigated and analyzed the thermal cycling life and mechanical properties of functionally graded YSZ and GZ double layer TBC tested at 1100.C and compared results to single layer GZ and YSZ TBC. Samples used for this experiment were prepared using in-house plasma spraying equipment at APS Standard (STD) coating type and tested using CM 1700 bottom loading programmable furnace for thermal cycling tests. The test were conducted as in (Ogad et al 2010). The results showed that YSZ and GZ double layer TBC averaged more thermal cycles compared to single layer GZ and YSZ TBC. Further research can be conducted on the effect of doping on the thermal properties of YSZ and GZ double layer TBC.

References: Robert Vassen, Alexandra Stuke, and Detlev Stover, Recent Developments in the Field of Thermal Barrier Coatings, Journal of Thermal Spray Technology., Vol 18(2), 2009, p 181-186.

Ogad Agu, Ravinder Diwan, Patrick F. Mensah, Monica B. Silva, and S.M. Guo, “Porosity and Thermal Cycling Behavior of Plasma Sprayed and EBPVD Thermal Barrier Coating”, Proc. Of ASME Turbo Expo: Power for Land, Sea and Air GT June 14-18, 2010, GT 2010- 22433, (2010).

Funder Acknowledgement(s): Supported by Clean Power and Energy Research Consortium with sponsorship from DOE grant Number DE-FG0-2608NT001471 and HBCU-Rise Award.

Faculty Advisor: Patrick Mensah, Patrick_Mensah@subr.edu

349

Subcategory: Materials Science

Measuring Fracture Properties of Soft Gel Materials

Alex A. Avendano, Iowa State University
Co-Author(s): Pranav Shrotriya, Iowa State University

Micromechanical models developed for the deep penetration of a soft solid are used to quantify fracture properties of soft materials. Specifically, the energy release rate (Jic) and the fracture toughness (Kic) are measured for PVA gel like material similar to silicone rubber. A cylindrical punch is utilized to determine the fracture mode of the material. In this process the soft solid is penetrated with the punch until reaching steady loading conditions and then the corresponding crack geometry is recorded to decide the fracture mode. The determination of the fracture mode allows for the selection of the appropriate model to analyze the data. The punch radius was then varied along with the crack geometry to determine the minimum penetration pressure. This minimum pressure was then used along with the punch/crack ratio to calculate the value of the energy release rate and the fracture toughness of the solid. These measurements were compared to results from the models to determine the validity of the technique. These properties will be used to further investigate how soft materials fracture which will aid in the investigation of design and optimization of ultrasound treatments to mechanically destroy cancerous tumors. Note: Experiments are currently in progress and results will be obtained by the time of the ERN Conference. It is expected that the PVA gel will follow a Mode I Crack propagation since it resembles a silicone rubber solid which was shown as Mode I in literature.

Funder Acknowledgement(s): Iowa State University Department of Mechanical Engineering Iowa State University McNair Program

Faculty Advisor: Pranav Shrotriya, shrotriy@iastate.edu

350

Subcategory: Materials Science

Electrodepostion of Magnesium on a Metal

Zain Bhatti, North Carolina A&T State University

The purpose of the project is to make any metal biocompatible and non-reactive with an electrodeposition of magnesium. The deposition of the magnesium on a foreign material will aid in stopping reactions within the human body. Metal like lithium is not biocompatible and used as a coin-sized battery in the endoscopic camera. In the process of a camera moving through the organs, lithium chemically reacts with internal fluids (such as saliva) and can cause injury to the internal tissue. My project aim is to deposit magnesium on the iron initially and then perform similar experiments on different metals for the same purpose. The magnesium’s electrodeposition on iron experiments takes place in argon gas environment in the glove box. The electrodeposition of magnesium is performed at various current densities and electric potentials. Magnesium rod and iron plate are used as counter and working electrodes. The methyl magnesium chloride in THF is for deposition of Mg^{2+} on an iron plate. The Mg deposits are systematically characterized by the technique of scanning electron microscope (SEM) for the result purposes. The electrodeposition of magnesium is a step towards making coated metals unreactive or not harmful to tissues and organs.

Funder Acknowledgement(s): National Science Foundation

Faculty Advisor: Jang Yongseok, pooh3180@hotmail.com

351
Subcategory: Materials Science

Flow Sensors from Carbon Nanomaterials

Abenazer Darge, Virginia Tech

Fish have a unique flow sensing organ called a neuromast that helps them detect changes in water flow, which is essential for predation and orientation. Neuromasts contain hair cells that perform this task by transforming mechanical stimulation from the flowing water to electrical impulses that ultimately are transported to the brain. Inspired by this mechanism, flow sensors were fabricated from polydimethylsiloxan (PDMS) that serves as a polymer substrate and carbon nanomaterials, which are a type of smart material that generate voltage when exposed to water flow. The fabrication method used in this study was first introduced by Cao. This method was then modified to fit this research and maximize electrical response. In this process the carbon material is coated with PDMS. This allows it to be embedded within the polymer substrate while part of it protrudes from the surface. This is an effective means of sensor fabrication that prevents the carbon nanomaterial from being washed away by the flowing liquid. Additional improvements have been made resulting in lower sensor resistance and better voltage generation. Some of these include using extra layer of PDMS to prevent water from coming in contact with the electrodes and introducing pin through the electrode to boost electrical conductivity. Different carbon materials such as long and short single walled carbon nanotubes, carbon nanohorn, peapod, and multi walled carbon nanotubes have been used in this research. All sensors from these carbon materials performed well when fabricated using this method. Future focus of this research will be to maximize electrical response by implementing different techniques, aimed at improving hydrophilicity by introducing a functional group such as siloxane to the sensing surface and increasing the surface area in contact between the electrodes and the sensing surface.

Funder Acknowledgement(s): This study was made possible by the grant from NSF EFRI REM to Michael Philen, Aerospace and Ocean Engineeing, Virginia Tech, Blacksbug, VA 24060.

Faculty Advisor: Michael Philen, mphilen@vt.edu

352
Subcategory: Materials Science

Structural and Compression Characteristics of Sintered Recycled Glass Design

Jorge De Jesus Silva, University of Puerto Rico at Mayaguez
Co-Author(s): Wesley Cuadrado, Liliana M. Hernandez, Gerardo Nazario, and O. M. Suarez, University of Puerto Rico, Mayaguez

Soil pollution is a majorproblem typically caused by industrial activity, misuse of agricultural additives, and the improper disposal of wastewater. This research involves the fabrication of porous glass beds embedded with TiO_2 particles for the degradation of soil pollutants. Recycled glass powders with particle sizes of 0.60 mm (MG-30) and 0.18 mm (MG-80), were sintered from 700°C to 800°C for 10 minutes to 30 minutes. Resulting porous glass specimens were characterized by optical microscopy and their porosity assessed by quantitative image analysis.Also, sample water percolation characteristics were measured by recording the elapsed time to obtain a water volume change of 600 ml. Samples of compressive strength were analyzed to determine the amount of soil that it can sustain without fracture. MG-30 porosity values ranged from 63% to 0%, while MG-80 porosity values ranged from 69% to 4%. Brittle MG-30 and MG-80 percolation samples were obtained for low sintering parameters of 700°C to 725°C for 10 to 15 minutes. MG-30 water percolation values ranged from 55.14 ml/s to 3.36 ml/s, while MG-80 percolation values ranged from 18.24 ml/s to 1.73 ml/s. The highest compressive strength for MG-30 and MG-80 samples was obtained at the highest sintering parameters with a value of 80 MPa. We discovered an inverse relationship between the recycled glassstructural characteristics with the corresponding sintering parameters. There exists a direct relationship between the filter original glass particle size and the porosity and percolation time through the filter samples. We found a direct relationship between the compressive strength of the filter and the sintering parameters.

Funder Acknowledgement(s): This project and its participants are supported by the Center for Education and Training in Agriculture and Related Sciences and the Center for Research Excellence in Science and Technology of the University of Puerto Rico-Mayaguez (NSF Grant No. HRD 0833112).

Faculty Advisor: Oscar Marcelo Suarez, msuarez@ece.uprm.edu

353
Subcategory: Materials Science

The Influence of Osmotic Pressure on Energy Relevant Biomolecular Materials

Esha Kapania, University of Virginia/Virginia Tech
Co-Author(s): Eden Cunningham, Hampton University
Katherine Lizette Guillen, Virginia Tech

Bimolecular unit cells, a new and developing branch in the field of bio-inspired smart materials are promising candidates for cellularly-derived devices. They mimic the properties of natural cell membranes and utilize an artificial lipid bilayer created through the droplet-interface-bilayer technique. The bilayer is formed by adding droplets of lipid solutions into an aqueous environment and by utilizing the water/oil interface to create two lipid monolayers, each surrounding the electrolyte droplet containing different ion concentrations. When these monolayers are brought into contact to create a bilayer, the concentration gradient between the two droplets generates a membrane potential and allows for energy storage through selective transport across the membrane. However, a significant limiting factor in the effectiveness and durability of these bimolecular unit cells is the detrimental influence of osmotic pressure. The focus of the study conducted during this summer was to quantify the impact of osmotic pressure on the lifespan of the cells. The hypothesis was that the greater the ionic concentration gradient between the two cells the greater the osmotic pressure, and as a result, the cells would rupture sooner. Preliminary results showed our hypothesis to be true and indicated a proportionality between osmotic pressure and the lifespan of the biobattery.

Funder Acknowledgement(s): This study was supported by a grant from NSF (EFRI-REM) under Grant #0938043 awarded to Michael Philen, Associate Professor, Aerospace and Ocean Engineering Virginia Polytechnic Institute and State University.

Faculty Advisor: Michael Philen, mphilen@vt.edu

354
Subcategory: Materials Science

Annealing and Characterization of Bismuth Selenide Thin Films

Nerrissa Mitchell, University of New Orleans
Co-Author(s): Joesph Brom and Joan Redwing, Penn State University

Topological insulators are a newly discovered category of materials that have conducting surface states, but are insulting in the bulk. Bismuth Selenide thin films are 3-D topological insulators. However, the materials usually have semiconducting behavior due to a high electron carrier concentration. A high electron carrier concentration may be caused by selenium vacancies in the lattice or from defects such as grain boundaries. The selenium vacancies may also be the cause of low electron mobility. The objectives of this experiment were to decrease carrier concentration and increase electron mobility through annealing. For this project, thin films of Bismuth Selenide (Bi2Se3) deposited on sapphire substrates were fabricated, using metal organic chemical vapor deposition (MOCVD) in a cold-walled vertical tube reactor with Trimethyl Bismuth and Dimethyl Selenide as the precursors. The thin films were sealed in glass ampoules with selenium pellets to reduce selenium vacancies by keeping a high vapor pressure of selenium and annealed for 24 hours at temperatures 220°C, 300°C and 400°C in order to increase the grain size and decrease the surface roughness to achieve these goals. The annealed thin films were compared to their non-annealed counterparts (thin films fabricated at the same time) using atomic force microscopy (AFM), a profilometer, and a Hall measurement system. It was discovered that annealing the thin films did not have the intended effects. The results demonstrated that the electron mobility dropped significantly after annealing and decreased more significantly with every increase in annealing temperature. The carrier concentration also increased after annealing. An annealing was done at 300°C using Bi2Se3 flakes instead of selenium in order to determine if this would reduce the selenium vacancies to get the intended results. The results showed that while the electron mobility decreased, the carrier concentration also decreased. Furthermore, annealing did not prove to be effective in improving the grain boundaries. For future research, the thin films can be annealed in ampoules filled with an inert gas to see if the desired results can be produced.

Funder Acknowledgement(s): National Science Foundation (DMR 062040 and DMR 1062691).

Faculty Advisor: Ashok Puri, apuri@uno.edu

355
Subcategory: Materials Science

The Integration of Natural Dyes Into Solar Cells

Eduardo Valle, University of California, San Diego
Co-Author(s): Alaksiandr Zaretski, University of California, San Diego

Silicon solar cells are currently the standard method of harnessing the energy transmitted from the sun into electricity. We are trying to create a new standard of solar cells, one that is made of compounds that are found in every day fruits and easily extracted. The colors of fruits and vegetables arise from alternating single and double bonds (conjugation) in pigment molecules. Different pigments absorb different wavelengths of light; differential absorption of light results in different colors. The absorbing properties of anthocyanins has caught the attention of the solar cell community and has led to the development of Dye-Sensitized Solar Cells (DSSCs) that use anthocyanins as the electron donors (which carry holes) in the active layer of the cell. Current DSSCs can achieve high efficiencies (~12%). The problem with DSSCs is that the electrolytic fluid—which is necessary to shuttle charge from the dye to the electrode— cannot be preserved for long periods of time and is not stable to low or high temperatures because of its liquid nature. Our goal is to create a solid state organic solar cell (OSC) using these conjugated compounds. We will test the photovoltaic capabilities of anthocyanins, chlorophyll, and beta-carotene in bulk or bi-layer heterojunction system with phenyl-C61-butyric acid methyl ester (PCBM) and poly(3-hexylthiophene) (P3HT). By pairing a pigment derived from a natural product with either a fullerene (PCBM) or polymer

(P3HT), we will eliminate the obstacle presented by the electrolyte. We start by extracting and purifying the specific compound. Anthocyanins are extracted from purple corn—a crop that can be grown over large areas in many climates—via vacuum filtration and column chromatography. In a bi-layer system, the purified material is then spin coated onto glass bearing a layer of a transparent conductive polymer. Depending on the respective band gap of the molecule, an adequate small molecule with complimentary band gap levels will then be spin-coated on top of the formal layer. A drop of eutectic gallium-indium as the top electrode completes the device. The cell will then be placed in a solar simulator to test its performance. Preliminary results suggest that anthocyanin and a derivative of C60 form a working solar cell. We will try to further expand this project and implement other natural dye molecules.

Funder Acknowledgement(s): LSAMP, CAMP, McNair

Faculty Advisor: Darren Lipomi, dlipomi@eng.ucsd.edu

356
Subcategory: Nanoscience

Tradeoff Optimization in Nanoproperties: Bactericide Applications

Nicole A. Blanco, University of Puerto Rico at Mayaguez
Co-Author(s): Yarilyn Cedeño, Oscar Perales-Pérez, and Mauricio Cabrera-Ríos, Univerisity of Puerto Rico at Mayaguez

Magnesium Oxide (MgO) nanoparticles are environmentally friendly and have shown antimicrobial activity against bacteria such as *E. coli*. This material could provide a reliable solution for environmental problems such as water contamination and disinfection of medical environments. This project aims towards developing a polymer with food covering applications that can minimize the possibility of food getting contaminated.

The purpose of this work is to eventually minimize the bacterial growth of the synthesis process as function of nanoparticle concentration and particle size. In this work a statistical experimental design was used to perform a tradeoff between MgO characteristics in the nanoscale. The development of an experimental design is key to obtaining the data needed to develop the pareto efficient frontier that will allow us to perform a tradeoff between the conflictive properties in this work. At the end, it will be possible to prescribe the variable levels required in order to minimize the bacterial growth. The use of a Multiple Criteria Optimization Method will enhance the decision-making associated to future experiments that involve tailoring multiple nanoproperties already planned within our research group. Being able to predict outcomes of synthesis process reduces experimental costs and consumption of resources in general.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant HRD 0833112 (CREST program); National Institutes of Health MARC Grant 5T36GM095335-02 Bioinformatics Programs at Minority Schools.

Faculty Advisor: Mauricio Cabrera-Rios, mauricio.cabrera@gmail.com

357
Subcategory: Physics (NOT Nanoscience)

Lithium-Air Battery Stratospheric Performance

Mbeke Tom Ekanem, Morehouse College
Co-Author(s): Rhyan Smith, Morehouse College

The HARP Platform is composed of a multitude of research systems that are lifted to stratospheric levels via hydrogen balloons. The problem that the battery team investigated was to determine the behavior of a prototype lithium air battery under stratospheric conditions. Further using a prototype lithium air battery, the battery team supplied electrical power to two light emitting diodes (LED) lights in order to observe the behavior of a termite behavior co-experiment in the HARP platform. We hypothesized that the lithium air battery performance would improve at high altitudes.

In order to test our hypothesis, the prototype battery was first tested under laboratory conditions of low temperature and pressure in order to mimic the conditions of the earth's stratosphere. Laboratory data suggests that our battery performed best in low temperature conditions, in which, the voltage increased from 0.5 to 7.0 volts. In-flight remote monitoring of the Lithium Air Battery on the HARP platform revealed that voltage performance improved with altitude. It was determined that there was a direct correlation between temperature and battery efficiency. Lower temperature may have increased the amount of oxygen available at the cathode component of the battery. Future research will involve the testing of lithium air batteries without a supply of prepackaged oxygen supply. The second generation of prototype batteries will provide useful power by overcoming the limitations of current oxygen filter technologies.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant No. DMR-0934142, Clark Atlanta University and Morehouse College PREM.

Faculty Advisor: Darkeyah Reuven, darkeyah.reuven@gmail.com

358
Subcategory: Physiology and Health

Predicting the Best Tradeoff Solutions in Sports Training

Astrid J. Varela-Agront, Univertsity of Puerto Rico at Mayaguez
Co-Author(s): Mauricio Cabreras, University of Puerto Rico, Mayaguez

In the athletic world there are diverse types of trainings for different goals. Often one finds that changing the routine affects some of the athlete's performance measures in a positive manner, while negatively affecting some others. This constitutes a conflict. When conflicts result, it is possible to find the best tradeoffs between the various performance measures of interest through multicriteria optimization (MCO). The best tradeoffs are known as Pareto-efficient solutions. MCO, however, is not common knowledge in sports training. This project attempts to identify the best tradeoff solutions among two sports performance measures in conflict: muscular strength and muscular resistance.

For the purpose of this research the two performance measures that are analyzed are the muscular strength (M-PM-1) and muscular endurance (M-PM-2). These measures will be assumed to follow dependencies on training decisions modeled through second order regression equations. The regression models will be used to predict M-PM-1 and M-PM-2 under several training configurations. The resulting predictions will then be analyzed to determine the configurations that are Pareto-Efficient. The tradeoff between these configurations will then be established to aid the selection by the user (athlete or trainer).

The preliminary results include a variational study on the different parameters of the regression models to determine their effect on the shape described by the Pareto-Efficient solutions. This knowledge sheds light on the multicriteria sports performance sensitivity to training decisions. These results are presented graphically for interpretation and discussion. Decision-making to meet multiple goals is important in many disciplines including sports training. The mathematical modeling of training decisions in presence of conflicting criteria will be important for performance enhancement as well as for health preservation in athletes. It is expected for this project to bridge knowledge across two disciplines that often times do not intersect.

Funder Acknowledgement(s): National Science Foundation under Grant HRD 0833112 (CREST program).

Faculty Advisor: Mauricio Cabrera Rios, mauricio.cabrera1@upr.edu

359
Subcategory: Plant Research

Effects of Treatment of Vegetable Soybean Residue with Ammonium Hydroxide

Tyana Brown, Virginia State University

Ruminants have a unique advantage of utilizing plant cell wall structural carbohydrates as a source of energy. One highly underutilized energy source for ruminants is crop residues. These are vegetative portions of plants that are harvested after the plant is physiologically mature and consequently highly lignified, with low digestibility and intake. This limits their potential use in ruminant diets. Chemical treatment with alkalis has been shown to be effective in improving both digestibility and intake of crop residues by ruminants. The study was undertaken to determine the effects of alkali treatment of vegetable soybean residue on composition and digestibility. Vegetable soybean residue was treated with three levels of ammonium hydroxide (NH4OH) (0, 50, and 100 g kg -1 residue dry matter), and allowed to react for two weeks. There was an increase in dry matter digestibility *in vitro* (IVDMD) with an increase in the amount of NH4OH added to the vegetable soybean dry matter. The hemicellulose content of the straw decreased with the addition of ammonia per kg of dry matter. Cellulose content was not affected by the addition of ammonia. The development of more economical and safe procedures which improves digestibility of the structural cell wall components would be very beneficial for improving the nutritive value of low quality roughages.

Funder Acknowledgement(s): Oluwarotimi Odeh

Faculty Advisor: Adnan Yousuf, ayousuf@vsu.edu

360
Subcategory: Plant Research

Effect of Treatment of Sorghum Stover Residue with Ammonium Hydroxide on Cell Wall Composition and In Vitro Digestibility

Ashley Dismuke, Virginia State University
Co-Author(s): A.B. Yousuf, Virginia State University

Ruminants have a unique advantage of utilizing plant cell wall structural carbohydrates as a source of energy. One highly underutilized energy source for ruminants is crop residues. These are vegetative portions of plants that is harvested after the plant is physiologically mature and consequently highly lignified, with low digestibility and intake. This limits their potential use in ruminant diets. Chemical treatment with alkalis has been shown to be effective in improving both digestibility

and intake of crop residues by ruminants. The study was undertaken to determine the effects of alkali treatment of sorghum stover residue on composition and digestibility. Sorghum stover residue was treated with three levels ofammonium hydroxide (NH_4OH) (0, 50, and 100 g kg -1 residuedry matter), and allowed to react for two weeks. There was anincrease in dry matter digestibility in vitro (IVDMD) with an increase in the amount of NH_4OH added to the sorghum stoverdry matter. The hemicellulose content of the stover decreased with the addition of ammonia per kg of dry matter. Cellulose content was not affected by the addition of ammonia. The development of more economical and safe procedures whichimproves digestibility of the structural cell wall componentswould be very beneficial for improving the nutritive value of low quality roughages.

Funder Acknowledgement(s): Oluwarotimi Odeh

Faculty Advisor: Adnan Yousuf, ayousuf@vsu.edu

361
Subcategory: Water

Selection of a Dolphin for the Development of a Biologically Inspired Hydro

Alhaji Harune Janneh, Hampton University
Co-Author(s): Danielle Lynn Moore and Michael Philen, Virginia Polytechnic Institute and State University

Studies have shown that Europa, one of the four Galilean Satellites, has a thick layer of ice on its surface. The presence of this icy surface has led to the hypothesis that there is a vast ocean existing underneath this surface, which could possibly serve as a habitat for extraterrestrial life. To determine the existence of life on this moon, it has been proposed that an underwater glider (hydrobot) capable of propulsion could be sent to explore the ocean. Our research focuses on utilizing smart materials in order to develop a biologically inspired dolphin tail that will assist the hydrobot in propulsion. Dolphins are highly efficient and excellent gliders which makes them the ideal candidate for ocean exploration. In order to select the best dolphin species, we began by reviewing literature on dolphin swimming energetics. We employed the Analytical Hierarchy Process (AHP) to compare the different species, focusing on their Propulsive Efficiency, Speed, Fluke Aspect Ratio and Power Density. *Lagenorhynchus obliquidens* (Pacific White-Sided Dolphin) was found to be the best choice to mimic in creating a bio-inspired hydrobot. With a close swimming observation of the Pacific White-Sided Dolphin tail, we developed a simple hydrobot tail prototype in the lab using polycarbonate sheet and shape memory alloy wires. The prototype demonstrates that Dolphins propel themselves efficiently through the water moving their fluke in a sinusoidal path. Our next step will be to develop the hydrobot tail and evaluate it in an underwater environment to determine its efficiency and effectiveness.

Funder Acknowledgement(s): This study was supported by a grant from NSF (EFRI-REM) under Grant#0938043 awarded to Michael Philen, Associate Professor, Aerospace and Ocean Engineering Virginia Polytechnic Institute and State University.

Faculty Advisor: Michael Philen, mphilen@vt.edu

Graduate Abstracts for Oral Presentation

Biological Sciences

Grad. #1
Subcategory: Biomedical Engineering

Polymer Biomaterial Effects on MCF10A Breast Cells in 3D Culture Systems

Michelle M. Coleman, University of North Carolina at Charlotte
Co-Author(s): Stephen L. Rego and Didier Dréau, University of North Carolina at Charlotte
Jordon Gilmore, Erin McCave, Timothy C. Burg, and Karen J.L. Burg, Clemson University

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 polymer materials into our 3D matrix would more closely mimic the heterogeneous microenvironment of breast tissue, leading to increased cell viability and formation of polarized 3D structures. We also hypothesized that coating polymers with ECM-related proteins would increase cell adherence and cell viability. MCF10A breast epithelial cells were grown in 3D collagen / Matrigel™ matrices embedded with polylactide beads or fibers for 7 days. Treatment groups included different polymers (control vs. beads vs. 2.5mm fibers vs. 5mm fibers), different plating methods (mixture versus sandwich), and different polymer coatings (control vs. collagen I). Outcome measures included cell viability and formation of acini and duct-like structures. 2D *in vitro* attachment and viability of MCF10A to polymers were also assessed. Treatment groups included polymers coated with collagen, bovine serum albumin (BSA), fibronectin, periostin, or no coating. Results indicate that MCF10A cells adhered to polymer beads and fibers in 3D cultures, regardless of plating method. Furthermore in 3D cultures the number of acini and cell localizations differed between the polymers tested and the cell viability tended to increase in the presence of polymers compared to control conditions. In 2D cultures, the adhesion and proliferation of MCF10A cells incubated with beads and fibers were comparable. Collagen-I coated beads led to increased adhesion and survival of MCF10A cells compared to control conditions. Improving 3D *in vitro* breast tissue systems is an essential step to generate a reliable tool for the evaluation of early breast cancer progression and the testing of specific therapies. The present study demonstrates that the incorporation of biomaterials utilizing a “mixture” plating method improves MCF10A cell viability and acinus formation in 3D culture systems. Future studies will determine whether these models fully mimic the effects of heterogeneous density on normal mammary gland development and cancer progression observed in humans.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the National Science Foundation EFRI program (CBE0736007).

Faculty Advisor: Didier Dréau, ddreau@uncc.edu

Grad. #2
Subcategory: Cancer Research

Kinetics of Cell Response Upon Lipoic Acid Analog (CPI-613) Treatment

Moises O. Guardado, Stony Brook University
Co-Author(s): Zuzana Zachar and Paul M. Bingham, Stony Brook University

Hypothesis: The kinetics of cell death commitment in different cell lines is a function of the effect of CPI-613 on PDH activity. Tumor cell metabolism is inherently different from normal metabolism. One main difference is the mitochondrial enzyme pyruvate dehydrogenase (PDH). PDH links glycolysis to the tricarboxylic acid (TCA) cycle. PDH is a key gate keeper controlling carbon flux into the TCA cycle. PDH is one of four complexes that use lipoate as a cofactor. Lipoate, in addition to the catalytic activities, acts as regulatory signal. Specifically, it regulates the kinases that control PDH activity by inactivating phosphorylation. Our lab developed lipoate analogs as novel cancer chemotherapeutics. We have investigated one particular member, CPI-613. CPI-613 induces cell death in different tumor cell lines at similar EC50s (Zachar et al., 2011). CPI-613 treatment results in phosphorylation of PDH E1α, thus inactivating it (op. cit.) We have observed that the kinetics of cell death commitment varies between different cell lines. The effect of CPI-613 on PDH in tumor cell lines was assessed by two assays. First, I performed carbon flux analysis on PDH by measuring oxidation of 114C-pyruvate under different treatment conditions. Second, I examined the level and kinetics of phosphorylation of E1α as a function of CPI-613 treatment by western blot using Abs specific for each phosphorylated serine (pSer232, 293, 300). In all experiments the controls were vehicle treated cells under identical conditions. CPI-613 treatment affects PDH activity in a dose dependent manner in all cell lines assessed by carbon flux. However, the kinetics and severity of the change in PDH activity varies by cell line. The onset and level of E1α phosphorylation also varied by cell line. The kinetics of changes in PDH activity and phosphorylation showed a strong correlation with the kinetics of commitment to cell death, suggesting that PDH is a target for CPI- 613. CPI-613 affects PDH in a dose and time dependent manner. The kinetics of the response vary between cell lines and appear to correlate with the kinetics of cell death commitment. Future research will examine CPI-613 effects on other complexes containing lipoic acid and their contribution to the mechanism of cell death commitment.

Reference: Zachar, Z., et al., 2011. Non-redox-active lipoate derivates disrupt cancer cell mitochondrial metabolism and are potent anti-cancer agents *in vivo*. J Mol Med. 89:145-164.

Funder Acknowledgement(s): Stony Brook University; Cornerstone Pharmaceuticals, Inc.

Faculty Advisor: Zuzana Zachar, zuzana.zachar@stonybrook.edu

Grad. #3
Subcategory: Cancer Research

Chemotherapy-induced Modulation of Expression of Telomerase

Torez Moody, Claflin University
Co-Author(s): Leslie Wooten, Tallahassee Community College
Omar Bagasra, Claflin University

Prostate Cancer is the most common cancer in American men and affects more than 1 in every 6 men. Studies concerning the disparity between African-American (AA) men and Caucasian (CAU) men show a drastic inequality with regards with mortality and pathologic stage. It has been shown that there are differences in gene expression of androgen receptors, apoptosis, and growth factors. In recent years, cancer research has focused on the activation of the enzyme telomerase, which is a critical step in carcinogenesis. Telomerase has been shown to be active in cancer while it is not expressed in normal somatic tissues. Telomerase is a ribonucleoprotein complex composed of three subunits. Two of the three subunits, the RNA portion (hTR) and the protein portions, are ubiquitously expressed while the reverse transcriptase portion (hTERT) is only expressed in cancer. This makes hTERT an attractive chemotherapeutic target. Several chemotherapies currently in use in the clinic target the de novo synthesis of the bioactive sphingolipid ceramide, a naturally occurring compound, which acts as a molecular switch controlling many cell processes such as apoptosis and cell growth. Increases in intracellular ceramide cause cells to enter apoptosis; likewise, the chemotherapies used in our research increase ceramide. Previous data from other laboratories has shown that treatment of lung cancer cells with exogenous ceramide caused a decrease in hTERT expression and an increase in apoptosis, however, this has not been shown in prostate cancer. The hypothesis of this research is that chemotherapies, which alter de novo synthesis of ceramide, will decrease the expression of hTERT. The purpose of this series of experiments is to determine the expression of the hTERT promoter and genes of the de novo ceramide synthesis pathway in prostate cancer following exposure to chemotherapies individually and in combination. Future works will involve in looking into the differences in sensitivities to combinatorial chemotherapy treatments in CAU and AA prostate cancer cell lines. The methods that we employed to conduct this research included RNA extraction, RT-PCR to generate cDNA, and PCR to amplify the DNA. To test for chemotherapy sensitivity, we performed XTT assays which determined cell viability following chemotherapy treatments. Our preliminary results showed that there was dramatic decrease in expression after the cells were treated with Cisplatin, Gemcitabine, Fenretinide, and Doxorubicin in DU-145, LNCAP, PC-3, MDAPCA2B cell lines. In conclusion chemotherapies differentially affect the expression of hTERT in prostate cancer cell lines.

Funder Acknowledgement(s): Department of Education, South Carolina Independent Colleges and Universities

Faculty Advisor: Omar Bagasra, obagasra@claflin.edu

Grad. #4
Subcategory: Cancer Research

Phosphatidylserine in Human-Leukemia Cells Induced by Garlic Extract

Sylvianne Njiki, Jackson State University
Co-Author(s): Sanjay Kumar, Begonia Gregorio, and Yedjou Clement, Jackson State University

Garlic (*Allium sativum*) is among the most important plants. Garlic is one of the ten commonest herbal medicines used in the United States according to recent sales data. Medical use of garlic displays therapeutic effects in the treatment of hypercholesterolemia, prevention of arteriosclerosis, and some cancers. For example, non-pharmacological treatment with garlic preparation is suggested to reduce blood pressure in hypertensive individuals. However, the mechanisms by which garlic extract (GE) induces cytotoxic and apoptotic effects in cancer cells remain largely unknown. The present study was designed to use HL-60 cells as a test model to determine the cytotoxic and apoptotic effects of garlic after treatment of human leukemia cells. Human leukemia (HL-60) cells were treated with different concentrations of garlic extract for 12 hr. Live and dead cells was determined by propidium iodide using the cellometer vision. Annexin V negative and positive cells were determined by flow cytometry. Data obtained from the propidium iodide assay showed a gradual increase in necrotic cell death in GE-treated cells compared to the control group. Flow cytometry data showed a strong concentration-response relationship between GE exposure and annexin-V positive HL-60 cells. Findings from the present study demonstrate that in therapeutic concentrations, garlic treatment induced cytotoxic and apoptotic effects in HL-60 cells.

Funder Acknowledgement(s): This research work was financially supported by a grant from the National Institutes of Health (Grant No. G12RR013459-14), through the RCMI-Center for Environmental Health.

Faculty Advisor: Begonia Gregorio, gregorio.begonia@jsums.edu

Grad. #5
Subcategory: Cancer Research

Native American Cancer Patient Navigators in Indian Country

Cornelia Santos, University of Colorado

Patient Navigation to address the barriers along 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 cancer education and outreach, aiding with access to screening and facilitating timely treatment. Native American Cancer Patient Navigators promise to be a culturally relevant and community sensitive solution to the cancer disparities happening in Indian Country today.

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 states as distant from each other as Florida and Alaska. Native Navigators were interviewed from across the United States.

Native Navigators representing American Indian and Alaskan Native tribes from both genders who resided in both urban and rural settings participated in the study. Collected data consisted of field notes, supporting documents and in-depth ethnographic Native Navigator interviews. Results included the exclusive roles these Native 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.

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). On-going research with Native Navigators helps explore the proven success of Native Navigators and poses an interesting, timely and effective solution to the current cancer disparities crises in American Indian and Alaskan Native communities.

Funder Acknowledgement(s): Write-up for this study was partially provided by the SAPAI program (through AGEP).

Faculty Advisor: Honorine Nocon,
Honorine.Nocon@ucdenver.edu

Grad. #6
Subcategory: Cancer Research

p53 Codon 72 Polymorphisms in African-American women with Triple-Negative Breast Cancer

Wesley D. Sims, Alabama Agricultural and Mechanical University
Co-Author(s): Upender Manne and Shantel Hébert-Magee, Department of Pathology, University of Alabama at Birmingham and Alabama A&M University

Triple-negative breast cancer (TNBC) is defined as the lack of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER-2) expressions. TNBC is disproportionally higher in African-American (AA) women. The TNBC subtype has been reported to have frequent p53 mutations. The p53 codon 72 polymorphism is disproportionately higher in AA women compared to Caucasian (CA) women. We hypothesize that this polymorphism is expressed at a higher rate in AA women with TNBC than AA women with luminal subtype (ER+/PR+) and CA women, subsequently leading to the higher occurrence of TNBC in AA women.

We reviewed our database of breast cancers histologically diagnosed between 1990 and 2010. Inclusion criteria included CA and AA female patients evaluated and confirmed for the expression of all receptors (ER/PR/HER2). Exclusion criteria included other races and cases lacking sufficient tumor marker data. Formalin-fixed paraffin embedded tissue sections were micro-dissected and DNA was extracted. DNA quality and concentration were estimated by spectrophotometry. The mutational status of the p53 gene was assessed by PCR and whole gene sequencing. 410 patients met the criteria. Our cohort consisted of TNBC from AA (n=30), ER+/PR+ from AA (n=30), TNBC from CA (n=30), and ER+/PR+ from CA (n=30). Tumor and normal DNA has been extracted from each group respectively, n=21, n=23, n=26, n=26. We have begun sequencing and intend to perform mutational analyses.

We anticipate finding that the p53 codon72 polymorphism is disproportionally higher in AA women with TNBC. We intend to correlate the presence of this polymorphism with prognosis, disease-free survival, and response to therapy.

Funder Acknowledgement(s): This research has been supported in part by National Institutes of Health grant Award Number 5U54 CA118948-02A1 and in part by the National Science Foundation-AAMU HBCU-UP Project number (HDR#0928904).

Faculty Advisor: Mostafa Dokhanian,
mostafa.dokhanian@aamu.edu

Grad. #7
Subcategory: Cell and Molecular Biology

Characterization of TDRD7 Null Mouse Mutant Lens

Carrie Barnum, University of Delaware
Co-Author(s): Shaili D. Patel and Salil A. Lachke, Department of Biological Sciences, University of Delaware
Shinichiro Chuma, Institute for Frontier Medical Sciences, Kyoto University, Kyoto Japan

The lens is a transparent tissue of the eye that serves to focus light on the retina for optimal visual acuity. Loss of lens transparency results in a disease termed “cataract” which affects ~77 million individuals and accounts for ~50% cases of blindness worldwide. Specialized lens cells termed “fiber cells” function to render the lens transparent by undergoing a terminal differentiation program that involves dramatic regulation of gene expression accompanied by cellular elongation and organelle degradation. We have identified an RNA granule component TDRD7, mutations in which are associated with posterior polar cataracts in pediatric patients. TDRD7 encodes a Tudor family protein with three OST-HTH/ Lotus domains (for RNA interaction) and three Tudor domains for protein-protein interactions. TDRD7 exhibits highly enriched and dynamic expression in differentiating lens fiber cells. Therefore, we hypothesize that TDRD7 mediates post-transcriptional control of gene expression in lens fiber cells. TDRD7 null mouse mutants closely phenocopy human cataracts and thus represent an excellent resource for investigating TDRD7 function in the lens. We have characterized lens defects in TDRD7 mouse mutants by light microscopy, histology and scanning electron microscopy, and find that TDRD7 nullizygosity results in severe lens and eye defects by postnatal day P22. To identify differentially regulated transcripts and potential splice variants in TDRD7 null mouse mutant lens, we have performed next-generation RNA sequencing (RNA-seq). These approaches have begun to identify the molecular targets/components of the TDRD7 pathway, which in turn will provide novel insights into the etiology of congenital posterior polar cataract in humans.

Funder Acknowledgement(s): UDRF, LSAMP

Faculty Advisor: Salil A. Lachke, salil@udel.edu

Grad. #8

Subcategory: Cell and Molecular Biology

Testing the Hypothesis That the Levels of Id2 and Id3 Expression Change in a Cell Cycle-dependent Manner and Are Affected by the Presence of MyoD in C2C12 Myoblasts

Monica Chinea Diliz, California State University, Los Angeles
Co-Author(s): Sandra B. Sharp, California State University, Los Angeles

The later stages of myogenesis are regulated through the binding of Myogenic Regulatory Factors (MRFs) such as MyoD to the regulatory regions of muscle-specific genes during the process of differentiation. We now know that MyoD also binds a wide array of DNA targets during the earlier proliferative stage of myogenesis, including regulatory regions in the genes of inhibitors of differentiation proteins, Id2 and Id3. Id2 and Id3 inhibit myogenesis, and are expressed in proliferating, but not differentiating, cells. It is not known whether MyoD binding to the Id2 genes affects their transcription, as the Id genes are actively expressed in many cell types that lack MyoD. To test the hypothesis that expression of Id2 and Id3 changes in a cell cycle-dependent manner in C2C12 myoblasts, we will synchronize the cells in Go using a methylcellulose-containing suspension medium, release the cells from arrest, collect mRNA at various cycles stages, and compare the levels of MyoD, Id2 and Id3 mRNAs via qRT-PCR. To test the hypothesis that the presence of MyoD affects Id2 and Id3 mRNA expression, the experiment will be repeated using MyoD knockdown cells, and the results compared with those from cells expressing MyoD. If our hypotheses are supported, we expect to see Id2 and Id3 mRNA levels peak at the transition between Go and G1, and again at the end of G1, as has been shown by others in non-myogenic cells. MyoD mRNA levels have been shown to rise as cells come out of quiescence and to vary with cell cycle stages. If the presence of MyoD positively controls Id gene expression, we predict that the mRNA levels of Id2 and Id3 will follow a similar, but delayed, change in levels relative to MyoD, and that the peak levels of Id2 and Id3 mRNAs will be higher in the presence of MyoD than in its absence.

If our hypothesis is correct, the results would suggest a myogenesis-specific regulation of Id expression during proliferation which could serve as a negative-feedback loop to keep MyoD activity levels sufficiently low to forestall premature terminal differentiation. Our results can be expected to increase our understanding of the role of MyoD in proliferating cells and help pave the way for future research on the regulation of other novel gene targets, by MyoD.

Funder Acknowledgement(s): This study was supported by the National Science Foundation under Grant # HRD-1246662.

Faculty Advisor: Sandra Sharp, ssharp@calstatela.edu

Grad. #9

Subcategory: Cell and Molecular Biology

Development of In-situ PCR as an Application in Certain Sexual Assault Cases

Aja Moss, Claflin University
Co-Author(s): Jessica Abercrombie and Matthew Fitts, Claflin University

Molecular techniques using Y-chromosome-specific DNA probes are new tools capable of identifying Y-bearing sperm and non-sperm cells (Sibille 2002). The purpose of this study is to identify male epithelial cells in sexual assault cases in which little to no traces of spermatozoa are present. These cases would include vasectomized males, cases in which no ejaculation occurred, or oral/digital assault only. From the epithelial cells identified, the aim is to create a male Y-chromosome STR profile to be used to identify assailants that commit such acts of violence, as described -situ hybridization reaction. Fluorescent probes bind to a specific location on a chromosome that exhibits a high degree of sequence specificity. The fluorescent probes are detected via fluorescence microscopy, and shows the specific location of where the probe is located on the chromosome. Tissue sections are fixed to slides, and permeabilized (through proteinase K digestion) to allow access to the target DNA. The target-specific probe consists of 20 pairs of oligonucleotides which hybridize to the target DNA within the tissue. Signal amplification is carried out through in-situ PCR/ hybridization steps, and the slides are examined under a fluorescence microscope. Female (XX-chromosome), which is used as a control, and male (XY-chromosome) buccal slides were prepared and fixed to a microscopic slide. Cells were put through a Proteinase K treatment to permeabilize the cells. A PCR master mix was made and equally dispersed amongst the male and female slides using the AmpF STR Y filer Kit for PCR reagents (Applied Biosystems, Washington, UK), Gold DNA polymerase, and Dnase free water. An additional master mix for in-situ hybridization was prepared containing all the same reagents within the PCR master mix, with the exclusion of the Gold DNA polymerase. This reaction mix was equally distributed among another set of female and male buccal slides for in-situ hybridization. Both sets of slides were placed in a two tower thermocycler, and a PCR setup protocol for in-situ amplification was carried out. Both female and male buccal cells were subjected to in-situ PCR using fluorescently labeled Y chromosome specific primers. Post amplification, cells were visualized under white and fluorescent light. It was evident that only the male epithelial cells were fluorescent, in the case of in-situ PCR, while there was no florescent activity detected within the cells that were carried through just in-situ hybridization. This work will later be used to create a male STR Y profile.

Funder Acknowledgement(s): Department of Education Grant number: p382G090010-13; Department of Energy Grant number: DE-EM0000479; Claflin University Department of Biology and Mathematics.

Faculty Advisor: Matthew Fitts, mfitts@claflin.edu

Grad. #10

Subcategory: Cell and Molecular Biology

Investigation of MyoD binding to Id2 and Id3 regulatory regions in C2C12

Pamela Russell, California State University, Los Angeles

MyoD is a muscle regulatory factor critical for myoblast determination and differentiation. During differentiation, MyoD and E12/47 heterodimerize bind to E-box sequences and transactivate downstream genes. Id2 and Id3 (inhibitor of DNA binding/differentiation) act as negative regulators of myogenesis by dimerizing with E-proteins and thereby preventing E-protein heterodimerization with MyoD. This prevents both binding and transactivation. Surprisingly, ChIP-sequencing has revealed that MyoD is bound at regulatory regions of the Id2 and Id3 genes during myoblast proliferation. We hypothesize that MyoD enhances Id gene expression during proliferation to prevent premature differentiation. To test this, we are generating a MyoD knockdown C2C12 myoblast cell line using shRNA that targets MyoD mRNA. C2C12 cells were transduced with lentivirus particles containing different MyoD shRNA target sequences or a scrambled shRNA sequence to produce a control. MOIs (multiplicities of infection) from 0.5 - 20 were used to determine most effective MOI for knockdown. Transductants were selected with puromycin. MyoD mRNA levels in the transductants were assessed by qRT-PCR. mRNA levels were lower in cells that had been transduced with shRNA MyoD target sequences at MOI 1 and 2 compared to higher MOIs and untransduced cells. Cells transduced with the scrambled shRNA at MOIs 1 and 2 expressed MyoD mRNA levels similar to untransduced C2C12 cells; higher MOIs of the scramble reduced MyoD mRNA levels. These data indicate the most efficient MyoD knockdown and transduced control cell line are both achieved using lower MOIs. We are currently determining the most effective knockdown sequences.

Ultimately, we will establish a permanent MyoD knockdown cell line from a single resistant clone. Both control and knockdown cells will be cultured and RNA will be isolated from both proliferating and differentiating cells. Id2 and Id3 mRNA levels in knock down cells, wild type cells, and cells transduced with a control shRNA will be compared. If our hypothesis is correct, we expect to see lower Id2 mRNA levels during proliferation in C2C12 cells with MyoD knocked down compared to C2C12 cells with full MyoD expression and C2C12 cells transduced with scramble shRNA. Identifying the function of MyoD at the Id2 and Id3 promoters will contribute to our understanding of the molecular pathway that regulates skeletal muscle development from proliferation to differentiation.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant # HRD-1246662, awarded to Pamela Russell as a LSAMP-BD Cohort X Fellow.

Faculty Advisor: Sandra Sharp, ssharp@calstatela.edu

Grad. #11

Subcategory: Microbiology/Immunology/Virology

The Antimicrobial Effect of Silver Nanoparticles Against *Streptococcus pneumoniae*

Ronda K. Bibbs, Alabama State University
Co-Author(s): Mamie Coats, Shree R. Singh, and Vida A. Dennis, Alabama State University

Streptococcus pneumoniae (pneumococcus) is an encapsulated gram-positive diplococcus that is responsible for both invasive and noninvasive diseases. Pneumococcus is associated with high morbidity and mortality with immunocompromised individuals including, but not limited to, children under five years of age, the elderly, organ transplant recipients and people with certain cancers. With antibiotics being the mainstay for treatment, the need for novel antimicrobials which can control pneumococcal growth is becoming more pressing due to increasing numbers of isolates that are antibiotic resistant. Nanotechnology has extended the usefulness of metals as antimicrobials while decreasing their toxic effects.

In this current study, we hypothesized that polyvinyl pyrrolidone (PVP) coated silver (Ag-PVP), will have antimicrobial effects on various infectious serotypes of the pneumococcus. The bactericidal effects of the Ag-PVP were measured by growing *S. pneumoniae* strains of varying serotypes (103 CFU/mL) in liquid media in the presence of the nanoparticle. Following incubation, there was a significant reduction, independent of serotype, in the survival of pneumococci grown in the presence of Ag-PVP nanoparticles compared to its control, phosphate buffer saline. Strains within the same serotype were also compared for their susceptibility to the antimicrobial effects of Ag-PVP. The susceptibility of the isolates within individual serogroups varied with a trend for more recent isolates being less susceptible to Ag-PVP. The complete absence of the capsular polysaccharide made bacteria resistant to the action of the nanoparticle indicating that the capsule is involved in the mechanism of action of Ag-PVP. These data demonstrate a serotype independent, capsule dependent, bactericidal activity for silver nanoparticles against *S. pneumoniae*.

Funder Acknowledgement(s): This work was supported by NSF-CREST (HRD-1241701) and NSF-HBCU-UP (HRD-1135863) at Alabama State University.

Faculty Advisor: Mamie Coats, mcoats@alasu.edu

Grad. #12
Subcategory: Microbiology/Immunology/Virology

SARS-CoV Spike Protein Epitopes Mapping with RNA Qβ Displayed Peptides: A Vaccine Candidate

Carrie Sanders, Alabama State University
Co-Author(s): Rana Singleton and Alain Bopda Waffo, Alabama State University

Severe acute respiratory syndrome (SARS) is an emerging deadly infectious disease in humans that remains without a cure or vaccine. SARS is a life threatening disease that continues to cause severe public health and economic encumbrances worldwide. SARS is caused by a positive-stranded RNA coronavirus (SARS-CoV) that has one of the largest RNA genomes. This genome codes for numerous proteins including the S protein, a major structural glycoprotein. The S protein plays a vital role in the SARS-CoV infectious cycle by mediating viral entry into host cells after membrane infusion and by inducing neutralizing antibodies.

This project focuses on exposing the S protein epitopes in the Qβ phage to develop phagotopes and/or mimotopes and to understand the animal immune responses when exposed to these hybrid phages. Our laboratory has developed, for the first time, a non-traditional phage display technology based on the RNA coliphage Qβ with a key feature: quasispecies. The S protein gene was obtained from the GenBank with the accession number AY274119. Using computational prediction, linear 15-mer peptides will be designed and stabilized using PepSurf. Furthermore, a chimeric randomized 15-mer was designed. In a preliminary study, two randomly selected regions of the S protein–Sr1 and Sr2–were used. Sr1 and Sr2 correspond to the amino acid sequence located between 447-455 and 789-799 respectively and were successfully cloned into pQβ8. In the plasmid pQβ8, the C-terminal of the A1 protein of the RNA phage Qβ was the region of genetic fusion. The plasmids, pQβ8Sr1 and pQβ8Sr2, were used to produce phages upon *E. coli* HB101upon transformation. pQβ8Sr1 and pQβ8Sr2 produced QβSr1 and QβSr2 phages respectively. The phage obtained produced plaque like phages on the lawn of *E. coli* Q13, the original host of the wild type Qβ. Hybrid phage genomes were sequenced after RT-PCR and found to harbor Sr1 and Sr2 fused in frame with the end of A1 gene. Moreover, phages obtained from the plasmids pQβSr1and pQβSr2 reacted positively with S mAb on an Ouchterlony double diffusion assay. Future studies will include the evaluation of animal serum immunized with phagotopes and/or mimotopes and will be investigated to understand the mechanism of RNA viruses escaping host control.

Funder Acknowledgement(s): NSF-CREST, NSF-MBRS RISE

Faculty Advisor: Alain Bopda Waffo, abopdawaffo@alasu.edu

Grad. #13
Subcategory: Plant Research

Plant Derived Antimicrobial Compounds for the Treatment of Diarrhea Diseases Caused by Salmonella Typhimurium

Orimadegun Famuyide, Claflin University
Co-Author(s): Florence Anoruo and Randall Harris, Claflin University

In every part of the world, infectious diarrhea disease is still a global health issue, though it occurs predominantly in the developing countries and underserved communities. Limited access to portable and clean water and appropriate medical care, collectively increase the incidence and severity of water/food borne diseases, while poor hygiene, inadequate and inconsistence environmental sanitation promote the reinfection. Despite the effort and the progress made in technology which increased understanding of the biology of disease causing microorganisms and their control in the industrialized world, the incidence of epidemic due to drug resistance pathogenic microorganisms still poses public health and environmental justice concerns. Antimicrobial compounds derived from plants represent a vast untapped source for therapeutic medicine.

The high cost of synthetic antibiotics, the serious side effects related to them, and emerging multidrug resistance bacteria have been of great concern in recent years. Salmonella, a gram negative rod shaped bacterium causes a wide range of human disease including diarrhea, enteric fever, gastroenteritis and bacteremia. Globally each year about 93.8 million cases of gastroenteritis cases are caused by Salmonella species with 155,000 deaths; it is considered one of the most serious infectious disease threats to public health on a global scale. We hypothesized that plant extracts that inhibit the growth of the bacteria will be effective as antimicrobial agents against Salmonella typhimurium. This research was therefore conducted to investigate the antimicrobial activities of *Mangifera indica* (Mango), *Psidium guajava* (Guava), *Vernonia amydalina* (Bitter leaf), and *Ocimum gratissimum* (African basil) against Salmonella typhimurium. Sensitivity assays (disc and spot diffusion) were used to determine the inhibitory capabilities of the plant extracts while Kanamycin, an antibiotic, was used as control.

Results indicated that *Mangifera indica* and *Psidium guajava* have inhibitory effects on Salmonella typhimurium. No significant antibacterial activity was detected with the extract of *Vernonia amygdalina* and *Ocimum gratissimum* against Salmonella typhimurium. This shows that both *M.indica* and *P. guajava* can serve as antimicrobial agents against Salmonella typhimurium. Further studies include purification and characterization of active compounds of these plants using High Performance Liquid Chromatography and Thin Layer Chromatography. Additionally, the molecular structure of the identified compounds will be ascertained using Nuclear Magnetic Resonance, with the aim of contributing to the research on manufacturing antimicrobial drugs to better manage resistant Salmonella infectious diseases.

Funder Acknowledgement(s): Claflin University School of Natural Sciences

Faculty Advisor: Florence Anoruo, fanoruo@claflin.edu

Grad. #14
Subcategory: Plant Research

Use of Bioimaging Techniques to Characterize Fungal Pathogenesis in Maize

Katharine Minker, University of Delaware
Co-Author(s): M.L. Biedrzycki, F.J. Perina, and R.J.Wisser, Department of Plant and Soil Sciences, University of Delaware
T. Jamann and R. Nelson, Department of Plant Pathology and Plant-Microbe Biology, Cornell University
Q. Yang and P. Balint-Kurti, USDA-ARS, North Carolina State University
J.L. Caplan, Department of Plant and Soil Sciences and Delaware Biotechnology Institute, Bioimaging Center, University of Delaware

Maize is a crop of worldwide significance that is afflicted by many diseases. Northern Leaf Blight (NLB) and Southern Leaf Blight (SLB) are two common diseases of maize caused by fungi (*Setosphaeria turcica* and *Cochliobolus heterostrophus* respectively) that can be controlled by genetic resistance. Resistance to each of these diseases is attributable to ~30 genomic loci that we have 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 bioimaging. Pairs of genetic stocks with contrasting 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 varying time points during pathogenesis, leaf punches are collected and preserved using a glutaraldehyde fixative. A digital camera is used to capture images of the fixed samples to record macroscopic features on the leaf surface. Samples are stained with Wheat germ agglutinin 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 autofluorescence 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 Highspeed Confocal Microscope to compile a microscopic overview of the leaf punch. Images are processed using Fiji ImageJ 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 germ plasm.

Funder Acknowledgement(s): This study was funded, in whole, by NSF PGRP 1127076 and EPSCoR awarded to Randall Wisser, University of Delaware.

Faculty Advisor: Jeffery Caplan, jcaplan@udel.edu

Chemistry and Chemical Sciences

Grad. #15
Subcategory: Chemistry (not Biochemistry)

Nature of Hydrogen Bonding in Acetamide Dimers: A Computational Study

Christopher Copeland, Jackson State University
Co-Author(s): Heir Jordan, University of Tennessee at Chattanooga
Devashis Majumdar and Jerzy Leszczynski, Jackson State University

In biochemistry, the peptide bond is taken to be one of the most important motifs because it provides the structural backbone in proteins. It is known that this type of bond is rotationally hindered due to the partial double bond character between the C and N atoms; this contributes to the stability of hydrogen bonds formed with adjacent peptide bonded chains. In this study, the acetamide molecule has been taken as a model, fundamental motif of the peptide bond that will be used to investigate several thermodynamic and spectroscopic properties of the hydrogen bonds formed by four potential dimers. Although the existence of proteins is primarily in an aqueous phase, it has been observed that insight can be gained from studying the changes in spectroscopic properties of the local hydrogen bonding groups (ex. O···HN). This selected compound has been well-studied by matrix isolation methods1-3 and several condensed phase techniques 4,5. The role of low-frequency hydrogen bond vibrations in the formic acid and formamide dimers have been investigated extensively by Cato et. al, and it has been postulated that there is a linear correlation between the intensity of these modes and the hydrogen bond energies.6

The computation of the minimum energy structures were performed using MP2 and two different density functional theory (DFT) methods, the standard B3LYP and M06-2X. All three methods employed Dunning's correlation-consistent augmented cc-pVTZ basis set. Because the binding energies of these dimeric systems are relatively low, (< 15 kcal/mol), the basis set superposition energy was calculated by the counterpoise method and included in the final energies as well as zero-point energy contributions as shown by Equation 1. Because the low lying fundamentals lie so close together, it was necessary to include the anharmonic contributions to these modes done by Barone's formalism to produce a corrected hydrogen bond energy as shown by Equation 4.

1. $\Delta E_B = E_{dimer} - 2(E_{monomer})$

2. $\Delta E_B = E_{dimer} - 2(E_{monomer})$

$\Delta ZPE = ZPE_{dimer} - 2(ZPE_{monomer})$

3. $\Delta ZPE = ZPE_{dimer} - 2(ZPE_{monomer})$

$\Delta ZPE^{corr} = \Delta ZPE^{harm} - \Delta ZPE^{anharm}$

4. $\Delta ZPE^{corr} = \Delta ZPE^{harm} - \Delta ZPE^{anharm}$

$\Delta E_B{}^{corr} = \boldsymbol{\Delta E}_B + \Delta ZPE^{corr} + BS\boldsymbol{SE} + \Delta ZPE^{harm}$

It is $\Delta E_B{}^{corr} = \boldsymbol{\Delta E}_B + \Delta ZPE^{corr} + BS\boldsymbol{SE} + \Delta ZPE^{harm}$ well known that the six-membered cyclic dimer of acetamide is the primarily observed structure in the gas-phase, and the results of this research support the same conclusion. Because the acetamide dimer has a similar six-membered structure as that of formic acid, it is expected that the linear correlation between the mode intensity and hydrogen bond energies will be observed. Future work will include investigation into the Gibbs free energy and enthalpy variations observed upon dimerization.

Funder Acknowledgement(s): CREST; Reasearch Initiative for Scientific Enhancement Program

Faculty Advisor: Jerzy Leszczynski, jerzy@icnanotox.org

Grad. #16
Subcategory: Chemistry (not Biochemistry)

DNP-Functionalized Polymers and Their Biocompatibility with IgE

Omotunde Olubi, Clark Atlanta University
Co-Author(s): Ishrat Khan, Clark Atlanta University

The use of polymeric materials in medicine and pharmaceuticals has a very rich history, and, of greater interest in recent times, is their use as active components in biosensors and other nanoscale electronic devices. In a quest for quicker diagnosis of certain ailments in humans in particular and animals in general at the point of care, we have synthesized block co-polymers of 3 -decylthiophene with 2-hydroxy ethyl methacrylate via Atom Transfer Radical Polymerization, ATRP. The macroinitiator, Poly (3-decylthiophene) was first made by Grignard Metathesis reaction to obtain the bromine end functionalized polymer which subsequently underwent a series of end-group modifications to yield the macroinitiator having bromoester functionalized end groups. ATRP of 2-hydroxy ethyl methacrylate was carried out in DMF to yield the co-polymers which were then functionalized with DNP-ε-amino-n-caproic acid. Characterization of the co-polymers was done by 13C and 1H NMR spectroscopy, FTIR, UV-Vis and Raman spectroscopy. Thermal analysis was done by differential scanning calorimetry. Electrical behavior was studied via cyclic voltammetry. The co-polymer solution in chloroform was drop-cast on to silicon substrates to form films whose morphology was studied via

electron and scanning probe microscopy. Biocompatibility studies, done through incubation in fluorescently tagged IgE, indicated there was preferential binding of the protein to the DNP groups as observed under the fluorescence microscope. A control experiment involving incubating the film in IgG did not indicate any binding.

The results obtained so far strongly indicate that these block co-polymers have potential use in biosensors, with the incorporation of specific functional groups that antibodies can identify and adhere to. Electrical characterization and mechanical testing of the films will be done.

Funder Acknowledgement(s): The authors gratefully acknowledge the support of the studies by NSF HRD-1137751.

Faculty Advisor: Ishrat Khan, ikhan@cau.edu

Grad. #17
Subcategory: Chemistry (not Biochemistry)

Hairy Nanoparticles: General Brush Architecture

Vernecia Person, Clark Atlanta University

Co-Author(s): Ishrat Khan, Clark Atlanta University
Rajiv Berry, Hilmar Koerner, Elizabeth Opsitnick, and Stephen Barr, Air Force Research Laboratory

Hairy Nanoparticles (HNPs) avoid the issues that normally plague conventional polymer nanocomposites such as agglomeration and difficulty mixing into the polymer matrix. Because HNPs afford the ability to utilize properties associated with both its organic and inorganic components, it is believed that manipulating the properties of those HNPs in order to get specific grafting density, particle size, and molecular weight will lead to the production of materials that are tougher and have a higher capacity for energy storage. This research is important because it carries the possibility of producing high energy density capacitors. Synthesis of the polymer chains is accomplished via Atom Transfer Radical Polymerization. The union of the inorganic particle and the polymer chain is accomplished using the Click Reaction. The materials obtained are experimentally characterized with the DSC, GPC, DLS, and NMR. The HNPs are simulated using MARTINI Coarse Graining to evaluate structural and dynamical properties of the brush. There are noticeable trends that are seen with the distribution of relaxation times, β values, as well as the characteristic relaxation times, τ values. As the annealing temperature increases, the β and τ value decrease.

This reveals that there is a broad distribution of the breadth of relaxation, as well an increased relaxation time. It is concluded that because the polymer is tethered to the particle, relaxation time is slower and the breadth of relaxation time is broader. This may be due to the broad size distribution of the nanoparticles. Because the graft densities are different, the local environment of the polymer is different from particle to particle, and therefore, the breadth of the relaxation time is broader. The modeling shows that as the grafting density increases, the coverage of the polymer chains about the bead becomes more uniform. There is patchy attachment of the polymer to the particle which is in agreement with a broader relaxation spectrum. My future goals for this project are to construct cooling curves to validate Tg and probe non-isotropic polymer distributions.

Funder Acknowledgement(s): National Science Foundation, Air Force Research Laboratory

Faculty Advisor: Ishrat Khan, ikhan@cau.edu

Grad. #18
Subcategory: Chemistry (not Biochemistry)

Synthesis of Novel S-block Metal Organic Frameworks

Peter J. Rosado Flores, Syracuse University
Co-Author(s): Karin Ruhlandt-Senge, Syracuse University

Microporous materials in form of metal-organic frameworks (MOFs) have recently found use in areas as diverse as catalysis and gas storage for fuel cells. While a significant number of transition metal MOFs have been realized, inquiry into s-block metal MOFs remains largely unexplored, although several highly attractive applications, based on the unique properties of the metals are evident. We are especially intrigued by low weight of the metals, paired with a large affinity towards hydrogen under potential hydride formation, suggesting that the resulting MOFs might be suitable hydrogen storage agents. The lack of studies involving s-block metals may be a result of the absence of systematic pathways towards desired complexes. In this work, the impact of ligand topology and synthetic conditions on resulting framework dimensionality in two new magnesium based MOFs containing the p-pyridinecarboxylic acid (Hin) and m-pyridinecarboxylic acid (Hnic) ligands have been explored. {[Mg(in)2]2·DMF}∞ (1) and [Mg4(in)8]∞ (2) were prepared by acid base reactions in vacuum sealed Carius tubes, using magnesium nitrate and acetate. The structural principles of the target compounds were explored via single crystal X-ray crystallography.

It was found that both compounds show coordination through the nitrogen in the pyridil ring and carboxylate moiety yet their resulting structures differ depending on the location of the nitrogen in the ring. In 1, the structure propagates via nitrogen and carboxylate moieties forming a 3D network exhibiting rhomboid shape cavities. These open cavities host disordered DMF molecules which can be replaced by polar solvents such as acetonitrile or THF by changing the reaction conditions. Contrary to 1, compound 2 displays intertwining chains to afford a dense 3D network without cavities. TGA experiments and temperature dependent PXRD were conducted to examine the temperatures of desolvation (of 1) and thermal stability, complemented by guest exchange experiments. An overview of this work will be presented.

Funder Acknowledgement(s): DOE-SCGF; Syracuse University; NSF

Faculty Advisor: Karin Ruhlandt-Senge, kruhland@syr.edu

Grad. #19
Subcategory: Chemistry (not Biochemistry)

Process to Functionalize Polyaniline for Biosensing Applications

Tiana Shaw, Clark Atlanta University
Co-Author(s): Michael Williams and James Reed, Clark Atlanta University

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 is 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 designed a process to functionalize polyaniline with biotin to create a biotin-avidin biosensor. We began with a 2-aminophenol which is a hydroxyl substituted aniline monomer. This monomer undergoes polymerization to yield 2-hydroxy polyaniline. 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.

Funder Acknowledgement(s): This study was funded, in part, by a grant from NSF/CREST awarded to Ishrat Khan, Director of the Center For Functional Nanoscale Materials, Clark Atlanta University.

Faculty Advisor: Michael Williams, mdwms@cau.edu

Grad. #20
Subcategory: Chemistry (not Biochemistry)

Metal-dependent Activity of Fe2+ and Ni2+ Acireductone Dioxygenases

Crystal E. Valdez, University of California, Los Angeles
Co-Author(s): Manuel Sparta, Max-Planck Institute for Bioinorganic Chemistry, Mülheim an der Ruhr, Germany
Anastassia N. Alexandrova, University of California, Los Angeles

Two virtually identical acireductone dioxygenases, ARD and ARD', catalyze completely different oxidation reactions of the same substrate, 1,2-dihydroxy-3-keto-5-(methylthio)pentene, depending exclusively on the nature of the bound metal. Fe2+-dependent ARD' produces the α-keto acid precursor of methionine and formate and allows for the recycling of methionine in cells. Ni2+-dependent ARD instead produces methylthiopropionate, carbon monoxide, and formate, and exits the methionine salvage cycle.

This mechanistic difference has not been understood to date but speculated to be due to the difference in coordination of the substrate to Fe2+ versus Ni2+: forming a 5-membered ring versus a 6-membered ring, respectively, thus exposing different carbon atoms for the attack by O2. Here, mixed quantum-classical molecular dynamics simulations show that contrary to the old hypothesis, both metals preferentially bind the substrate as a 6-membered ring, exposing the exact same sites to the attack by O2. Following the mixed quantum-classical molecular dynamics simulations, a full Density Functional Theory mechanistic investigation of the 6-membered ring reaction of both ARD' and ARD elucidates that it is the electronic properties of the metals that are then responsible for the system following different reaction paths to yield the respective products.

This study fully explains the puzzling metal-induced difference in functionality between ARD' and ARD and, in particular, proposes a new mechanism for ARD'. All results are in agreement with available isotopic substitution and other experimental data. The curious case of ARD' and ARD furthers the interest in understanding metal-dependent functionalities of metalloenyzmes.

Funder Acknowledgement(s): This work was supported by the DARPA Young Faculty Award N66001-11-1-4138 (A.N.A.) and the National Science Foundation Graduate Fellowship #2011115747 (C.E.V.).

Faculty Advisor: Anastassia N. Alexandrova, ana@chem.ucla.edu

Grad. #21
Subcategory: Materials Science

Dispersion and Delamination of Graphite by Melt Mixing in PETI Resins

Lionel Cross Jr., Clark Atlanta University
Co-Author(s): Eric A. Mintz and Candace Branch, Clark Atlanta University

We have previously examined the distribution and dispersion of multiwalled carbon nanotubes (MWCNTs), carbon nanofibers (CNFs), and graphite in PEIT 298 [formulated from symmetrical 3,4,3′,4′-biphenyltetracarboxylicdianhydride (s-BPDA), 1,3,-bis(3 -aminophenoxy)benzene (1,3,3-APB), 3,4′-oxydianliline (3,4′-ODA) and end-capped with 4-phenylethynylphthalic (PEPA)] and PETI 330 [formulated with asymmetrical 2,3,3′,4′-biphenyltetracarboxylic dianhydride (a-BPDA) and PEPA end-cap along with mixtures of 1,3-bis(4-aminophenoxy)-benzene (1,3,4-APB) and m-phenylendiamine (m-PDA)] by high torque melt mixing. PETI 298 and PETI 330 are imide oligomers that upon curing give high performance polyimides with glass transition temperatures (Tgs) of 298 and 330o C, respectively. These resins incorporated both π donors and π acceptors that can form charge transfer complexes with MWCNTs and graphene.

The combination of the energy transferred by high torque melt mixing and the formation of charge transfer complexes with these resins affect the distribution and dispersion of the MWCNTs and CNFs. The analogous process affects distribution and delamination of graphite. The incorporation of graphene and short stacks of graphene in the polymer matrix gives composites with improved thermal, mechanical, and electronic properties as well as an increased resistance to moisture. Natural flake graphite, surface enhanced graphite, and synthetic graphites with surface areas varying from 24 to over 350 m2/g have been investigated. XRD and Raman data indicated that in each case the graphite has to be extensively delamented and SEM confirms the distribution and dispersion. Melt rheology experiments indicate that at loadings up to 0.5% these composites exhibit sufficiently low melt viscosity to allow processing by RTM. DSC experiments indicated that activation of cure decreased with increasing loading up to 1%, potentially due to the increased thermal conductivity of the composite but increased above 2% loading due to an increase in viscosity of composite. However, the cured Tg remains the same, 298-300o C, upon fully curing with up to 5% loading.

Funder Acknowledgement(s): This material is based upon work supported by NASA Cooperative Agreement NCC3-1044 and Army Research Office contract W911NF-12-1-0084.

Faculty Advisor: Eric A. Mintz, emintz@cau.edu

Grad. #22
Subcategory: Materials Science

Scintillating Metal-Organic Frameworks for Detecting Sub-Atomic Particles

Stephan R. Mathis, II, Clark Atlanta University
Co-Author(s): Brandon Dennis, Esmeralda Castaneda, and Conrad Ingram, Clark Atlanta University

Advancement in radiation detection technology is needed for more reliable, more efficient and less costly screening in a variety of applications. 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. The organic linkers used in this project are not commercially available and are synthesized in house. Use of 1H NMR ,13C NMR and FTIR will be vital in verifying ligand structure before MOF synthesis. MOF synthesis will be conducted under solvothermal conditions to insure stability and protection of the organic species within it. Upon crystal formation, the MOF will be taken through a sequence of washes with solvents to prepare it for specific characterization methods. Single Crystal X-ray Analysis (SCXA) will be performed to discover/verify MOF structure and geometry. X-ray diffraction will be utilized to discover/verify diffraction patterns to further investigate unit cell parameters of the crystal. BET surface area will give information about porosity and surface area of the MOF. Radiation detection studies will be carried out at Clark Atlanta University in a specific setup for time-correlated single-photon counting. This setup will involve a multicomponent “light box” to observe and record time-resolved radio-luminescence spectrum from the scintillating MOFs. Organic ligands have been successfully synthesized in the lab and verified through 1H NMR. MOF crystals have successfully been prepared in the laboratory and are currently being analyzed for crystal structure from the SCXA. BET surface area is being used to reveal porosity and surface of MOF crystal. For future work, the “light box” for retrieving time-resolved radioluminescence spectra will be set up and used on the novel MOF. Also, substitutions of different scintillating ligands may be used to unearth new wavelengths, strengths and characteristics of the MOF crystals. Possible applications of neutron detection may be implemented as well.

Funder Acknowledgement(s): This study was supported, in part, by a grant from the National Nuclear Security Administration through the Nuclear Science and Security Consortium awarded to Conrad Ingram, Associate Professor of Chemistry, Clark Atlanta University.

Faculty Advisor: Conrad Ingram, cingram@cau.edu

Grad. #23
Subcategory: Pollution/Toxic Substances/Waste

Estimation of Melting Points of Bromo- and Chloro- Congeners of POPs

Marquita Watkins, Jackson State University
Co-Author(s): Karolina Jagiello and Tomasz Puzyn, Laboratory of Environmental Chemometrics, Faculty of Chemistry, University of Gdansk, Poland

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 systems but also for human health. Therefore, efficient tools for comprehensive environmental risk assessment for POPs are required. Among the factors of the highest importance for environmental transport and fate processes is melting point of a compound. This phys/chem property is important in environ-mental studies, since it affects solubility and many more crucial characteristics. Deciding factors 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 esti-mated 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 techniques by classifying structures using the Tanimoto index. This study is currently prepared for publication. Current and future studies include investigation of other vital properties of these compounds.

Funder Acknowledgement(s): This work is being funded by NSF -CREST.

Faculty Advisor: Jerzy Leszczynski, Jerzy@icnanotox.org

Computer Sciences and Information Management

Grad. #24
Subcategory: Computer Science & Information Systems

A Collaborative, Adaptive-Based Approach to E-Learning Technology Design

Candice Adams, Auburn University
Co-Author(s): Cheryl Seals, Auburn University

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 setting, 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 resources and skills. Another aspect of learning technologies is they provide an environment that enables users to access information at any time. Lastly, web-based learning environments provide a low cost and effective way to deliver and engage students in a particular subject.

This presentation will describe the formative research conducted to create a collaborative, adaptive-based system design based upon guidelines gathered from two previously built learning environments. Based upon empirical studies of one of the previously built online web-based environments called ChemiNet, it showed that learning depends on how well the student understands the concepts. After observing users using the ChemiNet application 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 application lacked. ChemiNet is a web-based learning environment that was designed to reinforce basic chemistry by providing a dynamic web-based environment for students to explore concepts that may or may not have already been introduced through traditional instructional methods. The results from the testing will be presented to show guidelines for the new collaborative, adaptive-based system design. The framework was designed in such a way that it allows novice developers to modify the content areas of the application framework in order to create their own course. The application created allows students to interact, manipulate and visually inspect the representation of various images and content. It also allows student access to lessons at home and at school without having their physical textbook.

Based upon the research and usability testing, the ability to utilize this tool to support both formal and informal settings increased its appeal for both teachers and students. Finally, a brief overview will be presented of future research in the direction of computer-supported collaborative learning that will outline the relationship between collaboration and learning and if it has an impact on the amount and quality of knowledge retained by students compared to traditional classroom setting learning experience.

Funder Acknowledgement(s): This research is supported in part by the National Science Foundation.

Faculty Advisor: Cheryl Seals, sealscd@auburn.edu

Grad. #25
Subcategory: Computer Science & Information Systems

A Labeled Data Set for Detecting Malware Infecting Android-based Smartphone

Husam Adas, Tennessee State University

As more businesses and consumers migrate to phones and tablets, cybercriminals have followed the herd. Mobil malware attacks have grown in both quantity and complexity, and the trend is projected to continue. Common malicious activities involve collecting user information, sending premium-rate SMS messages, credential theft, SMS spam, black hat search engine optimization, and ransom. Android based smart phones attract 79 per cent of malware according to a report by the US Department of Homeland Security and the Federal Bureau of Investigations. Most solutions for smartphone security require the presence of anti-virus software or intrusion detection system on the phones. These solutions are constrained by the limited memory, storage, computational resources, and battery power of smartphones.

In this research project, we develop a lightweight real-time classifier of URLs generated by smartphone web browsers in cloud computing platform to determine if the associated websites are malicious. This is accomplished by providing the classifier with a labeled data set of URLS and their extracted features. Mobile URLs are collated using a WebCrawler running on the cloud. The collected URLs are then stored on HDFS for feature extraction and labeling. Host level and URL inspection features are then extracted on the cloud. Host level features such as Whois information registration and expiration dates, IP Prefix, AS number, geographic location, and connection speed are extracted along with URL inspection features such as Hostname, Primary Domain, number of Path Tokens and TLD. The resulting data set is then labeled using reputation web scanners and is passed on to a Mohout machine learning library where a decision forest tree classification method is used for real time Malicious URL classification and detection.

Funder Acknowledgement(s): This study was supported by a grant from NSF Research Initiation grant awarded to Sachin Shetty, Tennessee State University.

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

Grad. #26
Subcategory: Computer Science & Information Systems

Using CAPEC Attack Patterns for Secure Software Development

Emmanuel Borkor Nuakoh, North Carolina A&T State University

Co-Author(s): Xiaohong Yuan, North Carolina A&T State University

To develop secure software, it is critical for software developers to understand how an attacker thinks and generates exploits against software. Attack patterns present a knowledge repository of how software may be attacked. Attack patterns have the potential to be used in each phase of the software development lifecycle for developing secure software. The CAPEC (Common Attack Pattern Enumeration and Classification) project is sponsored by the Department of Homeland Security and currently includes 474 attack patterns contributed by the community. How can this vast resource of attack patterns be utilized for developing secure software?

We propose an approach for utilizing CAPEC attack patterns with requirements, design and testing phases of secure software development lifecycle. First, the CAPEC attack patterns are categorized according to the STRIDE (Spoofing, Tampering, Repudiation, Information Disclosure, and Elevation of Privilege) categories. Next we conduct risk analysis using Microsoft SDL threat modeling tool. This will generate threats (i.e. risks) of six cate-gories: Spoofing, Tampering, Repudiation, Information Disclosure, and Elevation of Privilege. From the mapping we generated in step 1, i.e., based on the STRIDE categories, we are able to find all the attack patterns that actually apply to the software system being developed. We will rank the relevance of these attack patterns according to the severity of the attacks, the completeness of the attack patterns, attack prerequisites, likelihood of exploit, CIA (Confidentiality, Integrity, Availability) impact, etc. The most relevant attack patterns will then be scrutinized by the software developers to generate abuse cases, secure design and test cases.

Currently we are building the mapping of CAPEC attack patterns to STRIDE, conducting a case study using an open source health information system OpenEMR. We are using Microsoft SDL (secure Software Development Lifecycle) threat modeling tool to conduct threat modeling on OpenEMR. After this, we will find the most attack patterns and use them to develop abuse cases and test cases, recommend secure design features for OpenEMR. Our future work will be to develop a software tool to provide support for developers to utilize CAPEC attack patterns for secure software development.

Funder Acknowledgement(s): This work is partially supported by NSF HBCU-UP project (HRD-1137516).

Faculty Advisor: Xiaohong Yuan, xhyuan@ncat.edu

Grad. #27
Subcategory: Computer Science & Information Systems

Emergency Response Simulation Using Virtual Reality

Roy B. Brown II, Bowie State University

Over the past decade, wildfires have been making headlines. As a result, wildland firefighting has grown to a high level of importance. The US is in dire need of an effective strategy to address this issue, however, according to the Federal Aerial Fire Fighting agency the Unites States doesn't have an effective aviation plan that addresses this concern. In a panel held by Federal Aerial Firefighting Agency, it has been concluded that most professional aviation communities do not share information about successful techniques, good or bad results, nor do they discuss difficulties encountered in their operations. Further, each element of the conducted operation is not shared with others, except for what is learned during real-world operations.

The goal of this project is to create a helicopter training simulation that will aid in the efforts of treating wildfires. The simulation includes various scenarios immolating real-world instances. Real-world instances are in place to develop alternative techniques that may be applied to real life situations. Our hypothesis is that users of the application will be able to gain skills and knowledge in the virtual environment that they will then be able to apply to the real world due to the sense of presence and realism a virtual environment can provide. This application has a dual purpose. The simulation may be used for both training and educational purposes. The application will track user efficiency and decision making strategies. The virtual environment was created using WorldViz vizard that uses python programming. Textures and objects were modeled using 3DS MAX. Interaction plays a major role in this simulation. The user has several options to control the objects within the environment. Triggered events include: the helicopter releasing water and the helicopter deploying a rope to save people. Most of the built in avatars are located on rooftops displaying various emotions. In conclusion, the simulation is an ongoing project. Currently, the simulation runs smoothly, and the user is able to navigate the helicopter as expected. We are implementing the multi-user capability in the environment so that the pilot can communicate with teams to aid in better decision making strategies for evacuation. We believe that an emergency response simulation will be an effective tool for training firefighting personnel. A training simulation will promote communication while efficiency tracking will aid in training efforts.

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

Grad. #28
Subcategory: Computer Science & Information Systems

Kinect and Management Features in the Virtual Reality Classroom

Wenhao Chen, Bowie State University

The goal of the virtual reality classroom project is to use a virtual reality classroom as a learning tool for education and for students that are enrolled in online classes. Our aim is to create a multi-user virtual classroom environment with features such as chat, user information display, instructor behavior detection, session recording etc. Our hypothesis is that the virtual reality classroom will allow for better learning experiences and will facilitate the mental construction of three-dimensional space due to the "sense of presence" a virtual environment provides. We will conduct experiments in the classroom and learn what kind of behaviors contribute to effective communication and good learning outcomes.

The proposed Virtual Classroom environment was modeled in 3DS Max and exported to WorldViz Vizard which constitute the base of this application. Vizard scripts (in Python language) were used to create the management control panel and achieve the multi-user functionalities. Kinect is used to detect the movement of the instructor. The management control panel consists of several parts. The user information part contains a list of users logged in, user names, and emotions. Each user can select the emotion face to express their emotional state. The instructor has the ability to enable the audio or video in the user information part for each student so that no more than two students can speak at the same time. In the chat part, the student can chat with other students and chat history is available. This feature also allows users to ask question through the chat feature. In the emotion part, the users currently have five behavior icons: happy, sad, yes, no, and question. The user can click the button to select the emotional state. The "Rec" button offers a record function for recording a session. The kinect button enables the kinect function which can detect the movement of the instructor in real life and imitate it on the instructor avatar. It makes the class more vivid and interesting. The instructor also can launch the web camera to let the students see his real image. For most courses, a power point file is needed for presentation in the classes. Although Vizard doesn't support the power point file, we were able to include it. The instructor can export the power point file into an "avi" file and then upload it into the system. By clicking the forward and backward button on the panel, the user can go forward and backward in the file.

Funder Acknowledgement(s): National Science Foundation: HRD-1238784 and HRD-1137541

Faculty Advisor: Sharad Sharma, ssharma@bowiestate.edu

Grad. #29
Subcategory: Computer Science & Information Systems

Showcase Data Center

Emanuel Lin, University of California, Los Angeles
Co-Author(s): Drew Wyskida and Bob Calio, IBM

It is important to be able to utilize modern technology such as mobile devices, QR codes, and QR tags. As a part of my co-op position with IBM Research, I have been given the opportunity to create a content management system, which generates QR codes for individuals to scan in order to find out more information about some of our products.

The main purpose of this project is to allow visitors to be able to learn more about various IBM products that we have on display in the form of a briefing center. For this project, I was given the opportunity to create a website which displayed various types of QR codes such as text, pictures, videos, and/or sound recordings which could be scanned with a QR code reader application installed on an individual's device that is authenticated with proper IBM credentials. The QR code generator was created using PHP and HTML technology, and we are able to specify and print out various sizes of the QR code images in order to properly affix them to the corresponding places which have been tested with multiple types of mobile device. This gives the authorized visitors the ability to walk around our briefing center at their own pace without the need of following and listening to a tour guide if they choose to stay longer at a particular station.

Funder Acknowledgement(s): IBM Research

Faculty Advisor: Drew Wyskida, wysk@us.ibm.com

Grad. #30
Subcategory: Computer Science & Information Systems

SIED, A Data Privacy Engineering Framework

Kato Mivule, Bowie State University
Co-Author(s): Claude Turner, Bowie State University

Many organizations have to comply with data privacy laws that require that individual and sensitive data be kept confidential. However, one of the challenges in implementing data privacy is the ambiguous definition of what privacy is, making the gathering of data privacy requirements problematic. To respond to the data privacy implementation challenges, a privacy-by-design challenge was put forward and described by Cavoukian (2009), in which privacy is entrenched and embedded into the engineering requirements of different methodologies and technologies. Therefore, as a contribution, we propose SIED, a conceptual framework that takes a holistic approach to the data privacy engineering procedure by looking at the specifications, implementation, evaluation, and finally, dissemination of the privatized data sets. While a number of data privacy techniques have been proposed in the recent years, a few frameworks have been suggested for the requirement solicitation and implementation of the data privacy process. Most of the proposed approaches are tailored towards implementing a specific data privacy algorithm but not the overall data privacy engineering and design process. Our preliminary results show that a systematic approach to implementing data privacy is possible by meticulously gathering privacy requirements and, as such, minimizing ambiguities.

Funder Acknowledgement(s): This work was supported in part by the U.S. Department of Education HBGI Grant. Special thanks to the Bowie State University Computer Science Department for making this work possible.

Faculty Advisor: Claude Turner, cturner@bowiestate.edu

Grad. #31
Subcategory: Computer Science & Information Systems

Scalable Hybrid Implementation for Parallel Sparse Matrix-Matrix Multiplication with Reduced Communication Overhead

Md Rezaul Karim Raju, Texas Southern University
Co-Author(s): Christopher John Tymczak, Texas Southern University
Mohammad A. Hoque, East Tennessee State University

Our solution developed in hybrid parallel programming is a novel implementation of sparse matrix-matrix multiplication on heterogeneous cluster environment involving both distributed and shared memory architecture. The proposed algorithm is expected to be linearly scalable up to thousand processors for square matrices with dimensions over 10^6 (million). Our approach of parallelism is based on 1-D decomposition, while hybrid programming combines distributed node memory parallelization with shared memory parallelization inside each node, and can work for both structured and unstructured sparse matrices with regular sparsity. The storage method is based on a distributed hash list, which reduces the latency for accessing and modifying an element of the product matrix. This results in reduced merging cost of the partial results computed by the processors. Theoretically, the space and time complexity of our algorithm is linearly proportional to the total number of non-zero elements in the product matrix C. The performance evaluation results show that our solution is able to scale much better for sparse matrices with bigger dimensions. The speedup achieved using our algorithm is better than the performance of other existing 1D algorithm, the speedup ratio figures (>0.75) with 672 processors. Furthermore, our current research studies the impact of hardware topology, communication overhead and memory consumption on the scalability and performance of the proposed hybrid algorithm.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF-CREST project (Grant No. 1137732), awarded to C. J. Tymczak, Co-PI and Project Director for the Center for Research on Complex Networks, Texas Southern University.

Faculty Advisor: Christopher John Tymczak, tymczakcj@tsu.edu

Grad. #32
Subcategory: Computer Science & Information Systems

What Age Is Too Young To Teach Children Computer Programming?

Michelle Snowden, Bowie State University

The last few decades has brought rapid change to the computer world. Technology keeps getting smaller, smarter and faster. One of the many problems is teaching children programming. The purpose of this research is to evaluate different software and its effectiveness for teaching children about computer programming at an early age. As technology keeps getting smaller, smarter, and faster, children are becoming more inclined to learn about the developing software. At an early age, with the help of educational robots, virtual environments, and computer games, it will enable children to discover STEM (Science, Technology, Engineering, and Mathematics). The vision is that every child should learn how to program.

The goal of this research is to find out what age is too early for children to learn computer programming? The goal of this research will be to provide insight to developers of future software to be used in teaching children about computer programming, as well as providing insight into how the evaluation of different software could lead to children under the age of 4 to learn about computer programming.

This study will use handheld technology such as iPad, tablet, and mobile devices. These devices were chosen to find out what developing software can be used in teaching children programming at an early age of 2. To this end, my research is on the literature of current studies or related work involved in motivating children to learn about programming.

Funder Acknowledgement(s): I would like to thank NSF HBCU-UP for the grant that supported this research.

Faculty Advisor: Daryl Stone, dstone@bowiestate.edu

Grad. #33
Subcategory: Computer Science & Information Systems

Wireless Sensor Network on the Novel Remote Laboratory Unified Framework

Janne Taylor, Texas Southern University
Co-Author(s): Ning Wang, Xuemin Chen, and Wei Li, Texas Southern University

This work presents a remote laboratory for developing, monitoring, and validating energy efficient wireless sensor network (WSN) algorithms. We are building the remote WSN laboratory based on a novel remote laboratory unified framework which was supported by NSF projects and currently is supported by Qatar National Research Fund (QNRF). The user can remotely access these WSN experiments and manipulate the network parameters through a novel remote laboratory framework solution. Remote laboratory is the use of telecommunications to remotely conduct real experiments and is also an inevitable necessity for Internet enabled education in Science, Technology, Engineering, and Math (STEM) fields due to their effectiveness, flexibility and cost savings. This new solution will significantly benefit future WSN experiment development.

The remote WSN laboratory includes three parts, i.e., Experiment Control application, Center Server application and Client web application. For Experiment Control application, we use LabVIEW to setup the WSN experiment. The sensor node data is collected and analyzed by LabVIEW application. We also develop a network communication module in LabVIEW. We use this module to implement the real time communication between experiment workstation and web server. For Center Server application, it is directly built on the top of MySQL Database, Apache web server engine and Node.js web server engine, and we also develop a LabVIEW to Node.js (LtoN) module on the server side. This module is used to handle the real-time communication between the clients and the experiment workstation. For Client web application, it uses the Web 2.0 technology which includes HyperText Markup Language (HTML), Cascading Style Sheets (CSS), and JQuery/JQuery-Mobile JavaScript libraries. In addition, the Mashup technology for user interface integration is employed. Upon implementing the remote WSN experiment under this new unified framework, the experiment interface can be run on any browser in any platform without installing any plug-ins. The user can also conduct the remote WSN experiments to obtain continuous measurements from any portable device browser with Internet access.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant No. 1137732.

Faculty Advisor: Xuemin Chen, chenxm@TSU.EDU

Grad. #34
Subcategory: Computer Science & Information Systems

Network Element Error Spread Prediction In Multichannel Telecommunication

Nathaniel Nana Kojo Taylor, Bowie State University
Co-Author(s): Bo Yang, Bowie State University

Telecommunication network Infrastructure planners often require detail about the number of elements by subscription size and by location to design their network topology. In addition, the operational data set from these elements can be stored in a database for reliability and fault-tolerance and support planning efforts. Errors in automated systems in large service provider networks, undermine attempts to provide reliable, predictable end-to-end high performance fault tolerance networks. While error free systems are not attainable, the dominance of errors in large enterprise network operations cost is very expensive. This study use Poisson distribution, a statistical technique for network element error spread prediction in multichannel telecommunication service provision. This technique is valuable for the arrangement of the various elements. Essentially, the placement of the network's various components, including device location and cable installation, provides a simple and reliable tool for the error spread prediction at nearly any level of topology for a given point in time. The Poisson distribution is a probability distribution of a discrete random variable that stands for the number (count) of statistically independent events occurring within a unit of time or space. Given the expected value, μ, of the variable, X, the probability function is defined as: Where e is the base of the natural logarithm (e = 2.71828...). Consequently, the Poisson random variable can be "stretched" over longer or shorter time intervals. Since μ is the expected (average) number of events per one unit of time or space, μt, there are a wide variety of applications of the Poisson distribution in biology and engineering. However, there are only few documented applications in error spread prediction. This study puts forth two key advancements over prior published work: (1) An entirely new and greatly simplified method for applying the distribution, and (2) Evidence of the reliability of the technique for network element error spread prediction or size distributions in telecommunication service provisioning.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF/HBCU-UP awarded to Bo Yang, Computer Science Department, Bowie State University.

Faculty Advisor: Bo Yang, byang@bowiestate.edu

Ecology, Environmental and Earth Sciences

Grad. #35
Subcategory: Climate Change

CO2 and Carbon Sequestration in Terrestrial/Biological Context

Dorine Reed Bower, University of Arkansas

In 2007, Eystein Jansen et al. of the Intergovernmental Panel on Climate Change stated that “It is very likely that the average rates of increase in CO_2 ... have been at least five times faster over the period from 1960 to 1999 than over any other 40-year period during the past two millennia prior to the industrial era.” A report on climate global analysis for July 2012 from the National Oceanic and Atmospheric Administration preliminarily speculated that July 2012 was characterized by the highest Northern Hemisphere land surface temperature since records had been kept, with temperatures 1.19°C (2.14°F) above the average. With the level of anthropogenically-produced and naturally occurring carbon dioxide (CO_2) in the atmosphere becoming an increasingly important environmental problem, the importance of carbon sequestration as a viable solution is likewise increasing. The well-known “Keeling Curve” shows this precipitous rise of CO_2 levels. Characterization of carbon flux in an oak-hickory forest, red cedar forest and two grassland communities (one native and the other managed) in the Pea Ridge National Military Park of northwest Arkansas is the focus of this ongoing research effort. The capability of this gaseous inorganic molecule to be sequestered or stored in the biomass or detritus of the various components (e.g., living plants, soil, coarse woody debris and litter) that make up each of the four different vegetation types is being assessed.

In addition, this capability will be evaluated in the context of the changes that have occurred in the overall landscape of Pea Ridge National Military Park since the 1940s. Sample collection is complete for the native grassland site, and nearly complete for the red cedar site. Similar efforts are underway for the oak-hickory forest and managed grassland study sites. The researcher will be measuring either 10 or 20 mg samples, depending on which component of the plant or soil is being considered. Samples will be loaded into aluminum “boats” and placed in an Elementar vario El cube (Elementar Americas, Inc., Philadelphia, PA) for analysis of total C and N by high temperature combustion. Results of the C and N concentrations can then be expressed as mg/kg on a dry weight basis. It is anticipated that at some point in the future the research effort will be extended to include the contribution made by endo- and ectomycorrhizal fungi as they relate to carbon sequestration. It is anticipated that the entire project will be completed during the first half of the 2014 field season.

References: Brye, Kristofor R., Riley, T. Lee, and Gbur, Edward E., Prairie restoration effect.

Funder Acknowledgement(s): This study is funded in part by the Slime Mold Project.

Faculty Advisor: Steven L. Stephenson, slsteph@uark.edu

Grad. #36
Subcategory: Climate Change

Warming and Nutrients Facilitate Exotic Species Invasions in Wetlands

Maria Meza-Lopez, Rice University

Habitats are often invaded by multiple invasive species. This may be a result of exotic species' common responses to environmental conditions or positive exotic species interactions. Climate warming has been predicted to enhance invasion success, but current knowledge is primarily based on bioclimatic models that neglect the effect of multiple environmental factors and their interactive effect on species invasions. We assessed the effects of nutrient addition and warming on exotic plants and exotic herbivore invasion success and their individual and combined impact on native species in wetlands. We conducted a 2 × 2 × 2 factorial mesocosm experiment with 5 replicates per treatment for 16-weeks. Forty freshwater native wetland communities were established. They were randomly assigned to: 1. warming (ambient or a 2°C increase), 2. nutrient addition (control or 6 mg/L N and 1.7 mg/L PO_4), and 3. plant origin (2nd planting of exotic plants [*Alternanthera philoxeroides*, *Eichhornia crassipes*, and *Pistia stratiotes*] or additional native plants [*Typha latifolia*, *Hydrocotyle umbellata*, *Limnobium spongia*, *Pontederia cordata*]). Exotic apple snails, *Pomacea maculate,* were introduced into all established native wetland communities. Weekly exotic snail egg mass surveys were conducted.

After 16-weeks, aboveground plant mass was harvested, sorted by plant species, dried, and weighed. Exotic snails were collected, measured, and weighed. Exotic plant and exotic snail invasions lowered native plant mass independent of environmental conditions. Warming had no effect on exotic plants, suggesting that nutrients and warming will facilitate exotic plant invasions in *P. maculata* invaded wetlands. Nutrients with warming increased *P. maculata's* mass and with warming alone *P. maculata's* reproduction had a 4 fold increase. This suggests that warming alone and in combination with nutrient addition will facilitate *P. maculata* invasions, enhancing their impact on native wetland communities, facilitating exotic plant invasions.

These results suggest that ecosystems invaded by multiple exotic species are primarily a result of exotic species' common response to anthropogenic environmental conditions.

Funder Acknowledgement(s): Meza-Lopez was supported by a Ford Foundation Predoctoral Fellowship and EPA STAR Fellowship. The study was supported by a Shell Center for Sustainability Research Grant and Rice Centennial Award to Support Undergraduate Research.

Faculty Advisor: Evan Siemann, siemann@rice.edu

Grad. #37
Subcategory: Ecology

Has Barandabar Corridor Forest Reached Carrying Capacity for Tigers?

Audra A. Huffmeyer, University of Michigan/University of Minnesota Twin Cities

Chitwan National Park (CNP), in southern Nepal, is home to one of the highest population densities of Royal Bengal tigers (*Panthera tigris*). Isolation of tigers within CNP threatens the future of this species. Eleven buffer zone community forests (BZCF) surround CNP and make up Barandabar Corridor Forest (69 km2). The BZCFs are managed by local people for wildlife and biodiversity to attract the eco-tourism that supports their livelihoods. These management practices may provide prime habit for tigers and their prey.

The goal of this study is to estimate the current carrying capacity of tigers in Barandabar Corridor Forest and determine how carrying capacity has changed from 2008 to 2013 in order to better understand how tigers use the buffer zone of CNP. Since the local people manage for wildlife, I hypothesized there will be an increase in prey abundance each year, thus an increase in tiger carrying capacity each year. Ungulate survey data was collected each spring from 2008-2013 and analyzed using Program DISTANCE 5 to estimate ungulate densities. Data analyses revealed Barandabar Corridor Forest is currently able to support three adult tigers and from 2008-2013; the carrying capacity of Barandabar Corridor forest increased by one whole tiger. The results of this study are identical with the 2010 national camera trap data, which revealed that three adult females occupy BCF. Future studies include analyzing this data with covariates and continuing to monitor tiger carrying capacity, annually.

Funder Acknowledgement(s): University of Minnesota, College of Food, Agriculture and Natural Resources.

Faculty Advisor: James L. David Smith, smith017@umn.edu

Grad. #38
Subcategory: Ecology

Stable Isotopic Evidence of Water Competition Between Aridland Plants

Jeffrey Ross, University of Utah

Invasive species threaten the integrity of agricultural and natural systems throughout the world because these species often exhibit enhanced performance in the introduced range. One such species, *Rhaponticum repens* [Russian knapweed], is clonal and has successfully invaded disturbed areas throughout much of the Western United States and Canada. *R. repens* is a long-lived, highly aggressive C3 perennial forb that has an extensive, dimorphic root system. Due to its extensive and connected root system, *R. repens* is predicted to have a competitive advantage over native species in utilizing soil moisture from varying soil depths and different locations through the year. By measuring the δ18O stable isotopes of cryogenically extracted plant stem water, this study determined the source of water being used by plants in a highly disturbed site on the Colorado Plateau.

Preliminary results from δ18O isotopic analysis revealed that stem water of *R. repens* varied from -5.1‰ to -14.6‰. In contrast to native herbaceous species, this evidence suggests that *R. repens* has the ability to utilize multiple water sources throughout the growing season. These results also suggest that *R. repens* stolons may be transporting water to other ramets. This makes *R. repens* a strong competitor for water in an otherwise water-limited environment. As such, without proper control and management, it is likely that *R. repens* could potentially replace native species over time.

Funder Acknowledgement(s): This study was supported by a grant from the Bureau of Land Management awarded to the Rio Mesa Center, University of Utah.

Faculty Advisor: James Ehleringer, jim.ehleringer@utah.edu

Grad. #39
Subcategory: Geosciences and Earth Sciences

Flood Heterogeneity as a Tool for Exploring Flood Frequency-Climate Linkage

Diana Zamora-Reyes, University of Arizona
Co-Author(s): Katherine K. Hirschboeck, University of Arizona

Accurate discharge estimates derived from flood frequency analysis (FFA) are needed for real-world applications to reduce flood hazard impacts. In the US, these estimates are currently calculated following the FFA method described in the 1982 Bulletin 17b (B17b). Although it has proven to be efficient over the past 30 years, the authors and the hydrologic community agree that it's time for an update. An assumption made in B17b is that all floods come from the same homogeneous population when in reality heterogeneity may exist. For such cases, incorporation of the driving atmospheric mechanisms into the analysis is encouraged. Moreover, watersheds that currently exhibit heterogeneity can benefit from this alternative analysis since climate change might not affect the prevalence of all flood types similarly.

Arizona's geographic location and complex terrain are associated with three different types of flood-generating atmospheric processes: summer and tropical cyclone-enhanced convective thunderstorms, and winter synoptic-scale storms. In an earlier study, regional patterns of flood heterogeneity in Arizona were found to influence discharge estimates in individual watersheds. In this study we build on these watershed-based climate-flood linkages by exploring the temporal relationship between flood heterogeneity and climatic variability. US Geological Survey partial duration series (PDS) peak flow discharge records from stations across Arizona were compiled and classified according to meteorological cause. Subsequently, the PDS for each station was analyzed for the prevalence of each flood type by counting the number of peaks-over-threshold in each classification per water year.

The observed record revealed distinct periods of temporal dominance by different flood producing mechanisms. These periods were used to guide the development of a series of future scenarios by resampling the observed data to simulate plausible changes in the mix of flood types. Using upper and lower quartile events to represent extremes, several scenarios were constructed for watersheds in different hydroclimatic regions. The scenarios included: increased/decreased convective activity due to enhanced/suppressed summer moisture-flux, and increased/decreased winter-synoptic activity caused by varying jet stream patterns. Finally, all heterogeneity information was compiled to create joint conditional probability equations which were used to calculate the 1% and 0.5% Annual Exceedence Probability discharge estimates. This experimental approach resamples from observed data to construct hydroclimatologically realistic scenarios for individual watersheds. It can be used as a complement to future climate change scenarios based on downscaled precipitation from global circulation models. Arizona is in clear need of studies that can coherently incorporate climate change into FFA since recent studies warn of the possibility of a considerable increase in future flood damage.

Funder Acknowledgement(s): This study was supported, in part, by the NSF Bridge to the Doctorate grant awarded to Maria Teresa Velez, Associate Dean for the Graduate College, University of Arizona.

Faculty Advisor: Katherine K. Hirschboeck, katie@ltrr.arizona.edu

Grad. #40
Subcategory: Water

A Comprehensive Analysis of the Schleman Hall Extensive Green Roof

Fushcia-Ann Hoover, Purdue University
Co-Author(s): Laura Bowling, Purdue University

As city populations continue to rise, so does the stress on stormwater systems as load increases. In addition to this system stress, increases in runoff from impervious surfaces are also leading to a greater release of pollutants and increased flow into rivers, lakes and natural waterways. Green roofs are one type of management practice that is being discussed as a means to reduce the runoff and stress being put on urban stormwater systems. Additional benefits of installing a green roof include reduction in energy use for the building, reduced greenhouse gas emissions and more.

In an effort to quantify these potential benefits, a case study was performed for the Schleman extensive green roof at Purdue University. An evaluation of its performance was conducted under the hypotheses that the Schleman green roof reduces stormwater loads being received by the West Lafayette treatment plant, in addition to reducing the energy requirements for operating the building. The total net impact of the green roof was determined by constructing an observation-based water balance of the 165 m2 roof system from measurements of soil moisture, precipitation, estimated evaporation, depression/detention storage and runoff. An extended cost-benefit analysis was simulated for the conference room below the green roof to address changes in energy consumption. A theoretical equation for runoff from a control roof was used for the water balance and a “with-without” scenario for the energy balance was designed to represent a control scenario.

The results from the water balance analysis revealed retention rates on average of 58% of precipitation per rain event, where retention included soil moisture, evaporation and detention/depression storage. Using the TRNSYS 17 energy auditing program to simulate Schleman room energy needs with and without the presence of the green roof, it was found that the green roof resulted in a 0.67% decrease in energy needed to maintain a near constant temperature in the conference room below the green roof. The analysis demonstrates the need for further research and detailed simulations regarding energy analysis and the valuing of ecosystem services offered by the green roof to create a more complete picture of the roof’s environmental and financial impact on the University. If expanded, the results could additionally impact the community at large and other equally sized urban areas where combined sewer and separated sewer systems exist.

Funder Acknowledgement(s): This research was supported by the Purdue University Ross Fellowship and the Purdue Midwest Crossroads Alliance for Graduate Education and the Professoriate Program.

Faculty Advisor: Laura Bowling, bowling@purdue.edu

Mathematics and Statistics

Grad. #41
Subcategory: Materials Science

Single Fiber and Fiber Bundle Strength Probability Distribution of High Performance Polymer Materials

Eugene Douglas, Virginia State University
Co-Author(s): Krishan Agrawal and Younjin Lu, Virginia State University

The initial interpretation of polymer single and bundled fiber tensile strength test data indicates a decreased reliability of single fiber strands when bundled from the same sample set. This research investigates the probability distribution of strength for single fibers and the Asymptotic probability distribution of tensile strength for unidirectional fiber bundles. According to the statistical theory of failure, the probability distribution of the strength of a single fiber follows a two-parameter Weibull distribution. The parameters of a Weibull distribution could be fitted by examining the sample data. The tensile strength of the bundle exhibits considerable variability. Possible causes are: position and severity of flaws vary randomly along the fiber length, load is not distributed evenly and slack exists in the fibers. Therefore, the actual failure process of a bundle and the relationship between the tensile strength of a single fiber and a fiber bundle are complex. Our preliminary examination of sample data sets of the strength for single fibers determined that the data follows the two-parameter Weibull distribution.

The research is based on data generated by Honeywell Analytical Labs between 2006 and 2012 and will analyze strength test data using the two-parameter Weibull probability distribution to determine the range of loss in strength of single fibers in unidirectional bundles of 60 fibers and unidirectional bundles in multiples of 60. Using MATLAB (Statistics Toolbox) software, we propose to employ Linear Regression and the Maximal Likelihood Estimation method to find the probability distribution function of tenacity for single and bundled fibers. Our ongoing research will also address factors that could affect the probability distribution of strength for bundle fibers and they are: the probability distribution of single fiber strengths, the mechanics of the load transfer from broken to unbroken fibers in the bundle, and the dependence of fiber strength on gauge length, fiber geometry, etc. This research is useful in new product development. Key References: Z. Chi, T. Chou, and G., Determination of Single Fibre Strength Distribution from Fibre Bundle Testings, 1984; W. Weibull, A statistical theory of the strength of material, 1939.

Funder Acknowledgement(s): This study is supported by the HBCU Master's (MS) Degree Program, funded by the Department of Education, Virginia State University; Pamela Leigh-Mack, Co-Project Director, Virginia State University; and Ronnie Moore, Advanced Fibers & Composites Honeywell Performance Materials and Technologies, Colonial Heights, VA

Faculty Advisor: Krishan Agrawal, kagrawal@vsu.edu

Grad. #42
Subcategory: Mathematics and Statistics

Snow Water Equivalent Data-Processing Simulator

Ka'Ren Byrd, Elizabeth City State University

This poster will discuss 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 (RTDs), 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): NSTI; NASA Goddard Flight Center, Greenbelt MD

Faculty Advisor: Akbar Eslami, aeslami@gmai.ecsu.edu

Grad. #43
Sub-Category: *Mathematics and Statistics*

A Randomized Algorithm for Tensor Decomposition

Deonnia Nichole Pompey, University of Alabama at Birmingham
Co-Author(s): Carmeliza Navasca, University of Alabama at Birmingham

Finding low-dimensional structures in high-dimensional spaces has several applications in signal and image processing in areas such as the biomedical field. Often, large data sets are encountered in this field which has high memory requirements and computational cost. Randomized algorithms have provided exceptionally accurate approximations for matrix factorizations. Not only in accuracy does the randomized method surpass the standard deterministic algorithms but also in speed and strength. In this project, we propose a randomized algorithm for tensor decomposition. The term tensor refers to a multi-dimensional array, and the order of the tensor is the cardinality of the indexed set. For example, a vector is a first order tensor and a matrix is a second order tensor. In this experiment, we will work with third order tensors (cube), which can be visualized as several matrices lined up back to back. We first use a randomized QR decomposition algorithm for matrix SVD, and then apply the algorithm for tensor SVD. Each tensor must be matricized, and the algorithm is performed on each successive tensor mode. For example, on a third order tensor the algorithm is applied for the three matricized sub-problems. We can use this technique on real life datasets in image clas-sification and MRI image compression. Theoretical results on the error estimation show the success of these randomized algorithms on real life data. Our randomized code is successful in finding a low-rank approximation for tensors and image processing.

In the future, we will experiment with implementing low-rank matrix completion using alternating minimization in our algorithms to perhaps achieve tensor with lower rank and less error. In this method, the low-rank target matrix is written in a bi-linear form, i.e. X=UV^T; the algorithm alternates between finding the best U and the best V. Also, ongoing work to improve the randomized algorithms will be done. We are always looking for a faster and cheaper way to solve these image compression problems.

Funder Acknowledgement(s): Bridge to the Doctorate LSAMP Program

Faculty Advisor: Carmeliza Navasca, cnavasca@uab.edu

Nanoscience

Grad. #44
Subcategory: Biomedical Engineering

Effect of Protein Corona on Cellular Uptake of Nanoparticles

Ayten Ay, Syracuse Academy of Science Charter School
Co-Author(s): Haarika Kamani and Shikha Nangia, Department of Biomedical and Chemical Engineering, Syracuse University
Sydney Mendez, Lincoln Middle School, Syracuse City (NY) School District

Nanoparticles (NPs) are being increasingly used in biological applications, and understanding how these NPs interact with the biological milieu is vital for their efficient use in areas of cancer drug delivery, biosensing, and bioimaging. Recent studies indicate that NPs when exposed to physiological fluids adsorb a coat of proteins/peptides in the form of a corona that ultimately determines their fate in biological systems. It is however, not clearly understood how factors like size, shape, charge, and chemical composition of NPs influence the protein corona formation and their subsequent cellular uptake. Our objective is to use coarse grained molecular dynamics simulations to investigate the formation of protein corona as a function of shape and charge of metallic NPs, and determine their rate of translocation through the cell-membranes. In the first step of our investigation, adsorption of blood serum proteins was studied on spherical and rice shaped gold NPs with varying surface charge density. In the second step, the translocation of the composite NP-protein corona particle through the lipid bilayers was investigated using the pull simulation technique. We found that corona formation is an electrostatically driven process and the stability of the corona is a function of NP surface charge density. Further, the corona remains intact during the translocation process with minimal loss of proteins from the NP surface. On the other hand, uncharged NPs translocated through the cell membrane as bare particles. Currently, we are performing calculations to estimate the energy barriers and translocation rate constants of NPs with and without protein coronas. These results indicate that biomedical application involving target specific charged NPs are potentially rendered ineffective due to fouling of the NP by the serum protein corona.

Funder Acknowledgement(s): This research is sponsored by the Research Experience and Mentoring program, which is funded by the Office of Emerging Frontiers in Research and Innovation (EFRI 1137186) of the National Science Foundation, 2013.

Faculty Advisor: Shikha Nangia, snangia@syr.edu

Grad. #45

Subcategory: Materials Science

Structural Properties of BTO/LSMO on STO and LAO Grown Using Plasma PLD

Sha'La Fletcher, Norfolk State University
Co-Author(s): Brandon Walker, Casey Gonder, R.M. Mundle, M. Bahoura, Qiguang Yang, J. Skuza, Bo Xiao, and A.K. Pradhan

Currently we explore multiferroics and dependence of their properties on thickness and growth conditions. These ferroelastic 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 thickness 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. Magnetization measurements were completed using the SQUID Magnetometer and compared for varying BTO thicknesses on LSMO grown on both STO and LAO substrates. Simultaneously, mechanical properties were explored using X-Ray residual stress measurements and compared to the results of nanoindentation measurements. Surface topography for structural differences of the two growth methods are explored using atomic force microscopy. Results show a dramatic difference in the structural organization of films grown in RF oxygen plasma, which can be attributed to the more complete filling of oxygen vacancies within the oxide films. 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.

Funder Acknowledgement(s): This work is supported by the DoD (CEAND) Grant Number W911NF-11-1-0209 and W911NF-11-1-0133 (US Army Research Office), NSF-CREST (CNBMD) Grant number HRD 1036494.

Faculty Advisor: Aswini Pradhan, apradhan@nsu.edu

Grad. #46

Subcategory: Nanoscience

Dendrimer-Templating: A Facile Fabrication Method for Bimetallic CuNi NPs

Md Ariful Ahsan, Tuskegee University
Co-Author(s): Willard E. Collier and Michael L. Curry, Tuskegee University, Alabama

The potential applications of metallic nanoparticles (NPs) as light absorbers in solar cells, storage media in technological devices, catalysts in catalytic reactions, and antimicrobials in biological systems have increased efforts in the development of novel methodologies to synthesize NPs with highly, controllable sizes, compositions, and morphologies. However, due to the high affinity of metal-to-metal interactions, size control and conglomeration of the formed NPs, they are difficult to control during the synthesis process. One promising method for the preparation of monodispersed metal NPs is the use of Poly (amido)amine PAMAM dendrimers as host templates, which can overcome limitations associated with traditional synthesis methods. In this work, we report the synthesis of monodispersed bimetallic CuNi nanoparticles with highly controllable sizes and composition. Using the chemical reduction approach, UV-Visible Spectroscopy shows that bimetallic CuNi NPs are formed within the interior cavities of the dendrimer structure. X-ray diffraction analysis confirms the presence of both Cu and Ni with a face-centered cubic crystal structure. TEM analysis confirms the production of spherical bimetallic NPs with an average size of 5 nm upon introduction of $NaHB_4$, chemical reduction. In addition, the catalytic activity of the formed bimetallic NPs will be evaluated for potential applications as antimicrobial agents and as enhanced light absorbers for solar cells.

Funder Acknowledgement(s): National Science Foundation under Grant Nos. EPS-1158862, HRD-1137681; Department of Chemistry and Department of Materials Science and Engineering, Tuskegee University

Faculty Advisor: Michael L. Curry, currym@mytu.tuskegee.edu

Grad. #47

Subcztegory: Nanoscience

β-Cyclodextrin/β-Sitosterol Inclusion Complexes as Drug Delivery Vehicles

Janet Cowins, Clark Atlanta University
Co-Author(s): Ishrat Khan, Clark Atlanta University

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 cavity of β-Cyclodextrin is hydrophobic. These unique characteristics enhance β-Cyclodextrin's solubility 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 in previous studies 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. To understand and determine the stability of the β-Cyclodextrin:β-Sitosterol non-covalent complexes, we have studied the complexes with IR (Infrared Spectroscopy), NMR (Nuclear Magnetic Resonance Spectroscopy) and DSC (Differential Scanning Calorimetry). NMR studies reveal an upfield shift of β-CD protons as the concentration of β-Sitosterol is increased. NOESY (Nuclear Overhauser Effect Spectroscopy) NMR studies suggest that most of β-Sitosterol was encapsulated in the β-CD cavity, as evidenced by cross peaks between β-Sitosterol hydrogens inside β-CD's cavity. Additionally, FT-IR and DSC studies also indicate the formation of stable β-Cyclodextrin:β-Sitosterol inclusion complexes. These initial studies suggest that the complexes have potential to be utilized as a target specific anti-tumor drug delivery vehicle.

References: Caliceti, P.; Salmaso, S.; et al., Bioconjugate Chem., 2003, 14, 899-908.
Awad A.; Fink, C., American Society for Nutritional Sciences, 2000, 130, 2127–2130.
Liu, B.; Zhao, J.; et al., J. Agric. Food Chem., 2012, 60, 12501-12507.

Funder Acknowledgement(s): These studies were supported by the MBRS/RISE Program-NIGMS/TWD Grant #2R25GM060414, in addition to the NSF/CREST/CFNM Grant #HRD-1137751 at Clark Atlanta University.

Faculty Advisor: Ishrat Khan, ikhan@cau.edu

Grad. #48

Sub-Category: Nanoscience

Effect of Fly Ash and Nano-Silica on Concrete's Compressive Strength

Nitza Garcia, University of Puerto Rico, Mayaguez
Co-Author(s): Luis Zapata, O. Marcelo Suárez, Mauricio Cabrera, and Giovanni Torres, University of Puerto Rico, Mayagüez

The replacement of cement by mineral admixtures in concrete has been of interest in the construction industry. Nevertheless, several of the potential replacements have shown a drop in concrete's compressive strength at early age due to slower reaction. Fly ash class F, for example, follows such pattern. Hence, a viable option to compensate this loss is mandatory. This project investigates the use of nano-silica to compensate the loss of compressive strength by accelerating the hardening process. Also the use of such nanoparticles is expected to improve the microstructure interface between cement paste and the aggregate by making it more uniform and compact. A statistical experimental design involving mixtures of Portland cement, fly ash, and nano-silica, in addition to water to binder ratio as an external factor, is proposed to this end. Ranges of factors were varied according to real industry. This design allows the estimation of a cubic regression model that properly accounts for the mixture components within a constrained experimental region, as well as the external factor at two levels. In this work, the results are discussed based on the chosen experimental design. The interaction terms that significantly affect the response variable were identified. As future work, an optimization problem of maximizing the concrete compression strength will be developed to look for an optimal mix that satisfies all the restrictions and at the same time uses fly ash as cement replacement.

Funder Acknowledgement(s): This material is based upon work supported by the National Science Foundation under Grant No. HRD 0833112 (CREST program). Additional support was provided by the US Dept. of Education through Grant No. P120A120097 (MSEIP program).

Faculty Advisor: Mauricio Cabrera, mauricio.cabrera@gmail.com

Physics

Grad. #49

Subcategory: *Astronomy and Astrophysics*

Symmetry in Quantum Turbulence

Cassandra Oduola, Texas Southern University
Co-Author(s): Jacques Richard, Daniel Vrinceaunu, Christopher J. Tymczak, and Oscar H. Criner

Turbulence is a phenomenon associated with chaotic and stochastic change in properties. The unpredictability of natural disasters such as hurricanes and tornadoes is due to turbulence in weather patterns. At the quantum level, turbulence can be found in quantum fluids also known as super fluids—a friction free state of matter containing charged particles. Super fluidity has recently been observed at the core of neutron stars. These fluids containing charged particles also act as perfect electrical conductors that never lose energy (superconductors). Studies have found that the remaining protons in the star's core are also in a superfluid state, and because they carry a charge also form a superconductor. This study employs the non-linear Schrödinger coupled with Poisson's equation for three dimensio -nal quantum turbulence simulations. These simulations follow Fermi-Dirac statistics. Research has found evidence of soliton solutions to the non-linear Schrödinger coupled with Poisson's equation. Solitons are self-reinforcing waves in nature that are also symmetric. Future research involves solving these equations in time for further proof of solitons found in quantum turbulence.

Funder Acknowledgement(s): I would like to thank the National Science Foundation for funding.

Faculty Advisor: Christopher Tymczak, tymczakcj@tsu.edu

Grad. #50

Subcategory: Materials Science

Plume Propagation Simulation for Pulsed Laser Deposition

Corey Oses, Cornell University
Co-Author(s): Timur Babakol and Joel Brock, Cornell University

Complex oxides have demonstrated a broad range of material properties that would serve well in new devices. High quality thin-film growth of complex oxides can be achieved by Pulsed Laser Deposition (PLD). While the process has certainly proven itself in regards to achieving atomically precise growth, the dynamics of the system are mostly unknown. The PLD process begins with a pulse from a KrF (248 nm) laser that strikes a target and evaporates the material, sending a plume of a monolayer toward the substrate for deposition. Using time resolved X-Ray Fluorescence and electric current measurements taken at the Cornell High Energy Synchrotron Source, a unique feature has been discovered. At pressures between 10^(-1) and 10^(-3) Torr, the plume differentiates into two distinct formations, while the plume maintains full integrity at higher and lower pressures. There are several types of interactions occurring to produce these results, including mechanical collisions with background particles, namely oxygen, chemical bonding, and electromagnetic attractions. The purpose of this project is to determine how much of our observations can be explained by simply considering the mechanical interactions. A robust, three-dimensional Monte-Carlo simulation of a target particle's trajectory through the PLD chamber was created. I incorporated the free path distribution of the target particles, the Maxwell-Boltzmann distribution for the speeds of the oxygen particles, the impact parameter distribution dependent on the ratio of the speeds of the colliding particles, and the elastic collision model to simulate random mechanical interactions between target and background particles.

The simulation proved fruitful in exemplifying canonical mechanics concepts, including the thermalization of the plume and mass matching in kinetic energy transfer. However, the simulation did not predict the plume partition exhibited in PLD. We observe that mechanical interactions are not enough to explain the plume partition we observe at our target pressure, and that chemical and electromagnetic interactions play a much larger role than expected. We hope to incorporate such interactions in future simulations.

Funder Acknowledgement(s): This research was done, in part, with support of LSAMP Program at Cornell University. I would also like to acknowledge the Brock Group at Cornell University for allowing me to perform research on such an exciting topic. The group has supported all of my research.

Faculty Advisor: Joel Brock, joel.brock@cornell.edu

Grad. #51

Subcategory: Materials Science

Development of Piezoelectric Coupled Cantilever Structure Energy Harvester

Mychal Thomas, Alabama A&M University
Co-Author(s): Motasim Alomari, Mostafa Dokanian, and Ashok K. Batra, Alabama A&M University

Piezoelectric materials have been used in various devices such as transducers, generators and sensors, as well as, in energy conversion from ambient vibration into electrical energy.

However, the electrical power obtainable from the piezoelectric ceramic materials is currently too weak to operate various milliwatt driven electronic devices. It is imperative to utilize a high performance piezo-element to extract maximum power from the piezoelectric energy harvesting systems.

Therefore, the general purpose of our research is to optimize the performance of the metal cantilever beam harvester by fabrication, characterization, and optimization of the harvesting circuits. We have studied a parametric optimization on the energy generation of a transverse mode piezoelectric-beam system via Euler-Bernoulli beam theory [EBBT]. The EBBT model was applied to predict the power generated from a metal cantilever beam with harmonic oscillations on two different materials: (I) commercially available materials, and (II) PVDF:PZT nanocomposite elements fabricated in our laboratory. The preliminary results indicate that the change in the geometrical properties profound effect on generating higher electrical power [Batra].

Funder Acknowledgement(s): This work has been supported, in part, by the AAMU-NSF HBCU-UP grant from the National Science Foundation # HRD0928904.

Faculty Advisor: Mostafa Dokhanian, mostafa.dokhanian@aamu.edu

Grad. #52

Subcategory: Mathematics and Statistics

Topological Bound States in One-dimensional Tight Binding Hamiltonians

Marvin Q. Jones Jr., North Carolina A&T State University/ Indiana University

Phases of matter are of fundamental importance to our understanding of many physical phenomena. Matter takes on numerous states, all of which differ in physical properties substantially. We know the common phases of matter: solid, liquid gas and plasma, which are all created through different conditions on a material. Variations in the conditions or parameters such as temperature, pressure and density often serve as catalysts for observing different phases of matter. Understanding the phases of matter and transitions between them is the subject of condensed matter physics.

We are also interested in materials such as solids and how electrons behave in such materials. Electrons in metal have their own distinct phases such as the ability to move more or less freely depending on the properties of the metal, however, electrons in an insulator may be more tightly bound to ions. Much of the interaction stems from understanding the lattice structure of the system, which is a repeating pattern between points and a prescription (or function) about how it repeats. Many crystals and solids have unique lattice structures, which affect how electrons may behave in that material. The behavior of the phases and transitions of these materials are classified by a topological invariant that does not change if parameters of the system are changed smoothly.

Understanding these new materials and their physical properties lead to many unique applications, which range from materials for computers to materials for gaming systems. We seek to investigate some of these topological properties in simple systems transitioning to more complex systems amenable to exact numerical calculations through a computer algebra system. The method involves diagonalizing the Hamiltonian matrix, which provides the eigenvalues and eigenvectors, to describe the energy spectrum of the system and the wave functions behavior at different points. Understanding the behavior of eigenvalues and eigenfunctions will help identify the topological properties of the phases of electrons.

Funder Acknowledgement(s): HBCU STEM Initiative, Indiana University

Faculty Advisor: Babak Seradjeh, babaks@indiana.edu

Grad. #53

Subcategory: Physics (not Nanoscience)

Electrodeless Time Resolved Microwave Conductivity for Photogeneration

Clement Etukakpan, North Carolina Central University
Co-Author(s): Yongan Tang and Branislav Vlhahovic, Department of Mathematics and Physics, North Carolina Central University

The electrodeless flash photolysis time-resolved microwave conductivity (TRMC) technique has been reported in studying the photogeneration of charge-carriers in spin coated films of regioregular poly(3-hexylthiophene) (P3HT) films, which has the high mobility coined with the environmental stability and ease of processing. A photon energy range from 1.9ev to 5.2ev for incident light intensities from 1013 to 1016 photons/cm2 per (3 ns) pulse was used to pump the electrons in the medium; it is because the first absorption band of P3HT is within the range 1.9ev – 3.0ev. The activation energy of the photoconductivity was found to be approximately 50mev at all photon energies. The high intensity, sub linear dependence of the photoconductivity can be described by the occurrence of either exciton – exciton annihilation or diffusional charge recombination with rate coefficients of 2.3 x 10-8cm3/s and 1.1 x 10-8cm3/s. The electrodeless TRMC experiment holds unique advantages over conventional DC techniques, The P3HT polymer in a microwave cavity where there was maximum exposure with the electric filed strength. The photo induced change in the conductance of the sample on flash photolysis was monitored as a change in the microwave power reflected by the cavity at resonance. This report is important in understanding about the efficiency and mechanism of converting light into electricity.

Funder Acknowledgement(s): This work was supported in part by NSF: HRD-0833184, NASA: NNX09AV07A and ARO: W911NF-13-1-0165.

Faculty Advisor: Yongan Tang, tangy@nccu.edu

Science and Mathematics Education

Grad. #54
Subcategory: Chemistry (not Biochemistry)

Teaching Tools for Pedagogy at the Nanoscale

Marc N. Muniz, North Carolina State Unviersity
Co-Author(s): Maria Oliver-Hoyo, North Carolina State University

The field of nanochemistry is at the forefront of the physical sciences and is increasingly finding diverse applications. As such, there is a need to allow this frontier to be explored thoroughly in undergraduate chemistry curricula. The development and assessment of new instructional materials is necessary, as the existing literature in undergraduate nanochemistry education does not provide instructors with adequate resources to help students make connections between core scientific concepts and those pertinent to the nanoscale. We have developed instructional materials, based on a theoretical framework for analogy and similarity[1], to explicitly connect core chemical and physical concepts to those at the nanoscale.

The principal research questions of the work are as follows: 1. Do the newly developed instructional materials promote in students the ability to effectively map core concepts into the realm of nanochemistry? What evidence can be provided to this effect? 2. Does analogical transfer enable students to develop a more sophisticated viewpoint on both core and nano knowledge domains? It is hypothesized that there will be evidence to positively support both of these research questions.

This evidence is being gathered and analyzed via a mixed-methods approach involving pre- and post-activity student interviews, and recordings of students' discourse in small groups as they carry out the activities. Conceptual change theory is the framework upon which the analysis rests. Coding of the interviews and students' group discourse is, in part, based upon an analytic epistemology by W. V. Quine[2], and the qualitative component of the assessment as a whole is adapted from Duit et al.[3, 4] The quantitative component is invoked when interesting patterns emerge in the data. It involves the use of small-sample data statistics for contingency tables, particularly Fisher's exact test and the Yates corrected Chi-Square test.[5] Results through this point indicate that students are able to make meaningful connections between the core conceptual (base) and nanoscale (target) domains. The final activity trial is to be carried out during the Fall 2013 semester. It is expected that the positive affirmation of the research questions will continue upon analysis.

References: [1]. Gentner, D.; Markman, A. B. Am. Psychol. 1997, 52, 45-56. [2.] Quine, W. V. Pursuit of Truth; Harvard University Press: Cambridge, MA, 1990; pp 1- 36, 61-76, 95-102. [3.] Duit, R. et al. Learn. Instr. 2001, 11, 283-303. [4.] Duit, R. et al. Int. J. Sci. Educ. 1998, 20, 1059-1073. [5.] Hoyle, H. Statistical Strategies for Small Sample Research; Sage Publications Inc.: Thousand Oaks, CA, 1999; pp 133-149.

Funder Acknowledgement(s): We acknowledge NSF for their generous support of this work.

Faculty Advisor: Maria Oliver-Hoyo, maria_oliver@ncsu.edu

Grad. #55
Subcategory: Social Sciences/Psychology/Economics

Time Perspective as a Predictor of Self-handicapping Behavior in African-American College Students

Brittney J. Pearson, Virginia State University
Co-Author(s): Katherine Nester, Stephen Scherer, Cheryl Talley, John E. Fife, Oliver Hill, Virginia State University

Previous research has shown that self-handicapping behaviors can interfere with academic achievement (Urdan, 2004). Time perspective, which is also related to academic achievement, is defined as the "totality of the individual's views of his psychological future and psychological past existing at a given time" (Lewin, 1951). However, there is a dearth of research on how time perspective affects African-American students' achievement, specifically their tendencies to self-handicap. The purpose of this study was to investigate how time perspective predicts self-handicapping behaviors. The Zimbardo Time Perspective Inventory was used to measure five dimensions of time perspective (past negative, past positive, present fatalistic, present hedonistic, and future orientations), and the Patterns of Adaptive Learning Scale was used to measure self-handicapping in 37 African-American freshmen STEM majors at an HBCU. The sample was a majority female (73.7%) and ranged in age from 17 to 20 years. A multiple linear regression was run in order to test the hypothesis that time perspective could predict self-handicapping tendencies. The overall regression, including all five dimensions, was statistically significant, $R = .593$, $R2 = .352$, adjusted $R2 = .247$, $F(5, 31) = 3.364$, $p = .015$. Self-handicapping can be predicted reasonably well from the five dimension of time perspective with about 24.7 percent of the variance in self-handicapping accounted for by time perspective. To assess the

contribution of each dimension t ratios were examined. Only one dimension of the five was significantly predictive of self-handicapping; this dimension was future time perspective, $t(31) = -2.267$, $p = .030$. The zero order correlation between future time perspective and self-handicapping, $r = -.508$, indicates higher scores on future time perspective indicate less self-handicapping tendencies, and the unique predictive contribution of future time perspective was 10.7 percent of the variance, $sr2 = .107$.

These findings indicate that students' time perspective may impact their tendency to engage in self-handicapping behaviors. Future research should focus on developing interventions geared toward shifting African-American students' time perspective to a future orientation in order to reduce their propensity to engage in self-handicapping behavior and increase academic success.

Funder Acknowledgement(s): This research was supported by a grant from the NSF/ HBCU-UP Broadening Participation grant awarded to John Fife, Virginia State University.

Faculty Advisor: John E. Fife, jefife@vsu.edu

Social, Behavioral, and Economic Sciences

Grad. #56
Subcategory: Education

Using Phenomenology to Investigate Dyslexia in Undergraduate Engineering

Velvet Fitzpatrick, Purdue University
Co-Author(s): Johannes Strobel and Eric Nauman, Purdue University

This investigation examines the use of phenomenology in the study of students with dyslexia in undergraduate engineering programs. During the 2009-2010 academic year, the National Center for Education Statistics (NCES) reported that 13.1% of the total public school population (ages 3-21) partook in special education programs provided under the Individuals with Disabilities Act (IDEA). Approximately 41% or 2.4 million students within this population had learning disabilities (LD). This makes LD the largest disability subgroup in PK-12, where dyslexia is the most common LD. Yet research on dyslexia and other LD in science, technology, engineering, and mathematics (STEM) higher education programs is limited. Federal engineering diversity initiatives and research largely focus on disabilities that can be observed (e.g. someone in a wheelchair or watching a person with a hearing impairment communicate through American Sign Language).

This perspective is taken due to the emphasis on physical interactions in laboratories and with technology. However, students with dyslexia face similar challenges that are invisible, or more correctly, are a result of different brain functionalities. The investigators hypothesize that the phenomenological research method may be an appropriate approach to conduct precursory examinations of the experience of engineering students' ability while being dyslexic. Findings from this method may be used to inform the development of quantifiable measures to assess a larger population and improve success of persons with dyslexia in engineering.

The present study reviews the use of phenomenology to capture how undergraduate engineering students with dyslexia in engineering experience their ability. The study method is a literature review matrix. The matrix maps criteria that are pertinent to the study of persons with dyslexia in engineering to phenomenological procedures. The results of the literature review matrix are presented in a tabular format. Advantages and disadvantages for the research methodology will be discussed. In conclusion, the matrix will be implemented in an upcoming phenomenological study of undergraduate engineering students with dyslexia. Findings may also be valuable in framing the study of other LD in engineering.

Funder Acknowledgement(s): This study was conducted under co-advisors Teri Reed, Texas A&M University and Johannes Strobel, Purdue University.

Faculty Advisor: Teri Reed, terireed-rhoads@tees.tamu.edu

Grad. #57
Subcategory: Physics (not Nanoscience)

Nuclear Energy Safety: Public Perception, Communication and Awareness

Sandra Cutts, Alabama A&M University
Co-Author(s): Matthew Edwards and Jacob Oluwoye, Alabama A&M University

The aim of this multidisciplinary multistage research sought to ascertain the perceptions of the public and nuclear energy stakeholders of the safety and use of nuclear energy facilities, in the wake of Japan's Fukushima event in 2011[1], as nuclear and other alternative energy sources, such as solar cells, are being investigated to address anthropogenic impact on the environment. We have designed and conducted two surveys that yielded statistical results indicating that there is a significant relationship between public perceptions of the nuclear energy industry[2] and awareness of the issues. Our results also indicated the public's overall perceptions of the nuclear industry's operational safety and communication were more favorable than nuclear energy stakeholders had contemplated; however, concerns exist and plausible alternative technologies should be further investigated. Based on results of the first stage, the use of more sophisticated social media tools, more effective methods of communication and advanced technologies should be considered in the nuclear energy industry's plan to reach and address concerns of all levels of public interest. The lack of communication and awareness has a statistically significant relationship on unfavorable perceptions of nuclear-facility operations. Thus, providing more education and communication channels for fostering public awareness and involvement could be valuable for the industry to grow and maintain favorable perceptions.

Additionally, we propose a plausible solution utilizing nano-composite polymer films with and without ferroelectric crystals to be used in nuclear energy safety and counter-terrorist or secondary warning systems. We have demonstrated the use of organic films in pyroelectric detectors and vidicon applications, via measuring and characterizing the pyroelectric coefficient of such nanocomposites[3]. Thus, further research should be to ascertain if vidicon made of these films can be used to mitigate hazardous conditions in nuclear power stations.

References: [1]M. Chossudovsky, "*Fukushima: A Nuclear War Without a War: The Unspoken Crisis of Worldwide Nuclear Radiation*," http://www.globalresearch.ca/fukushima-a-nuclear-war-without-a-war-the-unspoken-crisis-of-worldwide-nuclear-radiation/28870 (2012).
[2]L. Sjoberg and B. Drottz-Sjoberg , Intl Jou of Risk Mgmt, 11, 248 (2009).
[3]M. Edwards, A. Batra, A. Chilvery, P. Guggilla, M. Curley, and M. Aggarwal , Mat Sci App, 3, 851 (2012).

Funder Acknowledgement(s): This research was supported in part by NRC/ORISE and NSF grant #HRD 0928904.

Faculty Advisor: Mostafa Dokhanian, mostafa.dokhanian@aamu.edu

Grad. #58

Subcategory: Social Sciences/Psychology/Economics

Career Development and Retention in STEM

Amy B. Berman, Tennessee State University

Career development in college students has been well documented, resulting in a number of theories. Until recently, relatively little research has been conducted on career development of Science, Technology, Engineering, and Math (STEM) students, particularly Black STEM students. Concerns about the lack of participation by minorities in STEM are well known, as are the challenges related to student persistence and graduation from these programs.

The extant literature has focused on Black STEM students at Predominately White Institutions (PWI). Historically Black College and Universities (HBCUs) produce one third of all Black graduates in STEM. Our understanding of the career development of Black students in STEM is hampered by the context in which the research was conducted. This study examines the career development of Black STEM students over the course of their academic experience at an HBCU to test the hypothesis that Black STEM majors increase their commitment and skills in managing their careers over the course of their academic training, and to identify differences in contextual factors, supports and barriers influencing their career commitment in STEM.

This study uses a cross sectional design (Cook & Campbell, 1979; Heppner, Wampold, & Kivlighan, 2008) analyzed using a multivariate analysis of variance (MANOVA). Data was collected from all STEM majors during each academic semester from Spring 2013 through Fall 2013. Measures included STEM-specific measures of career interest and commitment: Self-Efficacy for Technical/Science Fields, Coping Efficacy, Outcome Expectations, Science Interests, Contextual Supports and Barriers, Educational Goals, and Persistence (Lent et al., 2003), as well as demographic and academic status information (e.g., year in college, math SAT scores). Preliminary findings did not support the hypothesis that Black STEM majors increase their commitment and skills in managing their careers across levels of their academic training.

Data gathering to evaluate change across semesters is ongoing and will be completed by the end of January with results to be presented at the ERN conference. Preliminary findings support recommendations for intervention based on the Social Cognitive Career Theory model and our understanding of career decisions, career management, and what is culturally appropriate. Findings from this project serve to inform the field about the strengths and growing edges among African-American students for planning and managing careers in STEM. Future research includes analyzing change across the entire training period in order to examine the impact of specific interventions and for model building.

Funder Acknowledgement(s): This study was supported by a grant from NSF/HBCU-UP/BPR (NSF 12-519) awarded to Marie S. Hammond, Department of Psychology, Tennessee State University.

Faculty Advisor: Marie S. Hammond, mhammond1@tnstate.edu

Technology and Engineering

Grad. #59
Subcategory: Cancer Research

Hs578T and HEY Cancer Cell Cytotoxicity to Arsenic (III) Oxide

Krystine Pimentel, Florida International University
Co-Author(s): Celisse Zabalo and Frank Alexander, Jr., University of South Florida

This proposal seeks to research cancer cell and drug treatment interactions cytotoxicity to enhance *in vivo* cancer diagnostics via microelectrode arrays for electric cell-substrate impedance sensing (ECIS). Nanowires are used to explore the cytotoxicity between tumors and drug treatment via testing of *in vivo* drug response *in vitro*. ECIS provides non-invasive and non-destructive sensing to identify membrane capacitance and resistance, cell attachment, growth and death of cells, and cellular properties. This paper will compare the response of Hs578T epithelial breast cancer cells to arsenic trioxide with HEY ovarian cancer cells using bioimpedance spectroscopy. The experimental methods used require the growth of silica nanowires, fabrication of a microelectrode device, spheroidal culture of both Hs578T epithelial breast cancer cells and HEY ovarian cancer cells, nanowire insertion, 24 hour impedance measurements with Agilent's 4294A Impedance Analyzer and LabVIEW software, anti-carcinogenic treatment of cells via arsenic trioxide and equivalent circuit models. The vapor liquid solid (VLS) method mixed with Dulbecco's Modified Eagle Medium (DMEM) or Roswell Park Memorial Institute (RPMI 1640) is used to grow silica nanowires. The nanowires are then exposed to a variety of spheroidal cell concentrations. Bioimpedance results of tumor response to silica nanowires reveal that high concentrations of silica nanowires are toxic to cells.

These preliminary results indicate that cell death may be due to the mechanical disturbance of high amounts of nanowires. Personalized cancer treatment has been hindered by the lack of certainty in current chemo-sensitivity and resistivity assays. Attempts in recreating *in vivo* assays to aid in predicting chemo-sensitivity is highly desired. Silica nanowires provide bio-compatibility with human cellular material and have become very popular in biological sensors. Due to its ease of fabrication on sensor surfaces with silicon substrates, silica nanowires are desired for *in vivo* sensing and biomarker monitoring. Bioimpedance spectroscopy is a non-invasive, non-destructive, label-free technique which provides real-time results and is a widely used approach in cancer cell detection. Bioimpedance spectroscopy offers quantitative label-free and real-time monitoring of cellular cultures. In bioimpedance spectroscopy, quantitative impedance measurements of cells covering microelectrodes are monitored to determine the effects of toxic agents, new drugs, or nanoparticles. Well-established equivalent circuit models can provide insight into the mechanisms causing cellular death. Leading research in cancer is focused on providing personalized treatment for patients. Being able to integrate silica nanowires would enable designs for minimally invasive, direct drug delivery to tumors.

Funder Acknowledgement(s): NSF Bridge to the Doctorate Fellowship

Faculty Advisor: Shekhar Bhansali, sbhansa@fiu.edu

Grad. #60
Subcategory: Civil/Mechanical/Manufacturing Engineering

Multiferroic Motor Design, Fabrication, and Characterization

Andres Chavez, California State University Northridge
Co-Author(s): George Youssef, Matthew Ferrer, Alonzo Mennano, and Joseph Haywood, California State University Northridge

As the spatial scale of motors is shrinking to fit into smaller packages such as medical implants or consumer electronics, the physics of direct electromagnetic coupling cannot be used. In the traditional design methodology of motors, passing an electric current through a wire generates a magnetic field, which in turn can be used to rotate the output shaft of the motor. This methodology fails when designing nanoscale motors due to high resistive energy losses.

To overcome this scientific barrier, designs incorporating Multiferroic composite materials, relying on mechanical strain to generate electromagnetic coupling have been proposed. Multiferroic composite materials overcome the limitations of current motor design methodologies by applying an electric field (i.e. voltage) across a piezoelectric material to produce mechanical strain which then strains the magnetostrictive materials they are bonded to, resulting in magnetic fields. This is advantageous on two fronts. First, using voltage to create magnetic fields rather than current will significantly improve energy efficiency by reducing overall energy transfer. In other words, the new motor design will generate far less heat than traditional motors likely eliminating the need for cooling systems, yet another energy savings. Second, since the magnetic field is indirectly related to the electric field through strain, a reduction in the size of the motor can be achieved by eliminating the need for coils. Therefore, the inception of high power density motors is within reach. In order to assess the scientific feasibility of Multiferroic based systems, a macroscale physical simulation of a multiferroic-based motor was designed. The motor consists of two concentric rings: the outer ring made from PZT (OD=30mm, ID=25mm) and the inner ring made from Terfenol-D (OD=25mm, ID =20mm). The rings are bonded using a conductive sheet epoxy approximately 100μm thick. Electrodes are patterned symmetrically on the top surface of the PZT and a uniform electrode covers the bottom surface acting as a ground. This geometry facilitates the generation of directed strains thereby inducing directed magnetic fields in the magnetostrictive phase (i.e. the Terfenol-D). The converse magnetoelectric effect (CME) of the structure is studied by applying a voltage bias (0-700V) and varying the magnetic bias field (0-3kOe). The dependence of the CME coefficient on voltage bias and magnetic bias will be presented and from this data the feasibility of the motor will be discussed based on criteria such as efficiency and power density.

Funder Acknowledgement(s): This work was supported by the National Science Foundation through the Cooperative Agreement Award EEC-1160504 (TANMS) managed by Deborah J. Jackson and CSUN-College of Engineering and Computer Science.

Faculty Advisor: George Youssef, george.youssef@csun.edu

Grad. #61
Subcategory: Civil/Mechanical/Manufacturing Engineering

Effects of Various Combustion Techniques in a Subsonic Turbine-less Engine

Hakob Karaoglanian, California State University, Los Angeles
Co-Author(s): Joseph David Wells, California State University, Los Angeles

A new high powered, green, clean, turbine-less engine has been developed at California State University, Los Angeles. It portrays a scaled down turbojet engine with the compressor replaced with an electric ducted fan. While the engine was successfully tested and run without any fuel mixing methods, the present study will investigate computationally and experimentally different mixing and combustion techniques to optimize and provide the ultimate amount of thrust and efficiency.

The control in this study will be the original model with a single fuel injection line. This will be compared to a multitude of fuel injection techniques that include dual injection lines without fuel mixture, a 1" diameter copper mixing chamber at various lengths with one and two fuel injection lines, 1 ½ "-2" diameter steel mixing chambers at various lengths with one and two fuel injection lines, and a tangential fuel injector with one and two incoming fuel lines both with and against the direction of the electric ducted fan. It is proven that the correct mixture of air and fuel (air-fuel ratio) will provide enough air to completely burn all of the fuel, and make the system as efficient as possible.

The above techniques will attempt to reach the stoichiometric mixture to create an engine that is most efficient. This is important for future propulsion systems on unmanned aerial vehicles in the near future. The turbine-less engine would lighten overall weight, while yielding more thrust of current systems.

Funder Acknowledgement(s): The funding for this program is provided by the National Science Foundation under Grant # HRD -1246662.

Faculty Advisor: Chivey Wu, cwu@calstatela.edu

Grad. #62
Subcategory: Civil/Mechanical/Manufacturing Engineering

Self-Consolidating Concrete in Precast, Prestressed Girders

Samuel D. Keske, Auburn University
Co-Author(s): Robert W. Barnes, Auburn University, Auburn, AL

Self-consolidating concrete (SCC) is a highly fluid, nonsegregating concrete that can spread through reinforcement and completely fill formwork without the use of mechanical consolidation. Precast, prestressed girder production is a demanding application that requires intricate formwork, heavy reinforcement congestion, and intense loading. While this is an economical opportunity to use SCC, adoption of the material has been limited due to the lack of hardened performance data from existing, in-service elements. Of specific importance is the relationship between compressive strength (fc) and modulus of elasticity (Ec) and long-term time-dependent behavior of SCC relative to that of vibrated concrete (VC). A designer's ability to predict strength, elasticity, and time-dependent deformations influences the performance of precast, prestressed members. Thus, evaluating the validity of current design provisions for SCC relative to VC is pivotal to its adoption. Herein, hardened-material test results are presented from the first implementation of SCC in full-scale precast, prestressed bridge girders in Alabama. SCC strength, Ec, unrestrained shrinkage, and creep were measured in samples collected during the production of 14 AASHTO-PCI bulb-tee girders. Identical tests were conducted on samples collected during the production of 14 companion VC girders. Strength and stiffness were evaluated to a concrete age of 28 days, while creep and shrinkage were evaluated to 3 years. The fc results of the SCC girders were similar to that of companion VC girders. The Ec of SCC was 10-15% less than that of corresponding VC. However, all predictions were conservative, and measured SCC Ec values agreed more closely with common Ec estimates than did VC values. Total deformations through 3 years were at least as predictable in SCC as in VC. The hardened material and long-term deformation performance of as-placed precast, prestressed SCC is, thus, acceptably similar to that of VC. Future research should focus on the response of the girders to service-level maximum live loads and ordinary traffic and environmental exposure. This structural performance data would be valuable in confirming the viability of SCC for precast, prestressed girder production.

Funder Acknowledgement(s): This project was partially supported by funding from the Alabama Department of

Transportation awarded to R. W. Barnes, and A.K. Schindler, both of Auburn University.

Faculty Advisor: Robert Barnes, barnerw@auburn.edu

Grad. #63
Subcategory: Civil/Mechanical/Manufacturing Engineering

Aeroelasticity Modeling using Galerkin and Finite Element Method

Andrew Tsoi, University of Colorado, Boulder
Co-Author(s): Kevin Reynolds, NASA Ames Research Center

Light-weight aircraft design has received considerable attention in recent years as a means for improving cruise and fuel efficiency. Modern light-weight materials, though capable of proving load-carrying capacity, provide less structural rigidity. As structural flexibility increases, aeroelastic interactions with aerodynamic forces and moments become an increasingly important consideration in aircraft design. Recently, NASA has begun evaluating combining distributed propulsion control systems, which take advantage of more efficient aerodynamics, as well as composite materials to create the next-generation of transport aircraft.

In this study, a generic transport model (GTM) aircraft outfitted with a new distribution propulsion system is studied. Aeroelasticity theory is used to develop a model of the GTM to solve for static deflection while accounting for interaction of wing bending and torsion equations. The Galerkin's method is used to implement a weak-form solution of the aeroelastic equations of the aircraft, coupled with rigid-body longitudinal dynamic equations, to formulate an aeroelastic model. The contribution of propulsive forces and moments to wing aeroelasticity is accounted for in the model. An eigenvalue analysis of the generalized linear aeroelastic system is used to determine the aeroelastic mode shapes of the wing. The aeroelastic analysis prepares a Galerkin implementation for aeroelastic frequencies and damping analysis for future flutter analysis used to characterize optimal weight distribution of the wing structure while maintaining vehicle stability.

Final results show good correlation between the Galerkin and Finite Element Methods. It is seen that the Galerkin Method offers a slightly less-accurate, but more computational efficient method of simulating static bending and torsional deflection of aircraft wings in flight. The Galerkin Method demonstrates good performance when predicting bending mode shapes, especially with wing-tip deflections. For torsional bending, Galerkin demonstrates good performance with maximum torsional stress but is inconsistent with mode shapes.

Future plans including this work involve modeling complex interactions between lightweight structures and advanced propulsion control. Examples for future work include investigating flutter conditions, unstable modes, and propulsion response and performance. Longitudinal and lateral flight dynamics will be evaluated within a flight simulation package.

Funder Acknowledgement(s): National Science Foundation, National Space Grant Consortium

Faculty Advisor: Kevin Reynolds, Carlos Felippa, carlos.felippa@colorado.edu

Grad. #64
Subcategory: Computer Engineering

Maximizing Data Collection with Guaranteed Residual Energy in Wireless Sensor Networks

Yawei Pang, Texas Southern University
Co-Author(s): Miao Pan and Wei Li,Texas Southern University

In recent years, we have witnessed the advent of wireless sensor technologies and proliferating applications of wireless sensor networks (WSNs) in different fields. Although the advances in processing and computing designs can endow sensors with a multitude of sensing modalities to support various applications, the crawling development in battery technology imposes harsh energy constraints on the battery-powered sensors or aggregation and forwarding nodes (AFNs) in WSNs. Since major energy consumption of sensors/AFNs comes from the wireless transmissions of perceived data, it poses great challenges to prevent the energy depletion of sensors/AFNs while guaranteeing the collection of the sensed data.

Fortunately, the recent breakthrough in the area of wireless charging/wireless power transfer technology developed by Kurs et al. at MIT has provided a promising alternative for the energy replenishment of sensors/AFNs in WSNs. Briefly, Kurs et al.'s work showed that by exploiting a novel technique called magnetic resonant coupling, wireless charging (i.e., the ability to transfer electric power from one storage device to another without any plugs or wires) is both feasible and practical. Besides, they experimentally showed that the source energy storage device does not need to be in contact with the energy receiving device for efficient energy transfer (e.g., 40% within 2 meters). Wireless charging technology is also insensitive to the neighboring environment and does not require a line of sight between the power charging and receiving nodes. To fully take advantage of the wireless charging vehicle (WCV) and remove the bottleneck of energy constraints in WSNs, in this paper, we let the WCV selectively charge the AFNs, and collect data from chosen AFNs. The WCV can carry the sensed data and deliver it to the control center. The chosen AFNs act as "virtual sinks", which help to avoid the energy wasted for long-distance transmissions. Given a joint consideration of energy replenishment, data delivery, flow routing and wireless power transfer, we formulate the problem and provide feasible solutions.

Our salient contributions are summarized as follows. We mathematically formulate this problem under flow routing, wireless charging and wireless transmission constraints into a mixed integer nonlinear programming (MINLP) problem. Since the formulated problem is MINLP, which is NP-hard to solve, we relax the formulated problem and convert it into a linear programming (LP) problem, whose solution is an upper bound of ERDC problem. We also develop a heuristic algorithm for the feasible solution and analyze its computational complexity. Through extensive simulations, we show that the lower bound obtained by the proposed heuristic algorithm is close to the upper bound. Besides, we show that the proposed scheme is effective in replenishing the energy of AFNs while guaranteeing the data delivery.

Funder Acknowledgement(s): This work was partially supported by the National Science Foundation under grant NSF-1137732.

Faculty Advisor: Miao Pan, miaopan.ufl@gmail.com

Grad. #65
Subcategory: Electrical Engineering

Wireless Sensor Network System for Precision Agriculture

Dontrey Bourgeois, Prairie View A&M University
Co-Author(s): Suxia Cui, Prairie View A&M University

Today the agriculture industry is dealing with some of the toughest challenges that they have ever experienced. With the help of state-of-the-art technology, the agriculture industry can face those challenges. Sources say that farmers are having a very hard time collecting data under harsh conditions such as rain and extreme heat. With the use of wireless technology, collecting data will be made easier for the agriculture industry. A Wireless Networks System is new technology that helps get data without the use of wires.

The project is a wireless network system that can get real time data such as temperature and humidity. The temperature and humidity can be able to be seen on a computer screen or on a mobile device such as a smart phone or tablet. If the temperature and humidity reading gets too high or too low, an email or text message will be sent to notify the user.

The Wireless Sensor Network System is comprised of two sensors that are both connected to a node that sends a signal to what is known as a gateway. The gateway is connected to the Ethernet port of the computer and the sensors are spread out within a 300 meter range. My group was able to test this system outside at Prairie View A&M University. During our testing, we was able to get the humidity and temperature reading on a computer and on a smart phone or tablet. The system was able to email or text message when humidity and temperature got too high or too low.

The future of this project will include different sensors such as light sensors. This project in the future will also will have a GPS system, will use Ni Technical Data Cloud, and be able to view data anywhere by using the internet. The use of the GPS system will help locate the sensors. The uses of the Ni Technical Data Cloud will help collect data without the help of the gateway; this allowed the user to spread the sensors more than 300 meters. The goal of this system is to be able to make collecting data such as temperature and humidity easier for farmers. The system will help minimize dangers that the farmers may face while collecting data efficiently under harsh conditions.

Funder Acknowledgement(s): NSF HBCU-UP; USDA Capacity

Faculty Advisor: Suxia Cui, sucui@pvamu.edu

Grad. #66
Subcategory: Electrical Engineering

Molecular Dynamics Study of Thin Films in Lattice Mismatched Substrates

Jose Juan Chavez, University of Texas at El Paso
Co-Author(s): X.W. Zhou, D.K. Ward, J.L. Cruz-Campa, and G. Nielson, Sandia National Laboratories
B.A. Aguirre, D. Marrufo, J. McClure, and D. Zubia, University of Texas at El Paso

Multilayered device fabrication is commonly used in modern electronics manufacturing to exploit material properties that enable and enhance device performance. However, the different lattice structures between dissimilar layers create strain induced charge-trapping defects, such as misfit dislocations, that hinder device performance. This study employed high fidelity molecular dynamics of vapor depositions because they are capable of capturing defect formation mechanisms with atomic precision, and can provide unprecedented insight to guide experimental efforts towards low defect density devices. We hypothesized that as the lattice mismatch between film and substrate increased; there would be a reduction in film quality when compared to latticed matched epitaxy. Additionally, the patterned substrate approach was explored to test our second hypothesis that growing selectively inside the pattern would help increase the film quality in both homoepitaxy and heteroepitaxy conditions.

In order to evaluate both hypotheses, molecular dynamics were implemented using a Stillinger-Webber interatomic potential. Planar growth simulations consisted of homoepitaxy of Zinc Telluride and heteroepitaxy of ZnTe on a Cadmium Sulfide substrate. The patterned growth simulation was implemented by forming a reflective wall that confined deposited atoms within the predefined pattern volume. Simulation results were post-processed to determine film quality by quantifying the number of misfit dislocations present.

The analysis of the planar growth simulation of ZnTe implementing a dislocation extraction algorithm detected 33 dislocation line segments. Similarly, analysis of the planar growth of ZnTe on a CdS substrate reported a total of 56 dislocation segments. Post-processing of the patterned growth of ZnTe homoepitaxy detected 7 dislocation line segments. Finally, the analysis of the patterned growth of ZnTe on CdS reported a total of 10 dislocation segments.

Data analyses indicate that in planar growth conditions, the lattice mismatch increase between film and substrate causes a larger number of dislocations to form in the film, supporting our first hypothesis. This finding is consistent with what is observed in experiments and serves to validate this study. The results obtained for patterned growth simulations show that selectively growing a thin film inside the pattern significantly reduces the number of dislocations found in the film for both heteroepitaxy and homoepitaxy conditions, supporting our second hypothesis. This finding shows that high fidelity simulations can guide experimental efforts towards low defect films by providing dislocation formation insight that cannot be easily obtained with empirical methods.

Funder Acknowledgement(s): This work was possible thanks to the support of the National Science Foundation's Bridge to Doctorate Fellowship, and through grants EIA-0325024 and CNS-0709438.

Faculty Advisor: David Zubia, dzubia@utep.edu

Grad. #67
Subcategory: Electrical Engineering

Development of Low-Cost Cu2ZnSnS4 Thin Films by Sol-Gel Deposition

Brett Jones, Florida International University
Co-Author(s): Deidra R. Hodges, Irina Tyx, and Manoj Chaulogain, Southern Polytechnic State University
Shekhar Bhansali, Florida International University

The development of Cu2ZnSnS4 (CZTS) thin films by non-vacuum, liquid-based techniques has been investigated. Solar power renewable energy research is very critical in the world as nations seek to find alternatives to reduce the excessive use of natural resources. The p-type semiconductor CZTS consists of earth abundant elements that are relatively cheap and environmentally safe, which is important when producing solar cells. The material has a direct band gap energy ranging from 1.45-1.6 eV and an absorption coefficient higher than 104cm-1. The sol-gel deposition technique is one of the most inexpensive deposition methods of thin films solar cells; minimum equipment is needed to produce the thin films. In the experiment the sol-gel was developed using the CZTS constituents, varying the chemical compositions, and processing parameters, to fabricate CZTS film with a tetragonal crystal lattice structure. The sol-gel is spin-coated onto soda lime glass then dried at 300°C for ten minutes on a hot plate; this step is repeated four more times for thick uniform thin films. The annealing times ranged from 30-120 minutes, and the temperatures used were 450°C, 500°C, and 550°C.

Characterization and analysis of the thin films were obtained using the Panalytical X-ray diffraction (XRD) and the JEOL 7600F scanning electron microscopy (SEM) to determine crystal structure, orientation and crystallite size. XRD data shows the formation of kesterite CZTS at 450°C, along with a Cu2SnS3 derivative, that is believed to phase out at higher annealing temperatures. SEM data shows the formation of a tetragonal CZTS crystal lattice structure and an average grain size of 1 micron. The improvement of the CZTS thin films thickness and overall quality will be further investigated to develop complete CZTS solar cells.

Funder Acknowledgement(s): This study was supported, in part, by a grant from NSF to Deidra Hodges, Assistant Professor Department of Electrical and Mechatronics Engineering, Southern Polytechnic State University. Also, National Science Foundation Broadening Participation Research Initiation (BRIGE); Major Research Instrumentation (MRI); Peach State Louis Stokes Alliance for Minority Participation (PSLSAMP).

Faculty Advisor: Shekhar Bhansali, sbhansa@fiu.edu and Deidra R. Hodges, dhodges@spsu.edu

Grad. #68
Subcategory: Materials Science

Crystalline Cellulose Extraction for Use in Sustainable Electronics

Kristy Crews, Tuskegee University
Co-Author(s): Chemar Huntley and Michael Curry, Tuskegee University

Due to an increase in electronic usage, limited land space and improper disposal or recycling of electronics, environmental pollution and human health risks have become of great concern to both the public officials and scientific researchers, especially in developing countries. Globally, the usage and reliance on electronics to complete the simplest tasks has increased significantly in the last decade, and with a decreasing life span and an increase in ownership of technological devices, worn or redundant electronics eventually end up in environmentally unfriendly locations (e.g., incineration, importation, or landfills). Hence, it is of great urgency that new methodologies for fabricating bio-degradable or recyclable technological devices are investigated.

To that end, the objective of this research is three-fold: 1) identify and synthesize suitable natural polymers (Nano-crystalline Cellulose, NCC) from agricultural waste as replacement alternatives or as reinforcers to the currently used plastic technology (e.g., ABS and HIPS which are used to fabricate electronic equipment casings), 2) explore the effect of crystalline cellulose on the properties of ABS and HIPS via loading and crosslinking methodologies, and 3) investigate the biodegradability and recyclability of the fabricated composites. XRD and SEM have shown that NCC can be extracted from wheat straw via strong acid hydrolysis.

Furthermore, XRD reveals a higher crystallinity for the extracted crystalline cellulose when compared to the manufactured cellulose (77% vs 68%, respectively). This is a desired result since polymers with high crystallinity generally show a higher resistance to deformation. TGA and DSC indicates that degradation temperature for the extracted cellulose falls well above the normal operating temperature of a laptop computer, which should eliminate premature breakdown when loaded into polymer composites.

Current research efforts are now focused on the incorporation of the extracted crystalline cellulose into ABS, HIPS, and ABS/HIPS composites to study the effects of the natural polymer on their physical and mechanical properties using TGA, DSC, TMA and DMA and its bio-degradability or recyclability through its Life Cycle Assessment.

Funder Acknowledgement(s): The authors gratefully acknowledge the National Science Foundation under Grant Nos.: EPS-1158862, HRD-1137681, and NSF IGERT on Sustainable Electronics DGE-1144843 for support of this research.

Faculty Advisor: Michael Curry, currym@mytu.tuskegee.edu

Grad. #69

Subcategory: Materials Science

Effect of Surface Modification on Woven Flax Fibers Bio-Based Composite

Vertonica F. Powell-Rose, Tuskegee University
Co-Author(s): Alfred Tcherbi-Narteh, Mahesh Hosur, Shaik Jeelani

Natural fiber reinforced polymer composites are becoming popular in replacing synthetic fiber composites due to increasing global depletion of crude oil suppliers and high costs associated with their fabrication processes. Although properties of these natural fibers vary widely based on geographical location, climate changes and soil conditions, there are common issues with all of these natural fibers used in composite fabrications. These issues are related to their moisture absorption behavior leading to extensive outgassing and void formation, poor thermal stability, and poor interfacial bonding between the fibers and matrix during fabrication of composite materials. In the current study, attempts were made to overcome these challenges, natural fibers were treated with potassium hydroxide (KOH) using different concentration and treatment time. Dry flax fabric was soaked in 1, 3 and 5% KOH for 1, 2, and 4 hours, washed to neutral and dried prior to fabricating composites using 37% recycled material based epoxy resin. Effect of surface treatment on fibers was studied using thermo-gravimetric analysis (TGA) and showed up to 20°C improvements in thermal stability compared to untreated fibers. Storage modulus of treated and untreated flax fiber reinforced polymer composites from dynamic mechanical analysis tests varied based on concentration and treatment time. Samples treated with 5% KOH for 1 hour showed the most improvement in flexure strength, about 55% compared to untreated composite samples.

Funder Acknowledgement(s): NSF-CREST, NSF-EPSCoR & NSF-IGERT

Faculty Advisor: Mahesh Hosur, hosur@mytu.tuskegee.edu

Grad. #70

Subcategory: *Nanoscience*

The Investigation of Glassy Carbon and Carbon Nanofiber (CNF) Electrodes for the Detection of Glucose

Julaunica Tigner, Tuskegee University
Co-Author(s): Jessica Koehne, NASA Ames, Moffett Field, CA

Both glassy carbon (GC) and carbon nanofiber (CNF) electrodes are proposed for the detection of glucose. Glassy carbon is a standard electrode material for biosensing due to its low electric resistance, wide potential window and good biocompatibility. CNFs have the added advantage of being straightforward to integrate on a silicon-based device. The CNFs are vertically aligned and have a range of diameters from 25 to 100 nanometers and heights ranging from hundreds of nanometers to several microns.

The objectives of this investigation are the following: (1) perform electrochemical characterization on both the GC and CNF sensors, and (2) create a glucose sensor comparable with commercially available glucose sensors on the market today. The cyclic voltammetry result shows that there is a change in capacitate current for both the GC and CNFs electrodes.

Funder Acknowledgement(s): The National Science Foundation is gratefully acknowledged for an IGERT: Nanomedicine Fellowship (DGE0965843). The NASA Volunteer Internship Program (VIP) is gratefully acknowledged for this summer internship opportunity.

Faculty Advisor: Tamara Floyd-Smith, tfloyd@mytu.tuskegee.edu

Abstract Index

C

D

E

F

G

H

I

J

K

L

M

N

S

X

Y

Z

Your Words, Our Image

You are in a unique position to shape the public image of people with disabilities. By putting the person first and using these suggested words, you can convey a positive, objective view of an individual instead of a negative, insensitive image.

Do say	Don't say
Disability	Differently abled, challenged
People with disabilities	The disabled, handicapped
Person with spinal cord injury	Cripple
Person with autism, on the autism spectrum	Autistic
Person with Down syndrome	Mongoloid
Person of short stature	Midget, dwarf
Uses a wheelchair, wheelchair user	Confined to a wheelchair, wheelchair-bound
Has a learning disability	Slow learner
Has chemical or environmental sensitivities	Chemophobic
Has a brain injury	Brain damaged
Blind, low vision	Visually handicapped, blind as a bat
Deaf, hard of hearing	Deaf-mute, deaf and dumb
Intellectual disability	Retarded, mental retardation
Amputee, has limb loss	Gimp, lame
Congenital disability	Birth defect
Burn survivor	Burn victim
Post-polio syndrome	Suffers from polio
Service animal or dog	Seeing eye dog
Psychiatric disability, mental illness	Crazy, psycho, schizo
How should I describe you or your disability?	What happened to you?
Accessible parking or restroom	Handicapped parking, disabled restroom

Want more information?

Download our brochure *Guidelines: How to Write and Report About People with Disabilities* at *www.rtcil.org/guidelines*.

Research and Training Center on Independent Living
The University of Kansas
4089 Dole Center, 1000 Sunnyside Ave.
Lawrence, KS 66045-7561
E-mail: rtcil@ku.edu
Phone: 785-864-4095
TTY: 785-864-0706
Web: www.rtcil.org

KU
RESEARCH
& TRAINING CENTER
ON INDEPENDENT LIVING
Life Span Institute