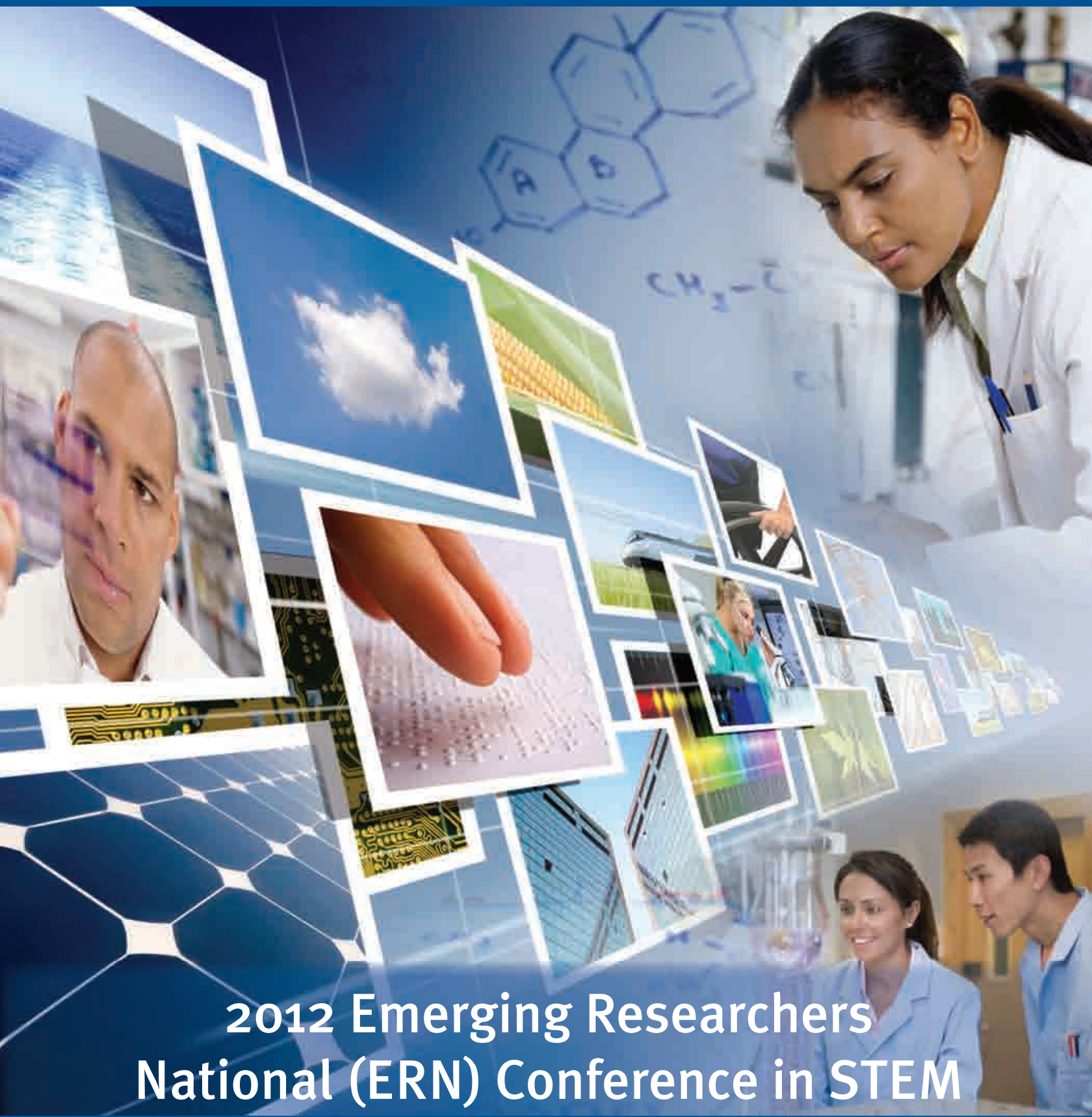
CONFERENCE PROGRAM



2012 Emerging Researchers National (ERN) Conference in STEM

Atlanta, GA • February 23-25, 2012

NSF

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

2013 AAAS ANNUAL MEETING
14–18 February ▸ Boston

Call for Symposium Proposals

Symposium proposals for the 2013 AAAS Annual Meeting are now being solicited. To submit a proposal, visit www.aaas.org/meetings. The deadline for submission is Thursday, 26 April 2012.

The Beauty and Benefits of Science

The theme for the meeting points to the "unreasonable effectiveness" of the scientific enterprise in creating economic growth, solving societal problems, and satisfying the essential human drive to understand the world in which we live. The phrase, "unreasonable effectiveness," was coined in 1960 by physicist Eugene Wigner, who explored the duality of mathematics — both beautiful unto itself, and also eminently practical, often in unexpected ways.

The same duality exists in all fields of science. Basic research can be seen as a quest to understand the beauty that underlies our universe and the myriad phenomena that it contains.

We now appreciate the reality of a much richer set of connections. Fundamental scientific understanding creates whole landscapes on which practical applications may flourish. Basic research may create territories that, only later, become the real estate for new industries. Equally important are the cases where the "pull" of environmental or societal problems drives fundamentally new basic research.

The program of the 2013 AAAS Annual Meeting will highlight the rich and complicated connections between basic and applied research, and how they bring about both practical benefits and the beauty of pure understanding.

Call for Poster Submissions

Online entries will be accepted at **www.aaas.org/meetings** beginning 14 May 2012.

Student Poster Competition

Open to college undergraduate and graduate students only

The competition recognizes the individual efforts of students who are actively working toward a college-level degree. Winners in each category receive a cash award and framed certificate, and are congratulated in the journal, *Science*.

General Poster Session

Open to postdocs and professionals

This session provides an opportunity for postdocs and professionals to present their research to the broad community of scientists attending the AAAS Annual Meeting.

AAAS
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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

AAAS
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Conference Program Editors: Yolanda S. George, AAAS, Education and Human Resources Programs (EHR)
Betty Calinger, AAAS, EHR
Donna Behar, AAAS, EHR

Conference Program Cover Design: Sandra Audia and Thea Mills, AAAS, Office of Public Programs

Conference Program Design: Donna Behar, AAAS, EHR

Contents

Overview of the Conference

EMERGING RESEARCHERS NATIONAL (ERN) CONFERENCE IN STEM

The 2012 Emerging Researchers National (ERN) Conference in Science, Technology, Engineering and Mathematics (STEM) is hosted by the American Association for the Advancement of Science (AAAS), Education and Human Resources Programs (EHR) and the National Science Foundation (NSF) Division of Human Resource Development (HRD), within the Directorate for Education and Human Resources (EHR). The conference is aimed at college and university undergraduate and graduate students who participate in programs funded by the NSF HRD Unit, including underrepresented minorities and persons with disabilities.

In particular, the conference seeks to highlight the research of undergraduate and graduate students who participate in the following NSF HRD-funded programs:

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

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

- Student poster and oral presentations.

Other conference activities include workshops focused on:

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

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

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

THE NATIONAL SCIENCE FOUNDATION (NSF) DIVISION OF HUMAN RESOURCE DEVELOPMENT (HRD)

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

HRD VISION:

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

HRD MISSION:

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

STRATEGIC GOAL 1:

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

STRATEGIC GOAL 2:

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

STRATEGIC GOAL 3:

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

HRD THEORY OF CHANGE:

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

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

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

About

AAAS

The American Association for the Advancement of Science (AAAS) is the world's largest general scientific society, and publisher of the journal, *Science* (www.sciencemag.org) as well as *Science Translational Medicine* (www.sciencetranslationalmedicine.org) and *Science Signaling* (www.sciencesignaling.org). AAAS was founded in 1848, and includes some 262 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 1 million. The nonprofit AAAS (*www.aaas.org*) 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!, *www.eurekalert.org*, the premier science-news Web site, a service of AAAS.

Memberships 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 Web site at *http://www.aaas.org/*.

Muriel Poston

NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

Directorate for Education and Human Resources

Division of Human Resource Development

Dear Conference Participants:

On behalf of the National Science Foundation (NSF), its Directorate for Education and Human Resources, and the Division of Human Resource Development, we welcome you to the 2012 *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 goes beyond classroom learning, to include 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 and participation in research as part of your educational experience.

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. Please take full advantage of all of the opportunities this conference has to offer.

Sincerely,

Muriel Poston, Ph.D.
Division Director

Welcome

Alan I. Leshner

Shirley M. Malcom

Yolanda S. George

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

Dear ERN Conference Participants:

Welcome to the 2012 *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 this important gathering of the next generation of STEM professionals. We applaud the NSF's commitment to enhancing the quality and excellence of STEM education and research through broadening participation by underrepresented minorities, persons with disabilities, as well as the institutions which serve them.

We wish to acknowledge the efforts of faculty and administrators who develop and implement innovative undergraduate and graduate educational initiatives, key components in keeping the U.S. at the forefront of technological innovation and in building a strong economy.

We appreciate the continued support and efforts of the some 50 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. These organizations provide very important information about graduate school admissions, fellowships, summer research opportunities, professional development activities, and employment opportunities.

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. This year we welcome over 500 undergraduate and graduate student presenters at the Conference.

We are grateful to the PhD alumni and current graduate students of the David and Lucile Packard HBCU Graduate Scholars Program and the AAAS Policy Fellows who are joining us at the Conference this year to help with judging student oral and poster presentations, as well as presenting workshops.

- From 1992 to 2003, the Packard Foundation provided fellowships for 120 graduates of HBCUs who were admitted to science and technology doctoral programs at U.S. universities. Since the inception of the Program in 1992, eighty-five (85) African American participants in the HBCU Packard Program have earned PhDs, primarily in physical sciences, engineering, and mathematics and statistics.

- The AAAS manages and administers Science & Technology Policy Fellowships in five program areas to provide the opportunity for accomplished scientists and engineers to participate in and contribute to the federal policymaking process while learning firsthand about the intersection of science and policy. The fellowships in congressional offices are funded by approximately 30 partner scientific and engineering societies. The fellowships in executive branch agencies are funded by the hosting offices.

As a part of its mission to "advance science, engineering, and innovation throughout the world for the benefit of all people," AAAS provides a wide array of programs and resources. To find out more about the internships, fellowships, and educational and career resources offered by AAAS, we invite you to visit online at http://www.aaas.org/.

We hope the contacts, strategies, and online resources that you discover at this Conference and via our Web site are useful in helping you meet your institutional or career goals.

Sincerely

Alan I. Leshner, Chief Executive Office, AAAS and Executive Publisher, Science
Shirley M. Malcom, Director, AAAS Education and Human Resources (EHR) Programs
Yolanda S. George, Deputy Director and Program Director, EHR

Directorate for Education and Human Resources Programs

American Association for the Advancement of Science
1200 New York Avenue, NW, Washington, DC 20005 USA
Tel: 202 326 6670 Fax: 202 371 9849
www.aaas.org

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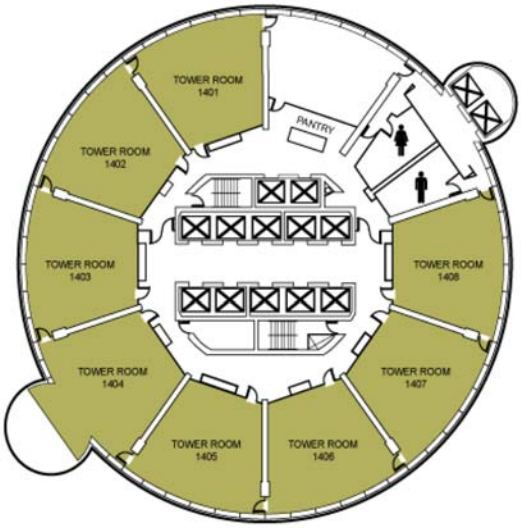

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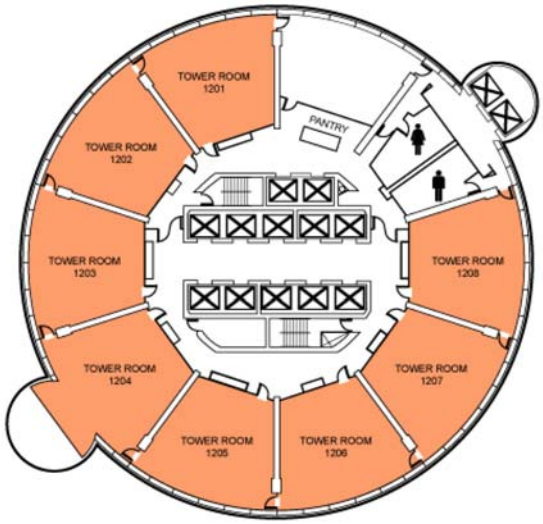

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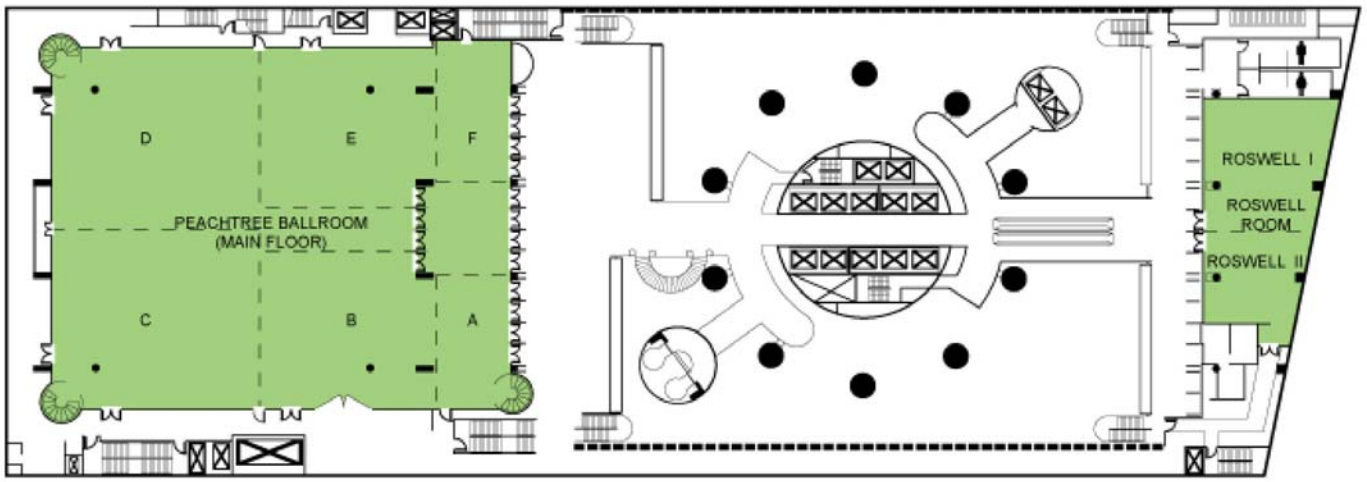

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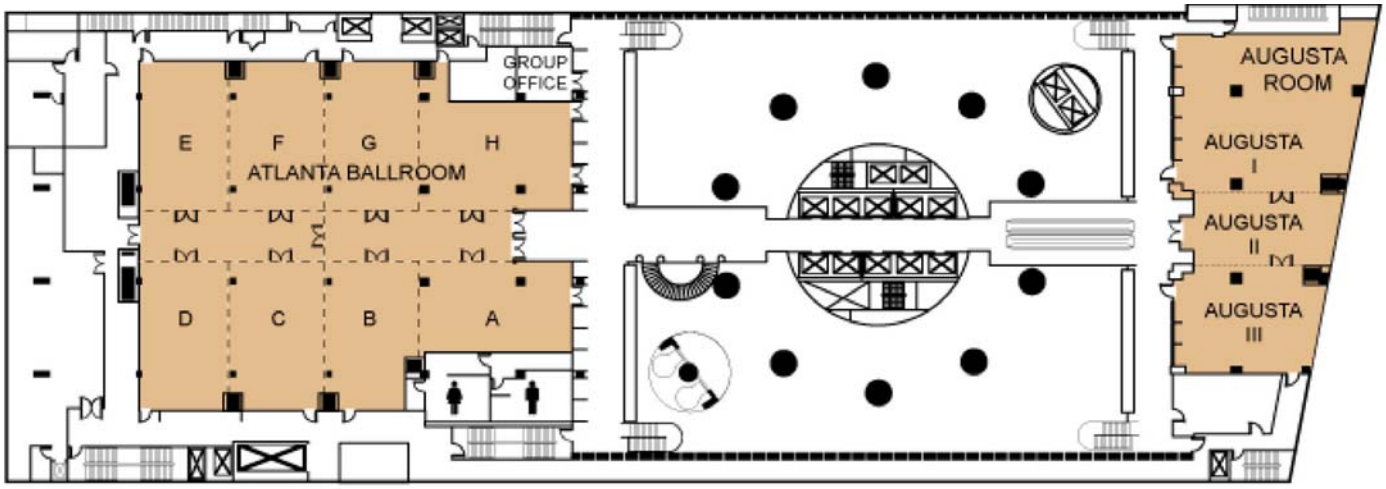

SEVENTH FLOOR

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NSF and AAAS Staff

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Victor Santiago, *Acting Deputy Division Director*

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NORTH DAKOTA STATE UNIVERSITY

graduate studies

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Botany (M.S. and Ph.D.)
Zoology (M.S. and Ph.D.)

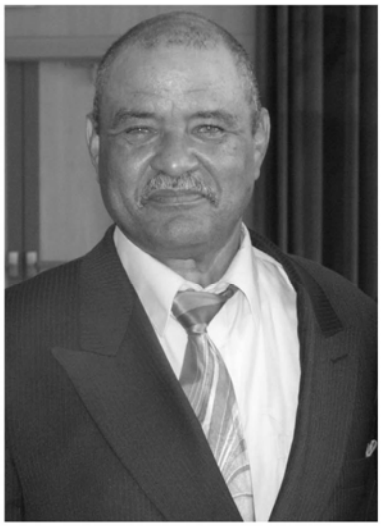
INTERDISCIPLINARY PROGRAMS

Cellular and Molecular Biology (Ph.D.)
Environmental and Conservation Sciences (M.S. and Ph.D.)
Genomics (M.S. and Ph.D.)
Natural Resources Management (M.S. and Ph.D.)
Science Education (Ph.D.)

www.ndsu.edu/biology

LYCEUM AGENCY

David "Sonny" Lacks | *The Immortal Life of Henrietta Lacks*



David "Sonny" Lacks has enthralled university and library audiences across the country talking about his mother Henrietta Lacks and her important contribution to science. The international success of Rebecca Skloot's New York Times bestseller, *The Immortal Life of Henrietta Lacks,* has left people keenly interested in the Lacks Family and Henrietta's legacy. In his appearances, Sonny shares with audiences what it meant to find out—decades after the fact—that his mother's cells were being used in laboratories around the world, bought and sold by the billions. Sonny's visits put a personal face to big issues such as the dark history of experimentation on African Americans, the birth of bioethics, and the legal battles over "informed consent" and whether we control the stuff we're made of, and should share in the profits.

Henrietta Lacks was a poor black tobacco farmer whose cells, taken without her knowledge in 1951, went on to become the first immortal human cells ever grown in the laboratory. Those cells, nicknamed HeLa, became one of the most important tools in modern medicine, vital for developing the polio vaccine, cloning, gene mapping, in vitro fertilization, and more. Though Henrietta died in 1951, her cells—alive and growing to this day—are still the most widely used cell line in the world.

Henrietta's family didn't learn that the cells existed until the '70's, when scientists wanted to do research on her children—Lawrence, Elsie, David "Sonny" Jr., Deborah, and Zakariyya—to learn more about the remarkable "immortality" of Henrietta's cell line. Her children were then used in research without their consent, and without having their most basic questions about the cells answered (questions like, "What is a cell?" and "What does it mean that Henrietta's cells are alive?"). Henrietta's cells have helped biotech companies make millions of dollars, yet her family has never benefited from the commercialization of HeLa cells.

Despite what the Lacks Family has endured, they are proud to honor the memory of Henrietta and her unparalleled contributions to science; their message is positive, optimistic, and—above all—celebrates Henrietta's life and legacy. Sonny's visits give audiences a sincere first-person perspective on the collision between ethics, race and the commercialization of human tissue, and how the experience changed the Lacks family forever.

PRAISE FOR DAVID "SONNY" LACKS and the FAMILY

I was really impressed with the turnout. They were so interested in every word; I have never seen a standing ovation there before! That's really impressive and shows how powerfully your family can present your case to the community. Excellent job speaking from the heart.

— Mark Willis, Community Relations Manager, Dayton Big Read

One of the high points of our Campus Reading Program activities this year was definitely the visit of David Lacks to our campus. His humility and charisma offer a powerful combination to have a truly meaningful impact on an audience, as his sincere reflections and shared perceptions touch on a personal level, making the messages of the book resonate all the stronger.

— Scot Guenter, San Jose State University

Miriam Feuerle, miriam@lyceumagency.com–503.467.4621
Kate Gannon, kate@lyceumagency.com–503.467.4622

Robin Shepard Broughton, ***AAAS Science & Technology Policy Fellow***

Robin Shepard Broughton is a molecular virologist who has worked to uncover mechanisms related to HIV biogenesis. She currently serves as an American Association for the Advancement of Science Science & Technology Policy Fellow in the Office of Cancer Genomics at the National Cancer Institute. Her primary responsibility is to manage a comprehensive genomics sequencing project focused on an HIV-associated cancer, Burkitt lymphoma. Broughton also currently serves as co-chair of the AAAS Minority Education & Career Exposure (MECE) affinity group, an organization she helped to create. The MECE affinity group works to seek and create opportunities to enhance the exposure and impact of underrepresented minorities in science along the education continuum.

Broughton previously was an Assistant Professor in the Department of Microbiology and Immunology at Meharry Medical College where she also served as the Science Deputy for the Center for AIDS Health Disparities Research (CAHDR). In addition to research, she taught graduate students, as well as creating and implementing a Fundamentals of Virology course. In her capacity as Science Deputy, Broughton advised and mentored graduate students and postdoctoral fellows in various aspects of their scientific and career development. She also served the CADHR Community Outreach Core by giving lectures to various audiences including faith leaders, college students and health care providers about the biology and epidemiology of HIV/AIDS.

Broughton's longstanding interest in the biological sciences began in high school when she worked in a Mycoplasma laboratory at the Food and Drug Administration. After graduating from North Carolina State University with a degree in Microbiology, Broughton worked as a research technician at the University of North Carolina at Chapel Hill and performed clinical and molecular research in the AIDS Clinical Trials Group Retrovirology Core Laboratory. She received her PhD in Microbiology and Immunology from the Wake Forest University School of Medicine in 2004 where her thesis work focused on examining the oncolytic properties of adenovirus. Dr. Broughton trained as a postdoctoral fellow at the Johns Hopkins Medical Institute and the University of North Carolina at Chapel Hill where she studied mechanisms of HIV-1 egress from infected cells.

Yolanda S. George, ***Deputy Director, Education and Human Resources Programs, 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, Washington, DC; Director, Professional Development Program, University of California, Berkeley, CA, a pre-college academic enrichment, university retention, and pre-graduate school program in Science Math and Technology (SMT) for minorities and women; 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, project and program reviews, and evaluation workshops for both the National Institutes of Health and National Science Foundation, as well as reviews SMT proposals for private foundation and public agencies, including Carnegie Corporation of New York, the Ford Foundation, and the European Commission. She develops and coordinates conferences and workshops related to SMT undergraduate reform and recruitment and retention of minorities, women, and persons with disabilities in SMT. 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 SMT.

Over the last 25 years she has raised over $80 million for a variety of SMT education initiatives for colleges and universities, associations, and community-based groups. She currently serves as principal investigator (PI) or co-PI on several National Science Foundation grants, including the Vision and Change in Undergraduate Biology Education; the Alliance for Graduate Education and the Professoriate; National Science Education Digital Library Biological Sciences Pathways; Historically Black Colleges and Universities-Undergraduate Programs; Robert Noyce Teacher Scholarship Program; and Transforming Undergraduate Education in STEM. 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: International Network of Women Scientists and Engineers (INWES); Maria Mitchell Women in Science Awards Committee; McNeil/Lehrer Productions Online Science Reports Advisory Committee; the Center for the Advancement of informal Science Education Advisory Board; and the South Dakota Biomedical Research Network Advisory Committee; Burroughs Wellcome

Fund, Science Enrichment Program Grants, Advisory Board; and The HistoryMakers, ScienceMakers, Advisory Board.

George 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.

Rosario A. Gerhardt, ***Office of VP for Institute Diversity and Professor of Engineering, Georgia Insitute of Technology***

Rosario A. Gerhardt was born and raised in Lima, Peru, and received her MS and Eng.Sc.D. in Metallurgy and Materials Science from the School of Engineering and Applied Science at Columbia University in NYC in 1979 and 1983 respectively. After receiving her doctorate, she worked as a post-doctoral research associate at Columbia and also at Rutgers University in Piscataway, NJ. After that, she served as a non-tenure track assistant research professor at the Center for Ceramics Research at Rutgers University from 1986-1990, where she mentored two PhD students to completion. In 1991, she joined the School of Materials Science and Engineering at Georgia Tech as a tenure track associate professor. She was granted tenure in 1997 and was promoted to full professor in 2001. Gerhardt also worked as an ASEE/NASA Faculty Fellow at the NASA Marshall Space Flight Center in Huntsville, AL during summer 1995 and at the Center for Nanophase Materials Sciences at Oak Ridge National Labs in Oak Ridge, Tennessee during the 2007-2008 academic year. Over the years she has supervised the research of over 40 M.S. and Ph.D. students. In addition, she regularly hosts 3 or 4 undergraduate research assistants, many of whom are under-represented minority students.

Gerhardt's research interests include developing relationships between the structure of materials at all length scales (atomic, nanoscopic, mesoscopic, microscopic and macroscopic) to the way the materials have been processed and their resultant properties. Her main emphasis has been on studying materials used in electronic applications such as fuel cells, capacitors, solar cells and displays, but her work also extends into materials used in structural applications such as gas turbine engines and materials for wear applications. Over the years she has worked with ceramics, metals, polymers as well as composites in bulk, thin film and in nanostructure form. Most of her work has dealt with the electrical and microstructural characterization of materials using impedance and dielectric spectroscopy, microscopy via optical, SEM, TEM and AFM as well as x-ray and neutron scattering methods. Her research has been funded by the National Science Foundation, the U.S. Department of Energy, NASA and various industrial companies. She is the proud mother of two daughters who are engineers, one who graduated in 2005 and the other who graduated in 2010.

Nancy Hurtado-Ziola, ***Executive Team and Senior Research Scientist, Sialix, Inc.***

Hurtado-Ziola was born in East Los Angeles, a barrio in Southern California. She spent most of her first 18 years in Whittier, CA, where she passed through the California public education system rather unnoticed. During regular counseling in high school, she was not encouraged to pursue higher education even though she knew early in her life that she wanted to be a doctor. Hurtado-Ziola married when she was 18 and had a son by the time she was 21. At age of 23 she was divorced and became a single parent. She worked 2-3 low-paying jobs at a time to keep her son fed and clothed while her parents helped care for her son. At this point, she made a promise to herself - to pursue an advanced degree in biology after her son graduated high school.

As a single parent raising a son, Hurtado-Ziola was not yet ready for the university setting and felt that the community college path was perfect for her situation. However, when she began taking community college classes, she was discouraged from pursuing an advanced degree because she was "too old". Undaunted, she continued taking classes all the while seeking academic and emotional support until she was able to transfer to a university. Later she transferred with a strong academic foundation to California State University, Fullerton (CSUF) where she was became a MARC scholar. While at CSUF, she developed an interest in biomedical policy. She received a BS in Biological Science with a minor in Biotechnology from CSUF at the age of 43.

Extramural summer research is another important undergraduate activity that helped make Hurtado-Ziola an attractive candidate for graduate school. She conducted summer research at UC Davis on a transgenic plant that could potentially take a biologically unavailable nitrogen source and process it into a bioavailable form. One year later she was chosen as a Minority International Research Training (MIRT) scholar. She worked in a biochemistry laboratory at Cambridge University, where she studied the role of glycans in platelet activation and atherosclerosis.

Encouraged by her MARC mentors, Hurtado-Ziola attended her first SACNAS National Conference in 1998, where she met under-represented minority STEM students and researchers. She found a deep sense of community at the meeting, which was important for her. She attributes much of her academic success

to the mentoring she received at SACNAS meetings. Finally, she applied to and was accepted into the University of California, San Diego (UCSD) Biomedical Graduate Program.

Within months of receiving a Doctorate in Biomedical Science from UCSD in 2007, Hurtado-Ziola was employed at a nascent biotechnology company, Gc-Free, Inc., (now Sialix, Inc.) in San Diego County. There she was the first and only paid employee. Now, she is a Senior Research Scientist and Principal Investigator (PI) at Sialix, Inc. Due in part to her efforts, the company has grown and now employs more than 10 people. She is the PI on two Small Business Innovation Research (SBIR) awards, one from NCI (*Glycan Arrays for Biomarker Discovery*), and another from the National Institute of Arthritis and Musculoskeletal and Skin Diseases (N-*glycolylneuraminic Acid in the Pathogenesis and Progression of Rheumatoid Arthritis*). She was co-PI on an NIGMS Small Business Technology Transfer grant, *The Detection of Non-Human Sialic Acid in Biotherapeutic Applications*. She has co-authored ten papers, has a review in press and is currently writing a manuscript about sialic acid binding proteins in humans and non-human primates.

Later, she was chosen to participate in the 2009 inaugural SACNAS/AAAS Leadership Institute. In an effort to 'give back', she now serves on the SACNAS Board of Directors where she is a champion for community college students and for careers in industry. Hurtado-Ziola would like to help students find their voice as a scientist through the mentoring of underrepresented minorities.

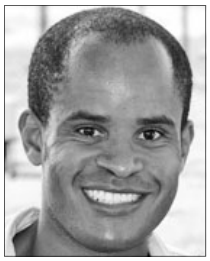
In addition to SACNAS, Hurtado-Ziola is a member of the American Society for Cell Biology , The American Association for the Advancement of Science , the Society for Glycobiology, the Association for Women in Science , and the International Society for Analytical Cytology.

David G. Jensen, *Managing Director, Kincannon & Reed Global Executive Search*

Dave Jensen is the Managing Director of Kincannon & Reed Global Executive Search, a retained search firm working with biotechnology, pharmaceutical and life sciences clients worldwide. Prior to 2010, Jensen was the founder of CareerTrax Inc, an executive search firm working in the life sciences, as well as founder and CEO of Search Masters International, a top biotechnology executive search practice founded in 1985. That company is now a unit of Kelly Services (Troy, MI) with its main offices in Chicago, IL. Prior to 1985, Jensen established a life sciences practice for Govig and Associates (Phoenix, AZ) under the Management Recruiters International franchise.

Jensen's monthly column "Managing Your Career" has been a visible part of the biotech industry for more than twenty years; the column ran for twelve years in *BioPharm* and is now in each issue of *Contract Pharma* where Jensen is the Contributing Editor. He has published over 300 papers on management and personal development topics for these journals along with regular features in *Genetic Engineering News, Life Sciences Magazine, Journal of Commercial Biotechnology* and others. Mr. Jensen has delivered seminars and workshops in industry meetings internationally, including keynote presentations, at career events held by the NIH, the EPA, Johns Hopkins University, Karolinska Institute, Harvard, Princeton, University of California, San Francisco (UCSF), and the California State University Program for Education and Research in Biotechnology.

Jensen writes the popular "Tooling Up" column for monthly career tips and techniques (*ScienceCareers.org*). He is the founder and moderator of the AAAS Science Careers Discussion Forum, located at *http://scforum.aaas.org/*.



Kenneth D. Gibbs, *AAAS Science & Technology Policy Fellow*

Kenneth Gibbs, Jr., PhD, is a AAAS Science & Technology Policy Fellow at the National Science Foundation in the Directorate for Education and Human Resources, Division of Human Resource Development. Prior to the AAAS fellowship, he was a graduate student and postdoc at Stanford in the lab of Garry Nolan where his research focused on the intersections of cell signaling, stem cell biology and cancer biology. While at Stanford, he was active in efforts aimed at improving the training experiences for all students, as well as increasing the participation of those from traditionally underrepresented backgrounds. He hopes to return to academia where he can have an impactful career and can combine his passions for service, teaching and research. Originally from Durham, NC, he received his B.S. in biochemistry and molecular biology summa cum laude from the University of Maryland, Baltimore County where he was a Meyerhoff, MARC, and HHMI scholar.

Kelly Mack*, Program Director, ADVANCE Program, NSF*

Mack is Professor of Biology at the University of Maryland Eastern Shore (UMES), where she has taught courses in Physiology and Endocrinology for 15 years, and is on loan from her home institution (since Fall 2008) serving as a Program Director for the National Science Foundation ADVANCE

Speaker Biographies

Program. At her home institution, Mack served in many capacities including Biology Program Director where she was responsible for providing leadership and strategic vision for the intellectual, educational, and professional development of biology majors and for the coordination of faculty in providing quality instruction, research, and development activities. During her tenure at UMES, Mack served as Principal Investigator, Director or Co-Director for externally funded projects that totaled over $12 million dollars, including the UMES ADVANCE Program, which focused on issues related to African American women faculty in the STEM disciplines and led to the initiation of several institution-wide practices to promote the professional development of all faculty.

Kelly Mack received her B.S. degree from the University of Maryland Eastern Shore in Biology and later the PhD degree from Howard University in Physiology. Mack has had extensive training and experience in the area of cancer research with her research efforts focusing primarily on the use of novel antitumor agents in human estrogen receptor negative breast tumor cells. Specifically, these efforts have included the role of the cellular accumulation of cisplatin in breast tumor cells, and the use of demethyltransferase inhibitors and histone deacetylase agents in inducing the re-expression of the estrogen receptor in human breast tumor cells. More recently, her research focus has involved the use of bioflavonoids in the regulation of estrogen receptor positive (ER+) and estrogen receptor negative (ER-) breast tumor cell proliferation.

Mack has served as a member of the Board of Governors for the National Council on Undergraduate Research and is a current member of the National Institutes of Health Review Subcommittee for the Minority Opportunities in Research Division.

Shirley M. Malcom, *Director, Education and Human Resources Programs, AAAS*

Shirley M. Malcom, Director for Education and Human Resources 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 and University Corporation for Atmospheric Research. 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 Advisers on Science and Technology from 1994 to 2001.

Steven Meyers, *Manager, International Activities Office, American Chemical Society*

Steven Meyers has undergraduate degrees in Biomedical Engineering and Computer Science and a doctorate in Biomedical Engineering with an emphasis on improving the performance of implanted medical devices and therapeutics. Steve previously served as a project manager for a transnational funding call in polymer chemistry and worked as a research scientist at entrepreneurial start-up companies, developing innovative technologies for ophthalmic refractive treatments and for the infant care market. At the ACS, he works in the Office of International Activities managing international exchange opportunities for students, fellows, and faculty.

Chiatogu Onyewu, *AAAS Science & Technology Policy Fellow*

Chiatogu Onyewu is currently an American Association for the Advancement of Science Science & Technology Policy Fellow with the Division for the Application of Research Discoveries at the National Heart, Lung, and Blood Institute (NHLBI) in Bethesda, MD, where she coordinates the Guidelines Executive Committee and supports current NHBLI efforts to develop and implement evidence-based clinical practice guidelines for the treatment of cardiovascular disease risk factors in adults. In addition to documenting the systematic processes and policies that govern this rigorous approach to science translation, Onyewu is also involved in the development of a new NHLBI initiative focused on reducing cardiovascular risk across the lifespan. She is particularly committed to addressing health disparities, and was recently selected as a 2011 Translational Health Disparities Course Scholar by the National Institute of Minority Health and Health Disparities.

Onyewu previously conducted health disparities research as a United Negro College Fund/Merck (UNCF/Merck) Postdoctoral Fellow in the Research Center for Genetic Medicine at Children's National Medical Center in Washington, D.C. As Study Director

for the Assessing Inherited Markers of Metabolic Syndrome in the Young (AIMM Young) Research Study, she worked to identify genetic risk factors associated with metabolic syndrome and related diseases among African American college students. Her research interests center around the design of unique interventions that incorporate personalized medicine approaches and foster cardiovascular disease prevention among minority young adults. She has discussed her work and the future promise of genetic testing as a guest panelist on the PBS television program, *To the Contrary*, and served as Co-Chair of the Medical and Health Stakeholders group for the D.C. Overweight and Obesity Action Plan. While at Children's National, she contributed to the formation of its Obesity Institute, and worked to establish an annual symposium series. Onyewu was a Robert & Jane Meyerhoff Scholar at the University of Maryland, Baltimore County where she received her B.S. degree in Biology in 1999. She completed the Medical Scientist Training Program at Duke University in 2007, with a doctorate degree in Pharmacology.

Lawrence Pileggi, *Tanoto Professor of Electrical and Computer Engineering, Carnegie Mellon University*

Lawrence Pileggi is the Tanoto Professor of Electrical and Computer Engineering at Carnegie Mellon University and the director of the Center for Circuit and System Solutions, one of six centers in the SRC/DARPA Focus Center Research Program. He previously held positions at Westinghouse Research and Development and the University of Texas at Austin.

He received his Ph.D. in Electrical and Computer Engineering from Carnegie Mellon University in 1989. He has consulted for various semiconductor and EDA companies, and was co-founder of Fabbrix Inc. (acquired by PDF Solutions) and Extreme DA (acquired by Synopsys). His research interests include various aspects of digital and analog integrated circuit design and design methodologies. He has received various awards, including Westinghouse Corporation's highest engineering achievement award, a Presidential Young Investigator award from the National Science Foundation, Semiconductor Research Corporation (SRC) Technical Excellence Awards in 1991 and 1999, the inaugural Richard A. Newton GSRC Industrial Impact Award, the SRC Aristotle award in 2008, and the 2010 IEEE Circuits and Systems Society Mac Van Valkenburg Award. He is a co-author of "Electronic Circuit and System Simulation Methods," McGraw-Hill, 1995 and "IC Interconnect Analysis," Kluwer, 2002. He has published over 250 refereed conference and journal papers and holds 30 U.S. patents. He is a fellow of IEEE.

Muriel Poston, *Division Director, Division of Human Resources Development, NSF*

Muriel Poston, PhD, is currently serving as the Division Director for the Human Resource Division in the Education Directorate at the National Science Foundation and is a Professor in the Biology Department at Skidmore College. She joined the Skidmore College administration in 2005 as Dean of the Faculty and until her recent appointment at NSF worked with colleagues to re-envision the science program, supported efforts to broaden the participation of underrepresented students and faculty in science, technology, engineering and mathematics (STEM) disciplines, and sought to enhance the capacity and infrastructure of the STEM facilities. Her primary research interests are in plant systematics, especially the evolutionary relationships of the neotropical family Loasaceae. Prior to her appointment at Skidmore, Poston spent over twenty years as a professor in the Department of Biology/Botany at Howard, where she focused on undergraduate education, served as curator of the university herbarium, and worked to develop the environmental science program. Poston previously served as a program director and deputy division director in the Biological Sciences Directorate at the National Science Foundation (NSF) where she was responsible for programs to enhance infrastructure for biological research collections, research instrumentation, and field station facilities. She recently stepped down as the Chair of the congressionally mandated Committee on Equal Opportunities in Science and Engineering and the NSF Advisory Committee for the Biological Sciences Directorate. She also serves as a member of the National Academy of Sciences, National Research Council Board of Life Sciences, the American Institute of Biological Sciences, Board of Directors and the Project Kaleidoscope Advisory Committee. Poston earned a B.A. degree from Stanford University, M.A. and Ph.D. degrees from the University of California at Los Angeles, and a J.D. degree from the University of Maryland.

Cindy Maria Quezada, *Life Sciences Specialist and AAAS Diplomacy Fellow*

Cindy Quezada has focused her scientific studies on protein structure and function. As a Fulbright Scholar at Oxford University, she studied how proteins obtain their three dimensional fold. During her PhD studies at the California Institute of Technology, she elucidated the structural and chemical mechanisms of a key protein that allows bacteria to sense the environment. As a postdoctoral scholar at Rockefeller University, she studied the molecular mechanisms of bacterial virulence.

Speaker Biographies

Quezada was a recipient of the L'Oreal For Women in Science Fellowship, which she used to evaluate a molecular diagnostic test for multi-drug resistant tuberculosis in Rwanda. In addition, Cindy has developed content for the Science Friday Initiative, the non-profit arm of National Public Radio's Science Friday program. She has also been actively involved in science outreach programs for young girls, junior high, and high school students that mix science with the arts.

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 B.S. in Mathematics, an M.S. in Statistics, an M.S. in Physics, and a Ph.D. 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.

Carmen K. Sidbury, *Associate Provost for Research, Spelman College*

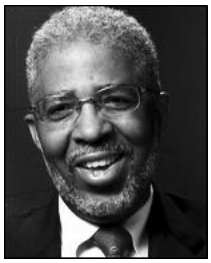
Sidbury is currently Associate Provost for Research at Spelman College. In this role she provides leadership for the cultivation of research capabilities at the college and assists in the coordination of activities associated with undergraduate student research and research training programs. She is also leading campus wide initiatives to strengthen the infrastructure and the development of policies and procedures that facilitate involvement of faculty in research and scholarly pursuits.

From 2009 to 2011 Sidbury served as a Program Director for the Graduate Research Fellowship Program, in the Division of Graduate Education in the Education and Human Resource Directorate at the National Science Foundation through the Intergovernmental Personnel Act. In this role she led the historic expansion of the Program, doubling the number of Fellowships from ~1,000 in 2008 to 2,000 in 2010 and 2011. She had specific oversight of initiatives to promote the professional development of Fellows and designed the Engineering Innovation Fellowship Program. While at NSF she was honored with the Director's Award for Collaborative Integration.

In 2007, Sidbury joined Spelman College as an Associate Dean. In this role she coordinated academic support services and student advising across disciplines for Sophomore and Junior students. She has earned BS and MS degrees in Mechanical Engineering from North Carolina A & T State University. After several years at AT&T-Bell Labs in Whippany, NJ, Carmen returned to graduate school and in 1995 became the first African-American female to earn a PhD in Mechanical Engineering from the Georgia Institute of Technology. Carmen has years of professional experience in technical positions at Lucent Technologies, formerly AT&T Bell Laboratories. At Lucent, she has had various assignments in telecommunications product design and development. In her most recent technical position she served as Director of Opto-Mechanical Systems for Luxcore Networks, Inc. in Atlanta, Georgia where she leveraged her technical expertise to develop packaging solutions to enable Luxcore's next generation optical networking systems.

Prior to joining Spelman, Sidbury was an Assistant Dean in the College of Engineering at the University of Washington. Carmen was responsible for the overall management of programs designed to recruit, retain and support outstanding and diverse pools of undergraduate and graduate students in the areas of engineering and science. In this role she collaborated with students, staff, faculty, secondary schools, private industry and federal agencies to develop programs and services to prepare students for lifelong learning, leadership, and service. She has written, published and presented research findings at national conferences and is a member of several organizations including the National Collegiate Inventors and Innovators Association, National Society of Black Engineers, Society of Women Engineers, National Association of Multicultural Engineering Program Advocates, and the National Action Council for Minorities in Engineering.

Sidbury is a seasoned professional with flexibility and adaptability rooted in a broad experience base, which includes experience in industry, government, and higher education institutions. She has developed strong relationships with local and national programs and serves as a diversity champion to promote the participation of underrepresented minorities in science and engineering.



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.

Wanda E. Ward, ***Senior Advisor to the Director for Planning and Assessment, NSF***

Wanda E. Ward is Senior Advisor to the Director for Planning and Assessment at NSF. Throughout her tenure at NSF, Ward has served in a number of science and engineering policy, planning, and program leadership capacities in the Directorate for Education and Human Resources (1992-1997; 2006-2010), Office of the NSF Director (1997-1999; 2010-present); and Directorate for Social, Behavioral and Economic Sciences (1999-2006). From 2001-2002 she was on assignment at the Council on Competitiveness as Chief Advisor to the initiative, BEST (Building Engineering and Science Talent), where she provided leadership in the launch and development of this public-private partnership, established to carry out the implementation of a national diversity initiative called for by the Congressional Commission on the Advancement of Women and Minorities in Science, Engineering and Technology Development.

Since joining the Foundation, Ward has also led or served on several NSF and interagency task forces, working groups, commissions and committees. These include: Chair, NSF Working Group on Pathways to STEM Family-Friendly Opportunities (2011-present) ; Co-Chair, Subcommittee on Social, Behavioral and Economic Sciences, the President's National Science and Technology Council (NSTC) Committee on Science (COS , 2004-2005); and NSF representative to the Interagency Working Group on the U.S. Science and Technology Workforce of the Future, NSTC COS (1997-1999). Since 2007, she has served as a U.S. member of the International Social Science Council Committee for Developing and Transition Economies .

Prior to joining NSF, Ward served as tenured Associate Professor of Psychology and Founding Director of the Center for Research on Multi-Ethnic Education at the University of Oklahoma, Norman. She took the B.A. in Psychology and the Afro-American Studies Certificate from Princeton University and the PhD in Psychology from Stanford University. She was awarded the Ford Foundation Fellowship, the 2005 American Psychological Association Presidential Citation, the 2006 Richard T. Louttit Award; and the 2006 Presidential Rank Award for Distinguished Executive. She is a member of the American Educational Research Association, American Association for the Advancement of Science, and Association for Women in Science.

Speaker Biographies

Richard Weibl, *Director AAAS Center for Careers in Science and Science, Technolgy, and Disability*

Ric Weibl is director of the Center for Careers in Science and Technology at the American Association for the Advancement of Science (www.aaas.org). He works with AAAS career development programs to strengthen their offerings and creates new partnerships with external groups to support the career aspirations and development needs of future and current scientists. Weibl joined AAAS in 2005 following a tour of service in the U.S. Peace Corps in the North West Province of South Africa. Before the Peace Corps, he served as U.S. editor for Science's Next Wave (www.sciencecareers.org) and as editor of Next Wave's Postdoc Network (now the National Post-doctoral Association @ www.nationalpostdoc.org). From November 1996 to June 2001, he was manager of the national Preparing Future Faculty (www.preparing-faculty.org) program and Director of Programs, Education and Institutional Initiatives at the Association of American Colleges and Universities. He has served in research and administrative positions at Antioch College, Ohio State University, Marquette University, Longwood College, and University of Georgia.

Valerie Petit Wilson, *Deputy Division Director for Graduate Education, NSF*

Valerie Petit Wilson, PhD, is the Deputy Division Director for Graduate Education. Prior to her position at NSF, Wilson was Associate Provost and Director of Institutional Diversity and Clinical Professor of Health Services, Policy and Practice at Brown University. Concurrently, for seven years, she was also Executive Director of the Leadership Alliance, a consortium of leading teaching and research institutions dedicated to preparing underrepresented students for careers in academic, government and private sectors through research and clinical doctoral training. Under her guidance, the Leadership Alliance became a 2007 institutional award recipient of the Presidential Award for Excellence in Science Mathematics and Engineering Mentoring, among other awards received by the consortium. From 2005-2009, she served as Associate Dean of the Graduate School at Brown, focusing on recruitment , retention and professional development activities and serving as co-PI of Brown's project in the PhD Completion Project of the Council of Graduate Schools, and Ethics in Physics Sciences grants.

Prior to her tenure at Brown, she was Deputy Center Director and Chief of Operations of the Center for Bioenvironmental Research and Clinical Professor of Environmental Health at Tulane University (1998-2003). From 1993-1997, she directed the Division of Health Sciences Policy at the Institute of Medicine, a part of the National Academy of Sciences. Earlier, her career focused on a variety of increasingly responsible positions in the Federal government, beginning as a staff research fellow and Program Director at National Institute of Diabetes, Digestive and Kidney Diseases of NIH, and then as Policy Analyst in biomedical research, and Policy Director in National HIV and AIDS Policy Office in the Department of Health and Human Services.

Wilson holds a BS degree in Chemistry from Xavier University of Louisiana, and a PhD in Molecular Biology from Johns Hopkins University.

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THURSDAY, FEBRUARY 23, 2012

3:00pm - 9:00pm **Registration**
Atlanta Foyer

1:00pm - 7:00pm **Exhibitor Setup**
Atlanta Ballroom

4:00pm - 5:00pm **Exhibitor Orientation**
Roswell Room

5:00pm - 6:00pm **Judges Orientation**
Augusta Room

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

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

Welcome Remarks:
Muriel Poston, *Division Director, NSF HRD*

Rosario A. Gerhardt, *Office of the VP for Institute Diversity and Professor of Engineering, Georgia Institute of Technology*

Speaker:
Larry Pileggi, *Tanoto Professor of Electrical and Computer Engineering, Carnegie Mellon University*

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

"How to Get the Most Out of the Conference"

8:00pm - 10:00pm **Exhibits Open / Judges Room Open**
Atlanta Ballroom / Augusta Room

FRIDAY, FEBRUARY 24, 2012

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

7:00am - 7:45am **Oral and Poster Presentations Session 1 (Set-Up)**
Tower Rooms (Oral)
200 Peachtree Street (Posters)

7:00am - 6:30pm **Judges Room Open**
Augusta Room

7:45am - 9:45am **Networking Breakfast & Plenary Session 2**
Peachtree Ballroom

Moderator:
Muriel Poston, *Division Director NSF HRD*

Welcome:
Carmen K. Sidbury, *Associate Provost for Research, Spelman College*

Speaker:
Nancy Hurtado-Ziola, *Executive Team and Senior Research Scientist, Sialix, Inc.*

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

10:00am - 12:15pm **Poster Presentations Session 1**
200 Peachtree Street

Oral Presentations Session 1
Tower Rooms

These include:
Biological Sciences Related Research (Graduate Students)
Tower Room 1201

Ecology, Environmental & Earth Sciences Related Research
Tower Room 1202

Cell and Molecular Biology
Tower Room 1203

Computer Sciences and Information Systems and Computer Engineering
Tower Room 1204

Mathematics and Science Education
Tower Room 1205

Mathematics and Statistics
Tower Room 1206

Concurrent Workshops Session 1

A. Writing Powerful, Winning Poster and Oral Presentation Abstracts
Tower Room 1207

Irene Hulede, *Manager Student Programs, American Society for Microbiology*

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

Kenneth Gibbs, *AAAS Policy Fellow, NSF HRD*

B. Identifying and Preparing for International Opportunities
Tower Room 1208

Steven Meyers, *International Activities Manager, Office of International Activities, American Chemical Society*

Krishna Foster, *Professor*, *California State University, Los Angeles*

Student Discussants:
Jephter Buahen, *Bowie State University*

Thomas Mota, *California State University, Long Beach*

Nicole Peretti, *California Polytechnic State University, San Luis Obispo*

C. Funding Opportunities and Support: Before, During and After Graduate School and Tips for Applying
Tower Room 1401

Liv Detrick, *Institute for Broadening Participation, Inc.*

Sara Hernandez, *Director of Diversity, School of Engineering, Cornell University*

Yolanda Trevino, *Assistant Dean, University of Indiana*

Lorraine Towns, *AGEP Coordinator, City University of New York*

Bernard Batson, *Director of Diversity and Outreach Programs, University of South Florida*

D. Choosing the Right Graduate School and Survival 101
Tower Room 1402

Travis Brown, *Manager, Center for STEM Diversity, Tufts University*

Rosario A. Gerhardt, *Office of the VP for Institute Diversity, Georgia Institute of Technology*

12:15pm - 1:30pm

Plenary Session 3
Peachtree Ballroom

"*Careers Beyond Academia*"

Moderator:
Richard Weibl, *Director, AAAS Center For Careers in Science and Science, Technolgy, and Disability*

Speakers:
Kendra Taylor, *Industrial Engineer Senior Consultant, CH2MHill*

Ahmasi Harris, *Senior Research Scientist, BAE Systems*

Cindy Quezada, *USAID, Egypt*

1:30pm - 4:00pm

Exhibits Open
Atlanta Ballroom

1:45pm - 4:00pm

Oral and Poster Presentations Session 2 (Set-Up)
Tower Rooms (Oral)
200 Peachtree Street (Posters)

4:00pm - 6:30pm

Poster Presentations Session 2
200 Peachtree Street

Oral Presentations Session 2
Tower Rooms

These include:
Cell and Molecular Biology
Tower Room 1201

Computer Sciences and Information Systems and Computer Engineering
Tower Room 1202

Ecology
Tower Room 1203

Mathematics and Statistics
Tower Room 1204

Microbiology, Immunology, Virology
Tower Room 1205

Plant Research
Tower Room 1206

Physics, Nanoscience, and Materials Sciences (Graduate Students)
Tower Room 1207

Social Sciences, Psychology, Economics
Tower Room 1208

Concurrent Workshops Session 2

A. Writing Powerful, Winning Poster and Oral Presentation Abstracts
Tower Room 1401

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

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

Kenneth Gibbs, *AAAS Policy Fellow, NSF HRD*

B. Identifying and Preparing for International Internship Opportunities
Tower Room 1402

Steven Meyers, *International Acitivities Manger, Office of International Activities, American Chemical Society*

Krishna Foster, *Professor, California State University, Los Angeles*

Student Discussants:
Jephter Buahen, *Bowie State University*

Thomas Mota, *California State University, Long Beach*

Nicole Peretti, *California Polytechnic State University, San Luis Obispo*

C. Funding Opportunities and Support: Before, During and After Graduate School and Tips for Applying
Tower Room 1403

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

Sara Hernandez, *Director of Diversity at the School of Engineering, Cornell University*

Yolanda Trevino, *Assistant Dean, University of Indiana*

Lorraine Towns, *AGEP Coordinator, City University of New York*

***Bernard Batson**, Directory of Diversity and Outreach Programs, University of South Florida*

D. Choosing the Right Graduate School and Survival 101
Tower Room 1405

Travis Brown, *Manager*, *Center for STEM Diversity, Tufts University*

Rosario A. Gerhardt, *Office of the VP for Institute Diversity, Georgia Institute of Technology*

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

9:00pm - 11:00pm **Talent Show Auditions**
Peachtree Ballroom

SATURDAY, FEBRUARY 25, 2012

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

7:00am - 7:45am **Oral and Poster Presentations Session 3 (Set-Up)**
Tower Rooms (Oral)
200 Peachtree Street (Poster)

7:00am - 8:30am **Buffet Breakfast & Plenary Session 4**
Peachtree Ballroom

Announcement About the AAAS International Research Collaboration Grants for Women in Minority Serving Institutions

Yolanda George, *Deputy Director, AAAS*

Presentation:
"***Street Savvy STEM Careers: Finding Your Job in Any Economy***"

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

Speaker:
Dave Jensen, *"Tooling Up" Columnist and Forum Moderator, AAAS ScienceCareers.org*

Agenda

9:00am - 1:00pm **Exhibits Open**
Atlanta Ballroom

8:45am - 10:30am **Poster Presentations Session 3**
200 Peachtree Street

Oral Presentations Session 3
Tower Rooms

These include:
Biological Sciences and Biomedical Engineering
Tower Room 1201

Chemistry and Chemical Sciences
Tower Room 1202

Computer Sciences and Information Systems and Computer Engineering (*Graduate Students)*
Tower Room 1203

Physics, Nanoscience, and Materials Science
Tower Room 1204

Concurrent Workshop Session 3:

A. STEM Job Offer Negotiation Strategies
Peachtree Ballroom

Dave Jensen, *"Tooling Up" Columnist and Forum Moderator, AAAS ScienceCareers.org*

B. NSF Graduate Research Fellowship Proposal Prepartion: Preparing for Graduate School
Tower Room 1205

Valerie Wilson, *NSF, Deputy Division Director, NSF Divison of Graduate Education*

Carmen K. Sidbury, *Associate Provost for Research, Spelman College and former Program Director, NSF DGE*

C. Writing Powerful, Winning Poster and Oral Presentation Abstracts
Tower Room 1206

Irene Hulede, *Manager, Student Programs, American Society for Microbiology*

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

Kenneth Gibbs, *AAAS Policy Fellow, NSF HRD*

10:30am - 11:00am **Break**

Oral and Poster Presentations Session 4 (Set-Up)
Tower Rooms (Oral)
200 Peachtree Street (Poster)

11:00am - 12:30pm **Poster Presentations Session 4**
200 Peachtree Street

Oral Presentations Session 4
Tower Rooms

These include:
Chemistry and Chemical Sciences
Tower Room 1201

Computer Sciences and Information Systems and Computer Engineering *(Graduate Students)*
Tower Room 1202

Ecology and Environmental Sciences Research
Tower Room 1203

Electrical Engineering
Tower Room 1204

Concurrent Workshop Session 4
Tower Rooms

A. The Power of Proactivity: For Graduate Students in STEM
Tower Room 1205

Robin S. Broughton, *AAAS Fellow, Office of Cancer Genomics at the National Cancer Institute*

Chiatogu Onyewu, *AAAS Fellow, National Heart, Lung, and Blood Institute*

B. NSF Graduate Research Fellowships Proposal Preparation: Preparing for Graduate School
Tower Room 1206

Valerie Wilson, *Deputy Division Director, NSF Division of Graduate Education*

Carmen K. Sidbury, *Associate Provost for Research, Spelman College and Former Program Director, NSF DGE*

C. Writing Powerful, Winning Poster and Oral Presentation Abstracts
Tower Room 1207

Irene Hulede, *Manager, Student Programs, American Society of Microbiology*

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

Kenneth Gibbs, *AAAS Policy Fellow, NSF HRD*

1:00pm **Exhibits Close**
Atlanta Ballroom

1:00pm - 3:30pm **Judges Meeting (Determining Awardees)**
Augusta Room

1:00pm - 6:30pm **Free time for Tours or Special Meetings**

6:00pm - 9:00pm **Plenary Session 5 & Awards Banquet**
Peachtree Ballroom

Moderator :
Kelly Mack, *Program Director, NSF ADVANCE Program*

Remarks:
Wanda E. Ward, *Senior Advisor to the NSF Director for Planning Assessment*

Presentation:
"The Immortal Life of Henrietta Lacks: A Conversation with David Lacks"

Discussant:
Taft Broome, *Professor, Civil Engineering and Engineering Ethics, Howard University*

Recognition of David and Lucile Packard HBCU Scholars

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

Recognition of the AAAS Policy Fellows & Presentation of Oral and Poster Awards

Shirley M. Malcom, *AAAS and* **Claudia Rankins***, NSF*

Presentation of Conference Incentives
AAAS ERN Conference Team

9:30pm - Midnight **Talent Show & Networking**
Peachtree Ballroom

Judges

John Alak
Southern University at Shreveport

Ken Anyenechi
Southern University at Shreveport

Leigh Arino de la Rubia
Tennessee State University

Jayashree Balakrishna
Harris-Stowe State University

Melissa Baumann
Michigan State University

Anthony Belvin
AAAS Policy Fellow, Department of Energy

Matthew Benacquista
University of Texas at Brownsville

Angela Birkes
University of Georgia/LSAMP

Suely Black
Norfolk State University

Gregory Bogin
Colorado School of Mines

Christine Broadbridge
Yale University/Southern CT State

Robin S. Broughton
AAAS Policy Fellow, Office of Cancer Genomics at the National Cancer Institute

Tony Bryant
Virginia State University

C. Marcel Buford
Institute for Defense Analyses

Reeshemah Burrell
AAAS Policy Fellow, NSF Engineering

Travis Brown
Tufts University

Kavan Clifford
Mercy Medical Center

John K. Coleman
Langston University

Brooke Coley
AAAS Policy Fellow, NSF Division of Computer and Network Systems

Elise Covic
University of Chicago

Agnes Day
Howard University, College of Medicine

Emmanuella Delva
AAAS Science and Technology Policy Fellow, USAID

Patrice Dickerson
Ohio State University

Linda Different
Cloud Sitting Bull College

Freddie Dixon
University of the District of Columbia

Robert Drummond
The Johns Hopkins School of Medicine

Cyntrica Eaton
Norfolk State University

Christopher James Ford
Georgia Institute of Technology

Matthew George, Jr.
Howard University College of Medicine

Kirk Grain
Southern University at Shreveport

Patrice Gregory
Sandia National Labs

Sasan Haghani
University of the District of Columbia

Melina Hale
University of Chicago

Ahmasi Harris
BAE Systems

Kelley S. Harris-Johnson
University of Wisconsin

Karl Henry
J. F. Drake State Technical College

Judges

Demarc Hickson
University of Mississippi, Medical Center

Christine Holler-Dinsmore
Fort Peck Community College

Joyce Hopson-King
Penn State University

Kimberly Jackson
Spelman College

Crystal James
Morehouse College

Margaret Jefferson
California State University Los Angeles

Marian Johnson-Thompson
Educational Consultant

Marcus Jones
J. Craig Venter Institute

Robert King
Educational Consultant

Tina King
Educational Consultant

Johnathan Lambright
Savannah State University

Mulatu Lemma
Savannah State University

Candice Lewis
University of Chicago

Emanuel Lin
UCLA AAAS Intern

Diana Lizarraga
UC Berkeley

George Mbata
Fort Valley State University

Arlene Maclin
AAAS Consultant

James McGee
Elgin College

Sydika McKissic
Vanderbilt University

Knashawn Morales
University of Pennsylvania

Lycurgus Muldrow
Morehouse College

Shantisa Norman
Sandia National Laboratory

Joe Omojola
Southern University at New Orleans

Chiatogu Onyewu
AAAS Fellows, National Heart, Lung, and Blood Institute

Cass Parker
Clark Atlanta University

Colette Patt
University of California

David Paul
University of Arkansas

Manu Platt
Georgia Tech and Emory University

Ann Podleski
Harris-Stowe State University

Chris Randall
NASA Marshall Space Flight Center

Karen Redden
University of the District of Columbia

Yenumula Reddy
Grambling State University

April Savoy
SA Technologies Inc.

Tomasz Smolinski
Delaware State University

Sonya Snedecor
Pharmerit North America

Rosie Sneed
University of the District of Columbia

Jean Shin
American Sociological Association

Michael Smith
Intel

Judges

Hattie Spencer
Mississippi Valley State University

James Stith
American Institute of Physics

Robert Stolz
University of the Virgin Islands

Kendra Taylor
CH2MHill

Audie Thompson
Prairie View A&M University

Gregory Triplett
University of Missouri, Columbia

Marcelo Vinces
AAAS Policy Fellow

Alicia Washington
Howard University

Richard Weibl
AAAS

Richard Whittington
Tuskegee University

Molly Williams
Fayetteville State University

Myron Williams
Clark Atlanta University

Victor Wyatt
USDA

Exhibitor Listing

Table	Institution
22	American Association for the Advancement of Science /Center for Careers in Science
13	American Chemical Society
1	American Society for Microbiology
23	Binghamton University / Thomas J. Watson School of Engineering & Applied Science
60	Black EOE Journal Magazine
58	Carnegie Mellon University
37	Columbia University
12	Cornell University -College of Engineering
5	Emory University MD-PhD Program/Graduate Division of Biological and Biomedical Sciences
50	Florida International University
53	Georgia Institute of Technology
32	IBP and HCF The Institute for Broadening Participation (IBP) Hispanic College Fund (HCF)
29	Iowa State University
20	Keck Graduate Institute
55	Lawrence Berkeley National Laboratory
16	Massachusetts Institute of Technology
24	Michigan State University
56/64	National Science Foundation
4	North Carolina State University The Graduate School of North Carolina State
7	North Dakota State University Graduate School
15	Ohio State University
25	Penn State University The Huck Institutes of the Life Sciences
11	Princeton University School of Engineering and Applied Sciences
6	Rensselaer Polytechnic Institute
39	Rochester Institute of Technology
19	Stony Brook University

Table	Institution
21	The City College of New York - CUNY Center for Exploitation of Nanostructures in Sensors and Energy Systems
33	The Graduate Center, CUNY
47	The Scripps Research Institute
88	University of Alabama
8	University of Arkansas
2	University of California, Davis
14	University of California at San Diego
28	University of Chicago
40	University of Cincinnati College of Medicine
26	University of Florida Master's Program in Translational Biotechnology
61	University of Florida
38	University of Illinois
34	University of Massachusetts MassNano Tech Institute
48	University of Michigan College of Pharmacy Graduate and Professional Programs
18	University of Minnesota Graduate School
41	University of Missouri
43	University of Missouri, School of Medicine
27	University of Pennsylvania Perelman School of Medicine/Biomedical Graduate Studies
36	University of Rochester - Arts, Sciences and Engineering
42	University of South Florida
17	University of Washington Molecular & Cellular Biology
49	University of Wisconsin Madison Graduate Engineering Research Scholars
31	XSEDE - Extreme Science and Engineering Discovery
9	Yale University Graduate School of Arts and Sciences

Exhibitor Descriptions

Table 22
American Association for the Advancement of Science
Careers in Science
1200 New York Avenue NW
Washington, DC 20005

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

The American Association for the Advancement of Science, 'Triple A-S' (AAAS), 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, as well as many scientific newsletters, books and reports, and spearheads programs that raise the bar of understanding for science worldwide.

Shaping a career in science has never been a solitary experience. Extending one's hand to help others experience the thrill of discovery and to forge a successful scientific career is one way AAAS advances science and serves society.

AAAS career development initiatives provide information, training, and opportunities for collaboration among educators, scientists, policy makers, professional organizations, non-profits, government, and industries regardless of geographic origin.

The Center for Careers in Science and Technology is a collaboration of AAAS departments and its affiliated organizations. Collectively, these groups offer a wide range of programs and services for AAAS members and the larger science community.

Table 13
American Chemical Society
1155 16th Street NW
Office of International Activities
Washington, DC 20036

Contact: *Steven Meyers, s_meyers@acs.org*

With more than 163,000 members, the American Chemical Society (ACS) is the world's largest scientific society and one of the world's leading sources of authoritative scientific information. A nonprofit organization, chartered by Congress, ACS is at the forefront of the evolving worldwide chemical enterprise and the premier professional home for chemists, chemical engineers and related professions around the globe.

Table 1
American Society for Microbiology
ABRCMS
ASM Education Department
1752 N Street, NW
Washington, DC 20036

Contact: *Irene Hulede, IHULEDE@asmusa.org*

The American Society for Microbiology (ASM) offers various programs and opportunties for undergraduate and postbaccalaureate students. ASM also manages the Annual Biomedical Research Conference for Minority Students (ABRCMS) which will be held November 7-10, 2012.

Visit: *www.asm.org to learn about ASM programs / www.abrcms.org to learn about ABRCMS.*

Table 23
Binghamton University
Thomas J. Watson School of Engineering & Applied Science
PO Box 6000
Binghamton, NY 13902-6000

Contact: *Elizabeth Kradjian, kradjian@binghamton.edu*

Binghamton University, one of the four university centers of the State University of New York, combines an interdisciplinary, international education with vibrant research programs. We offer more than 60 master's, 30 doctorate, and 50 accelerated degrees, plus 15 certificates and non-degree graduate programs, including Behavioral Neuroscience, Biological Sciences, Biomedical Anthropology, Biomedical Engineering, Chemistry, Computer Engineering, Computer Science, Electrical Engineering, Geological Sciences, Industrial & Systems Engineering, Materials Science & Engineering, Mathematics, Mechanical Engineering, Physics and Systems Science.

The Thomas J. Watson School of Engineering and Applied Science educates over 700 graduate students per year who are eagerly sought by high-technology businesses, financial firms, research and development institutions and management firms. One-third receive funding through fellowships and assistantships, with many supported on industry contracts and research grants. Faculty members are active in many research areas including applied nanomaterials, simulation, computer security, signal and picture processing, electronics packaging, healthcare, human factors, information systems, solar power and supply chain management.

Binghamton University is dedicated to diversifying graduate education by providing LSAMP students and McNair Scholars with application fee waivers. We also offer fellowship opportunities, including the Clifford D. Clark Graduate Fellowship for Diversity and the National Science Foundation funded State University of New York Louis Stokes Alliance for Minority Participation Bridge to the Doctorate fellowship program.

Table 60
Black EOE Journal
P.O. Box 18479
Room 645
Anaheim, CA 92807
http://www.blackeoejournal.com/

The *Black EOE Journal* is widely recognized as a nationwide leader in the advancement of workforce diversity. For over ten years, our publication has been instrumental in meeting the business needs of the minority community and encouraging diversity in the workplace.

In keeping with our commitment to workforce diversity, we endeavor to meet our readers' wants and needs by focusing on relevant topics such as: Management, Career Development, Engineering, IT/Technologies, Role Models, Mentoring, Education, Top Businesses and Top Employers, Minorities and Women in Business, Finance, Banking and Investment Trends, Business and Franchise Opportunities, Personal Success Stories, Self-Awareness, and Personal Opportunities, making the *Black EOE Journal*, an outstanding informational resources for the minority community.

Table 58
Carnegie Mellon University
533 Warner Hall
5000 Forbes Ave
Pittsburgh, PA 15213-3890

Contact: *Suzanne Laurich-McIntyre, suzannel@andrew.cmu.edu*

Carnegie Mellon University is a global research university of more than 10,000 students, and 4,000 faculty and staff. Recognized for its world-class arts and technology programs, collaboration across disciplines and innovative leadership in education, Carnegie Mellon is consistently a top-ranked university. Its real-world impact is visible within our local communities, across the country and around the world.

The university consists of seven schools and colleges: Carnegie Institute of Technology, College of Fine Arts, Dietrich College of Humanities and Social Sciences, Heinz College with Schools of Public Policy and Management and Information Systems, Mellon College of Science, School of Computer Science and the Tepper School of Business.

Table 37
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 School of Engineering and Applied Science offers graduate degrees in applied physics, applied mathematics, biomedical engineering, chemical engineering, civil engineering, engineering management systems, engineering mechanics, computer engineering, computer science, earth and environmental engineering, electrical engineering, financial engineering, industrial engineering, operations research, materials science, and mechanical engineering. Our academic programs allow students to advance knowledge in classical engineering or applied science disciplines or delve into new, exciting interdisciplinary fields. Degrees can be pursued on a full-or part-time basis. Distance education and MS/MBA programs are also available.

Table 12
Cornell University - College of Engineering
146 Olin Hall
Ithaca, NY 14853

Contacts: *Sara Hernandez, sh267@cornell.edu*
Teresa Carey, tei3@cornell.edu

The Cornell University College of Engineering is one of the world's leading engineering and technical institutions, set within a deliberately broad-based and diverse university. We have a longstanding focus on teaching excellence and groundbreaking research, supported by exceptional laboratories and libraries. Our dynamic culture of innovation and our particular strength in cross-disciplinary collaboration are enhanced by the open, engaging interactions among the members of our community - faculty and students alike.

We choose the members of our community with great care, realizing that each has an impact on the others. We select faculty who are able to make breakthrough contributions to the world's body of knowledge as well as to advance students' learning and graduate students who demonstrate promise of success.

If you are considering applying to our Ph.D., M.S., or M.Eng. degree program, we encourage you to explore the many graduate fields available to you. These fields cut across disciplines and are based on shared interests among faculty - one of the ways we cultivate our unusually strong culture of innovation. We also encourage you to learn about the individual faculty members who share your particular interests.

By earning a graduate degree from Cornell University's College of Engineering, you will find yourself exceptionally well positioned for a rewarding career in research, academia, or industry. In addition to your Cornell credentials and the professional experiences we help you gain, you will have access to expert career management services and a lifelong connection to one of the largest and most active alumni networks in the world.

Exhibitor Descriptions

We hope you will consider sharing the next phase of your journey with us at Cornell.

Table 5
Emory University MD-PhD Program/Graduate Division of Biological and Biomedical Sciences
1648 Pierce Drive, Suite P375-B
MSC: 1020-003-1AB
Atlanta, GA 30322

Contacts: *Rebecca Sandidge, rsandid@emory.edu*
Kathy Smith, kathy.smith@emory.edu

Emory University's MD/PhD Program provides the opportunity for exceptionally bright and dedicated students to acquire both clinical and basic research training to pursue careers in academic medicine. These physician-scientists will contribute to expanding the fields of science and medicine. The Program offers Ph.D. level training in the following programs:

- Graduate Division of Biological and Biomedical Sciences
- Rollins School of Public Health
- Graduate School of Arts and Sciences
- Georgia Tech/Emory Biomedical Engineering Dept

Emory University's Graduate Division of Biological and Biomedical Sciences consists of nine interdisciplinary Ph.D. Programs:

- Biochemistry, Cell and Developmental Biology
- Caner Biology
- Genetics and Molecular Biology
- Immunology and Molecular Pathogenesis
- Microbiology and Molecular Genetics
- Molecular and Systems Pharmacology
- Neuroscience
- Nutrition and Health Sciences
- Population Biology, Ecology and Evolution

Table 50
Florida International University
University Graduate School
11200 SW 8th Street PC 230
Miami, FL 33199

Contact: *Albert Hoyt III, ahoytiii@fiu.edu*

Florida International University has a nationally and internationally renowned faculty recognized for their outstanding teaching and cutting-edge research. More than 190 baccalaureate, masters and doctoral degree programs are offered in the following: College of Architecture and the Arts, Arts and Sciences, Business Administration, Education, Engineering and Computing, Law, Medicine, Nursing and Health Sciences, Public Health and Social Work, Journalism and Hospitality and Tourism.

Table 53
Georgia Institute of Technology
237 Uncle Heinie Way
Atlanta, GA 30332-0740

Contact: *Rosario Gerhardt, rosario.gerhardt@vpid.gatech.edu*

The Georgia Institute of Technology is one of the nation's top research universities, distinguished by its commitment to improving the human condition through advanced science and technology.

Georgia Tech's campus occupies 400 acres in the heart of the city of Atlanta, where 20,000 undergraduate and graduate students receive a focused, technologically based education.

Accredited by the Southern Association of Colleges and Schools, the Institute offers many nationally recognized, top-ranked programs. Undergraduate and graduate degrees are offered in the Colleges of Architecture, Computing, Engineering, Management, Sciences, and the Ivan Allen College of Liberal Arts. Georgia Tech is consistently ranked in U.S. News & World Report's top ten public universities in the United State.

Table 32
IBP and HCF
The Institute for Broadening Participation (IBP)
The Hispanic College Fund (HCF)
PO Box 607
Damariscotta, ME 04543

Contacts: *Chris Cash, ccash@ibparticipation.org*
Holly Triska, Htriska@hispanicfund.org

IBP: The Institute for Broadening Participation (IBP) is a non-profit organization created to design and implement strategies to increase access to STEM (Science, Technology, Engineering, and Mathematics) education and careers for diverse underrepresented groups.

IBP's Mission is to make education and careers in science more accessible to students - particularly to members of underrepresented groups; support faculty and administrators as they work to include students from a variety of backgrounds in their programs; foster an on-going exchange of ideas and resources between individuals and institutions who are working to navigate their future in the STEM fields.

IBP's funding is provided by the National Science Foundation and National Aeronautics and Space Administration.

HCF: Founded in 1993, the Hispanic College Fund (HCF) is a national non-profit organization based in Washington, D.C., with a mission to develop the next generation of Hispanic professionals. For 18 years, the Hispanic College Fund has provided educational, scholarship, and mentoring programs to

students throughout the United States and Puerto Rico, establishing a career pipeline of talented and career-driven Hispanics.

We accomplish our mission by providing Hispanic high school and college students with the vision, resources, and mentorship needed to become community leaders and achieve successful careers in business, science, technology, engineering and math.

Table 29
Iowa State University
Graduate College
1137 Pearson Hall
Ames, IA 50011

Contact: *Thelma Harding, tlhardi@iastate.edu*

Graduate study in one of more than 120 graduate programs at Iowa State gives you one-on-one mentoring that focuses on your needs and aspirations, together with all the resources of one of the world's most respected research institutions, including:

- World-class computing facilities across all major platforms;
- Network connections in all classrooms and residence-hall rooms;
- More than 580 campus wide public wireless access points; and
- A comprehensive research library housing millions of books, monographs, serials, and microform, film, and video units

Along with your major professor and study committee, you will collaborate in a student-friendly environment with faculty members who are leaders in their fields. Whether in seminars, research labs, studios, or internships, you will learn in small dynamic groups of peers and faculty.

For program-related requirements, consult the Graduate College's website at *www.grad-college.istate.edu.*

Table 20
Keck Graduate Institute of Applied Life Sciences
535 Watson Drive
Claremont, CA 91711

Contact: *Brandy Orlando, arivera@kgi.edu*

Keck Graduate Institute (KGI) is a stand-alone graduate institution that combines applied life sciences, bioengineering, bioethics and business management. KGI offers degree/certificate programs in: Master of Bioscience, Postdoctoral Professional Masters, PhD in Applied Life Sciences or Computational Biology, Post-baccalaureate Premedical Certificate, etc.

KGI is uniquely positioned to develop leaders who will meet the challenges and opportunities presented by this life sciences industry, by incorporating valuable business training that will prepare students to become successful in their field. KGI is a member of The Claremont Colleges, located in Claremont, California.

Table 55
Lawrence Berkeley National Laboratory
Center for Science and Engineering Education
One Cyclotron Road
MS: 7R0222
Berkeley, CA 94720

Contact: *Colette Flood, CLFlood@lbl.gov*

Berkeley Lab is a member of the national laboratory system supported by the U.S. Department of Energy through its Office of Science. It is managed by the University of California (UC) and is charged with conducting unclassified research across a wide range of scientific disciplines. Located on a 200-acre site in the hills above the UC Berkeley campus that offers spectacular views of the San Francisco Bay, Berkeley Lab employs approximately 4,200 scientists, engineers, support staff and students

Table 16
Massachusetts Institute of Technology
77 Massachusetts Avenue
Building 3-138
Cambridge, MA 02139

Contact: *Monica Orta, mmorta@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 24
Michigan State University
Graduate School
110 Linton Hall
East Lansing, MI 48824

Exhibitor Descriptions

Contact: *Steven Thomas, deshawn@msu.edu*

We are accepting application for graduate school and summer internships from students interested in the Science, Technology, Engineering and Mathematics 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.

Tables 56 and 64
National Science Foundation
4201 Wilson Blvd
Room 815 N
Arlington, VA 22230

Contact: *Claudia Rankins, crankins@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; and to secure the national defense." NSF is the funding source for approximately 20 percent of all federally supported basic research conducted by America's colleges and universities.

NSF is the only federal agency whose mission includes support for all fields of fundamental science and engineering, except for medical sciences. NSF ensures that research is fully integrated with education so that today's revolutionary work will also be training tomorrow's top scientists and engineers.

Please visit the NSF website at: *http://www.nsf.gov*

Table 4
North Carolina State University
The Graduate School at North Carolina State University
Campus Box 7102
Raleigh, NC 27695-7102

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

North Carolina (NC) State University is a premier center for graduate study, known internationally for innovative degree programs, a world-renowned faculty, and groundbreaking collaborative research. The Graduate School is responsible for administering over 220 different doctoral and master's degrees across 10 academic colleges. Currently, more than 8,000 students from all areas of the U.S. and 100 other countries are pursuing post-baccalaureate study at NC State.

NC State's Centennial Campus is a unique community of collaboration. Industry and government partners work alongside faculty, staff, post-docs and students conducting cutting-edge research in state-of-the art facilities. Home to more than 130 corporate and government research partners, as well as incubator companies, and NC State University research units, Centennial Campus is the premier university research campus in the country.

Table 7
North Dakota State University Graduate School
317 Stevens Hall
PO Box 6050
Fargo, ND 58108

Contact: *Kendra Greenlee, kendra.greenlee@ndsu.edu*

The North Dakota State University (NDSU) Graduate School in Fargo, ND, offers over 40 doctoral degree programs, over 60 master's degree programs and nine graduate certificate programs in eight colleges. NDSU was recently named among the nation's top 108 public and private universities in the Carnegie Commission on Higher Education's elite category of "Research Universities/Very High Research Activity" and is listed in the top 100 research universities in the country in several National Science Foundation research categories. The NDSU Graduate School is proud of its recent growth including enrollment of over 2,200 students, 600 graduate faculty members and research expenditures exceeding $100 million.

For more information about graduate degree programs at NDSU, please visit *www.ndsu.edu/gradschool* or call (701) 231-7033.

Table 15
Ohio State University
Graduate School
230 N Oval Mall
247 University Hall
Columbus, OH 43210

Contact: *Cyndi Freeman, papio.1@osu.edu*

The Ohio State University is one of the world's best comprehensive, public research universities, and it attracts high-achieving faculty and graduate students with its state-of-the-art facilities and abundant research opportunities.

Ohio State's 10,000 graduate students have access to a large and dynamic university environment, outstanding academic and professional development resources, and the cultural and recreational opportunities of Columbus, Ohio, one of the country's fastest-growing cities.

Table 25
Pennsylvania State University
The Huck Institutes of the Life Sciences
101 Life Sciences Building
University Park, PA 16802-2123

Contact: *Michael Radis, mwr1@psu.edu*

The Huck Institutes of the Life Sciences at the Pennsylvania State University is an administrative unit for 10 interdisciplinary life sciences programs including: Bioinformatics and Genomics, Cell and Developmental Biology, Ecology, Genetics, Immunology and Infectious Diseases, Molecular Medicine, Molecular Toxicology, Neuroscience, Physiology, and Plant Biology. These programs involve faculty from 8 of the 10 colleges within the Pennsylvania State University and more than 300 doctoral students. Programs are located at both the University Park and Hershey College of Medicine campuses in central Pennsylvania. Students receive training and experience as college teachers and researchers, lab rotation experiences, as well as receiving full funding (tuition and stipend) for their education.

Table 11
Princeton University
School of Engineering and Applied Science
C211 E-Quad
Olden Street
Princeton, NJ 08502

Contact: *Brandi Jones, acalcado@gmail.com*

Princeton Engineering offers advanced degrees in the following departments: Chemical and Biological Engineering (M.Eng, M.S.E, PhD); Civil and Environmental Engineering (M.Eng, M.S.E, PhD); Computer Science (M.S.E, PhD); Electrical Engineering (M.Eng, PhD); Mechanical and Aerospace Engineering (M.Eng, M.S.E, PhD); Operations Research and Financial Engineering (M.S.E, PhD). Princeton offers financial support for students, and most students receive financial assistance through tuition remission, fellowships and assistantships and/or stipends.

Table 6
Rensselaer Polytechnic Institute
110 8th Street
Admissions Office
Troy, NY 12180

Contact: *George Robbins, woychl@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 39
Rochester Institute of Technology
58 Lomb Memorial Drive
Rochester, NY 14623

Contact: *Sonja Phongsavanh, samadm@rit.edu*

Much more than just computers and engineering, RIT offers 70 graduate programs in career areas such as Art, Design, Crafts, Photography, Film, and Graphic Arts; Business, Communications, Service and Hospitality; Education, Psychology, and Human Resources; Science, Health Sciences, Mathematics, Statistics and Imaging Science; Applied Arts & Sciences; Sustainability; Computing and Information Sciences and Technology; and Engineering and Technology. Degrees offered include MBA, MFA, MS, MST, ME degrees and six PhD programs.

RIT is a privately endowed, coeducational university in Upstate New York that includes eight colleges enrolling more than 17,500 students.

Recognized by US News & World Report, Princeton Review, and the Fiske Guide to Colleges, RIT has internationally-recognized faculty, state-of-the-art facilities, and a vibrant campus life.

In 2010-2011, RIT provided over $16 million in merit scholarships and graduate assistantship tuition remission to approximately 2,100 graduate students. Thousands of on-campus jobs also are available.

RIT's most recent career fairs drew more than 400 employers from throughout the United States and two foreign countries.

Table 19
Stony Brook University
The Graduate School
The Center for Inclusive Education
Computer Science Building, Suite 2401
Stony Brook, NY 11794-4422

Contact: *Toni Sperzel, toni.sperzel@stonybrook.edu*

Stony Brook University is internationally recognized as a major research university offering the finest graduate degree programs available. Our collaborative relationship with Brookhaven National Laboratory and Cold Spring Harbor

Laboratory make the university an ideal choice for students interested in the sciences.

The Center for Inclusive Education (CIE), a division of the Graduate School, is home to three graduate level initiatives aimed at increasing the participation of underrepresented students in graduate study and the professoriate: The State University of New York Alliance for Graduate Education and the Professoriate (SUNY AGEP); The prestigious state funded W. Burghardt Turner Fellowship; and the GEM Fellowship program. With a combined budget of about $1.5 million per year, the CIE currently provides direct services for 160 students in 36 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 on admissions, fellowships, and campus visits please visit Table #19.

Table 21
The City College of New York - CUNY
Center for Exploitation of Nanostructures in Sensors and Energy Systems
160 Convent Ave.
CASI/Chemistry
MR-1120
New York, NY 10031

Contact: *Diane Beckford, censesinfo@ccny.cuny.edu*

The Center for Exploitation of Nanostructures in Sensors and Energy Systems (CENSES) is a multidisciplinary center that brings together faculty members, researchers, graduate students and undergraduate students from the Chemistry, Chemical Engineering, Electrical Engineering and Physics Departments of the City College of New York to pursue ground breaking research in nanomaterials for applications in sensors and energy systems.

In 2011, a broad spectrum of research was accomplished in the Center's three research thrust areas. CENSES has made research advances is areas such as self assembly of high-k dielectric nanoparticles into capacitance films for applications in energy storage/power conversion; the designing of de novo protein dyads and triads to aid in solar energy conversion; and use of microfluidic bead-based microarrays as platforms to measure biomolecular binding kinetics.

CENSES publications in high impact journals include (1) a light-splitting and energy concentrating metamaterial for use in the THz frequency range; (2) the use of carbon monoxide as a pretreatment agent to enhance the thermolytic release of hydrogen in a hydrogen storage material; (3) the observation of room temperature and narrow intersubband electroumin-escence from ZnCdSe/ZnCdMgSe quantum cascade laser structures for use in mid-IR detectors; as well as (4) the creation of a UV extended supercontinuum source for time-resolved and steady state spectroscopy for biological and chemical molecules.

Table 33
The Graduate Center, CUNY
Doctoral Science Programs & NSF AGEP
365 Fifth Avenue
New York, NY 10016

Contacts: *Lorraine Towns, ltowns@gc.cuny.edu*
Alix Zapata, azapata@gc.cuny.edu

The Graduate Center of the City University of New York (CUNY) is devoted primarily to doctoral study and awards most of CUNY's doctoral degrees. Over 1950 faculty members are drawn from CUNY's eleven senior colleges and New York City's leading cultural and scientific institutions. Students and faculty pursue a joint enterprise of expanding boundaries of knowledge in over 30 doctoral programs in the humanities, natural and social sciences. Professional development opportunities and financial support for doctoral students in STEM fields are offered through the CUNY NSF Alliances for Graduate Education and the Professoriate (AGEP) Program.

Table 47
The Scripps Research Institute
Kellogg School of Science and Technology
10550 North Torrey Pines Road
TPC-19
La Jolla, CA 92037

Contact: *Dawn Eastmond, eduprgm@scripps.edu*

The Scripps Research Institute is a non-profit research institution whose philosophy emphasizes the creation of basic knowledge for its application in medicine, the pursuit of scientific advances through interdisciplinary collaborations and the education and training of researchers preparing to meet the scientific challenges of the future. With an emphasis on individualized instruction, adherence to the highest scientific standards and a rich tradition of research excellence, the Kellogg School of Science and Technology provides an unparalleled environment for inspiring minds. Program offerings include doctoral programs in biological and chemical sciences, summer research opportunities for undergraduates and postdoctoral training. Through these programs, you will be able to make the most of your abilities and define your future.

With more than 250 faculty conducting cutting-edge research in cancer biology, cell biology, chemical physiology, chemistry, molecular biology, immunology, neurobiology, metabolism and aging, genetics, molecular medicine, and molecular therapeutics, there are many research labs in which you can

make an impact. Choose between two beautiful campuses: La Jolla, California and Jupiter, Florida.

To learn more about the post-graduate, graduate and outreach programs at the Kellogg School of Science and Technology at The Scripps Research Institute, contact us by phone at 858.784.8469, email at eduprgm@scripps.edu or online at http://education.scripps.edu.

Table 88
University of Alabama
College of Arts & Sciences
Box 870268
105 Clark Hall
Tuscaloosa, AL 35487

Contact: *Jimmy Williams, jwilliam@bama.ua.edu*

The University of Alabama is a major, comprehensive, student-centered research university, enrolling about 4,400 graduate students in more than 120 master's, educational specialist, and doctoral programs. The University of Alabama is regularly ranked among the top 100 public universities in *Kiplinger's* annual list of colleges and universities that combine "great academics and affordable tuition."

Our distinguished graduate faculty members, as well as visiting endowed professors and research fellows, provide graduate students with an impressive array of opportunities to learn and grow. The University of Alabama is further enhanced by the diversity of backgrounds and experiences of its graduate students. In 2008, The University of Alabama's Graduate School won the prestigious Council of Graduate Schools/ Peterson's Award for innovation in creating an inclusive graduate student community.

For more information about The University of Alabama's graduate programs, go to *http://graduate.ua.edu*.

Table 8
University of Arkansas - Graduate School
346 N. Arkansas Avenue
1 University of Arkansas
STON 50
Fayetteville, AR 72701

Contact: *Shani Farr, sfarr@uark.edu*
Alfred Dowe, atdowe@uark.edu

The University of Arkansas (U of A), a land-grant university and the flagship campus of the University of Arkansas system, is categorized by the Carnegie Foundation as a research institution with "very high research activity," a designation held by only 108 universities nationwide. The U of A considers research, scholarship and creative endeavor - all leading to the advancement of knowledge - a significant part of its primary mission. The university confers degrees in some three dozen doctoral programs and approximately 90 master's programs. More than 4,000 students pursue graduate study and law degrees at the university, with advanced degree enrollment targeted to grow to approximately 5,500.

The Graduate School benefits from a $100 million endowment, part of the historic $300 million gift from the Walton Family Charitable Support Foundation. The gift supports endowed fellowships for new doctoral graduate students, as well as a research fund for graduate students to travel to professional meetings and conferences. The U of A is located in Fayetteville, a city of more than 72,000, in the northwest corner of the state. Northwest Arkansas offers friendly people, beautiful scenery, a moderate climate, excellent school districts, a robust economy and a multitude of recreational activities.

Table 2
University of California, Davis
Graduate Studies
250 Mrak Hall
One Shields Avenue
Davis, CA 95616

Contact: *Hector Cuevas, mmcdermott@ucdavis.edu*

UC Davis offers more than 80 graduate programs leading to Master's or doctoral degrees, which together enroll over 4,000 graduate students. A list of UC Davis graduate programs and degrees can be found at: *gradstudies.ucdavis.edu/programs/*

UC Davis graduate students work with and learn from accomplished faculty, recognized for their contributions to research in their fields. More than 80 graduate programs leading to Master's or doctoral degrees are offered. Many programs are through graduate groups, an interdisciplinary concept that allows students to study and work in interrelated areas to broaden their intellectual experiences. A list of graduate programs and degrees can be found at: *gradstudies.ucdavis.edu/programs/*

Table 14
University of California at San Diego
9500 Gilman Drive #0003
Stu. Ser. Ctr. - 4th Fl.
9500 Gilman Dr. #0003
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 nationwide. 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 28
University of Chicago
5710 S Woodlawn Ave
Room 005
Chicago, IL 60637

Contact: *Chinonye Nnakwe, ccnnakwe@uchicago.edu*

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. 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.

Leading in the Sciences: 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.

Medical Scientist Training Program: The University of Chicago 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. The program has an illustrious history of training students to assume positions of leadership in academic medicine at major research institutions nationwide.

Table 40
University of Cincinnati College of Medicine
231 Albert Sabin Way
Medical Sciences Bldg Suite 2005
ML 0548
Cincinnati, OH 45237/0548

Contact: *Laura Hildreth, Laura.Hildreth@uc.edu*

UC College of Medicine provides an exciting and supportive environment for biomedical research training. Our nationally ranked faculty at UC and Cincinnati Children's Hospital prepare the scientists of the 21st Century to make unprecedented forward progress in understanding human health and disease.

- Summer Undergraduate Research Program
- Biomedical Sciences Flex Option (PhD)
- Cancer and Cell Biology (PhD)
- Epidemiology and Biostatistics (MS, PhD)
- Environmental & Industrial Hygiene (MS, PhD)
- Immunobiology (MS,PhD)
- Molecular & Developmental Biology (PhD)
- Pharmacology (MS, PhD)
- Molecular Genetics, Biochemistry & Microbiology (PhD)
- Neuroscience (PhD)
- Pathobiology & Molecular Medicine (PhD)
- MSTP Physician Scientist Training Program (MD/PhD)
- Systems Biology and Physiology (PhD)
- Toxicology (PhD)
- Medical Physics (MS)
- Public Health (MPH)
- Clinical and Translational Research (MS)
- Physiology (MS, 1-yr MD Prep program)
- Genetic Counseling (MS)

Table 26
University of Florida
Master's Program in Translational Biotechnology
13706 Innovation Drive
Alachua, FL 32615

Contact: *Tamara Mandell, tmandell@cerhb.ufl.edu*

The University of Florida's Science Master's Program in Translational Biotechnology is a two-year thesis program that is interdisciplinary (biosciences and business), is research

intensive, has industry involvement, and includes a formal internship at a company. Students graduate with a major (Master of Science in Medical Sciences) and a minor in business administration (Graduate Business Minor). Developed through NSF funding, the program is focused on applied and translational research. Translational Biotechnology includes drug/biologics/device product development, manufacturing process development, assay development, toxicology studies, quality systems, clinical trial support, and regulatory compliance. These activities are essential for testing new drugs/ biologics/devices in humans and their subsequent commercialization.

A foundation of the Program is a high-quality research project under the direction of a skilled mentor, with supervision by a committee composed of members from UF's Graduate Research Faculty. Specialization may be in any of the fields of research being pursued in the College of Medicine. During the first year of the Program students enroll in lecture courses and a seminar course, and begin working in a mentor's laboratory. The second year of study is devoted to finishing the required courses and doing research. Students may also enroll in additional courses, based on their interests and backgrounds. Following the four semesters of coursework and research, students complete a summer internship at a biotechnology-based company.

Table 61
University of Florida
115 Grinter Hall
Gainesville, FL 32611

Contact: *Earl Wade, ewade@ufl.edu*

The University of Florida is the state's largest, oldest, and most comprehensive institution of higher education. With 16 colleges, nearly 180 centers, bureaus and institutes, and nearly 200 graduate degree programs, UF is among the nation's top 20 public research universities. UF's faculty attracted more than $619 million in grant money in 2010-2011, which helps fund assistantships for graduate students. With an enrollment of 50,116 students, UF is one of the largest universities in the country. It is also culturally diverse, having an 8.27% African-American, 13.68% Hispanic/Latino-American, and 8.65% Asian-American student population. For more information visit: www.ufl.edu

Table 38
University of Illinois
Graduate College
801 S. Wright
204 Coble Hall
Champaign, IL 61820

Contact: *Ave Alvarado, amalvara@illinois.edu*

The University of Illinois at Urbana-Champaign offers research and scholarship opportunities to undergraduates through the Summer Research Opportunities Program. In addition, the campus offers in-coming graduate students from underrepresented populations an opportunity to excel in their academic careers by participating in the Summer Pre-doctoral Institute.

Graduate degrees in over 100 disciplines, including the biological sciences, natural sciences, physical sciences, behavioral sciences, and engineering may be obtained. Numerous interdisciplinary and several joint degree programs, such as the MD/PhD and JD/PhD are granted by this premier research extensive institution.

Illinois offers assistantships, traineeships, and fellowships to under-represented students--each of which is supplemented with a tuition waiver and stipend. Visit www.grad.Illinois.edu for more information.

Table 34
University of Massachusetts
MassNanoTech Institute
710 North Pleasant Street
Amherst, MA 01003

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 research and education. We specifically offer undergraduates assistance in applying to UMass Graduate School, and offer a 10-week Summer Research Program in Nanotechnology Innovation. Please visit out web site for more information. http://www.umass.edu/massnanotech/

Table 48
University of Michigan College of Pharmacy
Graduate & Professional Programs
428 Church Street
Ann Arbor, MI 48109

Contact: *Cherie Dotson, crdotson@umich.edu*
http://pharmacy.umich.edu
Phone: 734-615-6562

The University of Michigan College of Pharmacy offers the Doctor of Pharmacy degree (Pharm.D.) as well as PhD degrees in Medicinal Chemistry, Pharmaceutical Sciences and Social & Administrative Sciences. Pharm.D. students receive clinical training in the practice of pharmacy. Graduates of this program are eligible for examination for licensure as a pharmacist. PhD students in Medicinal Chemistry and Pharmaceutical Sciences are trained in various aspects of pharmaceutical research

ranging from drug discovery and design to drug transport and delivery. Training opportunities in the social, behavioral and economic aspects of medication use are provided through the graduate program in Social & Administrative Sciences. PhD students in good standing receive full financial support (full tuition subsidy, competitive stipend and health insurance) throughout the course of their training.

Highly motivated students with interests in pharmacy practice or research investigation are strongly encouraged to apply.

Undergraduate research opportunities are available in drug discovery and drug development research through the Interdisciplinary Research Experiences for Undergraduates Program in the Structure and Function of Proteins (http://pharmacy.umich.edu/reu). The application deadline is February 15th.

Table 18
University of Minnesota Graduate School
Medical Scientist Training Program MD/PhD
G254 Mayo Delivery Code 8293A
420 Delaware Street SE
Minneapolis, MN 55455

Contacts: *Jon Gottesman, orbs@umn.edu*
Nick Berg, mdphd@umn.edu
Derek Maness, dmaness@umn.edu

The University of Minnesota is one of the most comprehensive public universities in the United States and ranks among the top 10 public institutions in NIH funding and research expenditures in STEM fields.

The Biomedical Sciences Graduate Programs offer PhDs in 6 areas:

- Biochemistry, Molecular Biology & Biophysics
- Integrative Biology & Physiology
- Microbiology, Immunology & Cancer Biology
- Molecular, Cellular, Developmental Biology & Genetics
- Neuroscience
- Pharmacology

The Medical Scientist Training Program at the University of Minnesota (MD/PhD) enables you to train in both clinical medicine and biomedical research, with research fields spanning the full range of biological and physical sciences to include epidemiology. You will prepare for a career in academic medicine with training rooted in strong connections between health care and science. We are located on an urban campus with over 50,000 students, making the U of MN one of the largest, most vibrant educational communities in the United States. Broad opportunities for research exist in the labs of over 110 research preceptors and ten graduate school programs.

All students receive full financial support, free tuition and benefits.

On the Web: www.orbs.umn.edu/ERN / www.med.umn.edu/mdphd / www.grad.umn.edu

Table 41
University of Missouri
Graduate Life Sciences Programs
150c Bond Life Sciences Center
1201 Rollins Street
Columbia, MO 65211

Contacts: *Debbie Allen, allendebra@missouri.edu*
gradlifesci@missouri.edu
Steve Alexander, alexanderst@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.

Over 20 PhD programs emphasize interdisciplinary collaboration and innovation. We are a major research campus with shared resources from Medicine, Engineering, Agriculture, Veterinary Medicine, Health Professions, Business and Law. Research core facilities and a nuclear reactor bolster the research resources at MU.

Committed to graduate student success, we promote strong mentorship connections and career-directed resources. We offer a comprehensive support package including stipend, paid tuition, health insurance and travel funding. Columbia, Missouri is an excellent, diverse and affordable city with impressive amenities, located centrally between St. Louis and Kansas City.

Learn More: *http://www.missouri.edu/ and http://research.missouri.edu/*

Table 43
University of Missouri, Columbia School of Medicine
MA202D Dean's Offices
Medical Sciences Bldg
Columbia, MO 65212

Contact: *Traci Wilson-Kleekamp, wilsonkleekampt@health.missouri.edu*

The University of Missouri, Columbia School of Medicine is committed to the recruitment and retention of students from underrepresented groups and underserved areas. Recruitment activities occur at the high school and undergraduate levels and include participation in campus diversity programming, recruitment fairs and on-site campus visits. Our dedicated Office of Diversity and Inclusion focuses on increased minority student enrollment through extensive communication by mail,

email and telephone and by attending local, regional and national events. We have expanded our recruitment efforts to include colleges/institutions with large enrollments of underrepresented student groups.

Table 27
University of Pennsylvania
Perelman School of Medicine / Biomedical Graduate Studies
421 Curie Boulevard
160 BRB II/III
Philadelphia, PA 19104

Contact: *Arnaldo Diaz, diaza@mail.med.upenn.edu*

The University of Pennsylvania School of Medicine is the nation's first, with the Hospital of the University of Pennsylvania being the nation's first built medical school. Biomedical Graduate Studies (BGS) was established in 1985 and serves as the academic home for students pursuing a PhD in the basic biomedical sciences. BGS is composed of more than 600 faculty members and provides training through seven graduate groups - Biochemistry and Molecular Biophysics, Cell and Molecular Biology, Epidemiology and Biostatistics, Genomics and Computational Biology, Immunology, Neuroscience, and Pharmacology.

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

Table 36
University of Rochester - Arts, Sciences and Engineering
717 Hylan Building
PO Box 270415
Rochester, NY 14627

Contact: *Donald Mitchell, donaldmitchelljr@rochester.edu*

The University of Rochester offers more than 30 programs that lead to advanced degrees and certificates in a broad range of disciplines in Arts, Sciences and Engineering. More than 1000 students are enrolled in our PhD and Master's programs, through which our outstanding faculty provide training in research and for professional advancement.

Table 42
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 (USF) is a high-impact, global research university dedicated to student success. USF is classified by the Carnegie Foundation for the Advancement of Teaching in the top tier of research universities, a distinction attained by only 2.2 percent of all universities. The USF System serves 47,000 students in Tampa, St. Petersburg, Sarasota-Manatee and Lakeland.

Signature research areas in STEM include: Advanced Materials and Nanotechnology, Aging and Alzheimer's disease, Alternative and Clean Energy Resources, Biomedical Engineering, Cancer Biology, Marine Science, and Water Resources and Sustainability. NSF LSAMP Bridge to the Doctorate, Alfred P. Sloan, McKnight, and Graduate Student Success fellowships are available for STEM students from diverse backgrounds. Summer research opportunities are available in several areas, including: Applied Physics, Computer Science and Engineering, and Sustainable and Alternative Energy Alternatives.

Table 17
University of Washington
Molecular & Cellular Biology
MCB Program
Box 357275
Seattle, WA 98195

Contact: *MaryEllin Robinson, maryell@uw.edu*

Recognizing the need for highly trained scientists conversant across disciplines, the University of Washington and the Fred Hutchinson Cancer Research Center (FHCRC) created an interdisciplinary research program, the Molecular and Cellular Biology Graduate Program (MCB). Joined by the Institute for Systems Biology and Seattle Biomed, MCB offers a broad range of opportunities for research in all areas of biomedical science.

The goals of the MCB program are to facilitate the development of independent and highly motivated students into creative molecular and cellular biologists. The guiding philosophy of the program is that students should be actively involved in designing a program of graduate studies that meets their individual needs, coupled with the notion that ongoing and challenging dialogue between students and faculty is an integral part of higher education.

For more than 15 years, MCB has combined the strength of the FHCRC together with ten UW biomedical research departments - from biochemistry to Pharmacology - to foster an innovative and flexible, education-training program for graduate students interested in biomedical problems that cross disciplinary boundaries.

Exhibitor Descriptions

Table 49
University of Wisconsin Madison
Graduate Engineering Research Scholars (GERS) Program
College of Engineering
1513 University Ave,, Room 2107
Madison, WI 53706-1539

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

The Graduate Engineering Research Scholars (GERS) Program was created in 1999 with the intention of increasing the number of underrepresented minority (URM) students receiving doctoral degrees in engineering and entering the Professoriate. Since its inception, the program has graduated 42 PhDs and 46 MS. Already, nine of the 42 PhD graduates are in faculty positions, eight are in post-doctoral programs, and an additional seven are employed by national laboratories. Of the 42 PhDs awarded 25 (60 percent) were to women. GERS has a 90% retention rate to degree.

The program's director Professor Douglass Henderson received the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring from Barack Obama in January 2011 for his work with this program.

Table 31
XSEDE - Extreme Science and Engineering Discovery Environment
300 S. Craig St
Pittsburgh, PA 15213

Contact: *Robin Scibek, flaus@psc.edu*
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.

Scientists and engineers around the world use these resources and services - things like supercomputers, collections of data, and new tools to make us all healthier, safer, and better off. XSEDE, and the experts who lead the program, will make these resources easier to use and help more people use them.

Table 9
Yale University Graduate School of Arts and Sciences
320 York Street
New Haven, CT 06520

Contact: *Michelle Nearon, michelle.nearon@yale.edu*

Yale University is among the world's most distinguished centers of learning. The Graduate School of Arts and Sciences has 73 different academic disciplines in the humanities, social sciences, and natural sciences leading to the MA, MS, MPhil, and PhD degree. Extraordinary resources include state-of-the-art research facilities, one of the largest library system in the U.S., and 3 spectacular museums. All PhD students receive full tuition scholarships, stipends to cover living expenses, comprehensive health care and hospitalization insurance. Other student support services include career guidance, teacher training, a graduate writing center, and an Office for Diversity and Equal Opportunity.

Abstracts

Undergraduate Abstracts for Oral Presentation

BIOLOGICAL SCIENCES

BIOCHEMISTRY (*NOT CELL AND MOLECULAR BIOLOGY AND GENETICS*)

OA #1
Causes and Effects of Protein Denaturation in Chicken and Tools for Measuring It

Leighann Black, Claflin University

As the agricultural industry expands, the knowledge about the assets that these foods contain is becoming progressively more important. There is more pressure placed on the farmer and processing plants to present a product of "good quality," as our nation is becoming more and more focused on the dietary needs of its people. How do we insure that the consumers are buying good quality agricultural products? This question is addressed in government facilities that are dedicated to learning more about the chemical and electrical make-ups of different foods so that new methods can be introduced that will ultimately produce a better quality product. The primary focus is the dielectric spectroscopy of the chicken meat, which can ultimately give us the "electrical fingerprint" of the meat.

We carried out experiments on the dielectric measurements and paired these measurements with measuring the pH, measuring the water holding capacity, measuring protein solubility and moisture content. Water holding capacity is defined as the portion of fluid retained by the sample. A Bradford assay was conducted upon the completion of the protein solubility as a means for measuring the concentration of the protein in a solution. The dielectric measurements carried out by the Vector Network Analyzer were then reproduced using a qualitative software, Sigma Plot.

This experiment is extremely important because we can deduce that because chicken is made up of mostly water, that the dielectric spectra should be similar (however not identical) to water. Dielectric spectroscopy is extremely important in analyzing these trends and can be used to further the knowledge of quality in various agricultural products used today. After finalizing the dielectric spectroscopy for the remaining samples, these results will be used to investigate a possible correlation to the other factors affecting the quality of chicken meat. *[Acknowledgement: This experiment was funded by United States Department of Agriculture, USDA-Gov]*

Faculty Advisor: Pamela Shuler, pshuler@claflin.edu

BIOMEDICAL ENGINEERING

OA #2
Pupillary Light Reflex: Measurement, Analysis and Potential Applications

Kanesha Sewell, Fort Valley State University

Pupillary light reflex (PLR) refers to the pupil size changes in response to illuminance changes. The pupil is regulated by two muscles, the constrictor and dilator. Each muscle is innervated by two different subsystems of the autonomic nervous system (ANS): the parasympathetic and sympathetic nervous systems, respectively. In my test, PLR measurements were obtained by a computerized binocular pupillogram recording system that uses a green LED light at 530 nm as stimulation to the pupil. The device has two independent channels to examine PLR in each eye. A highly sensitive infrared video camera was used to capture pupil images. Data processing was conducted with custom-developed software to automatically retrieve data from the captured images. During this process a pupillogram is illustrated extracting five basic parameters needed to obtain the most accurate PLR measurements. It is hypothesized that abnormalities in PLR are detected when any part of the PLR pathway is dysfunctional.

The examples presented here indeed show abnormal pupillary actions can be an advantage in clinical ophthalmic and neurological applications such as autism spectrum disorders, homonymous hemianopia, Parinaud's syndrome, and optic neuritis by way of diagnosis. These applications help give explanations to why PLR responses are either absent or significantly reduced in some cases due to damage of the visual cortex, the brain and optic nerves, resulting in change of PLR responses.

As a conclusion, PLR has the potential to become a simple noninvasive diagnostic tool for many clinical disorders. *[Acknowledgement: This work was supported, in part, by NSF HRD HBCU-UP awarded to Sarwan Dhir Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030 and a NSF REU grant awarded to Dr. Satish Nair at University of Missouri-Columbia, Columbia, MO 65201]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

CANCER RESEARCH

OA #3
miRNA 200c Induces Mesenchymal-to-Epithelial Transition (MET) and Enhances Sensitivity to Androgens in Prostate Cancer

Daniela R. Anderson, Tuskegee University

Clayton Yates and Shaniece Theodore, Tuskegee University

Prostate cancer is the most common cancer among men and ranks second in mortality among males in the United States. Metastasis is responsible for the majority of these deaths. Initially, primary tumors rely on androgens for growth and function. As the cancer progresses, these cells lose androgen sensitivity and simultaneously undergo an epithelial-to-mesenchymal transition (EMT). This cellular transition results in increased reliance on epidermal growth factor (EGF) and increased ability to metastasize. Recently, numerous reports have demonstrated that loss of miRNA 200c is associated with increased metastasis, and that re-expression of this miRNA is sufficient for a mesenchymal-to-epithelial transition (MET). However, the role of this reversal on androgen sensitivity has not been explored. We hypothesized that loss of epithelial features by miRNA 200c down-regulation is associated with loss of androgen sensitivity in aggressive prostate cancer. To determine the relationship between androgen sensitivity and EMT, we stably transfected putatively androgen-insensitive PC3 cells with a vector over-expressing miRNA 200c, and performed cell proliferation assays with transfected and control PC3 cells after androgen stimulation. We performed both dose-dependent (at 0 nM, 1 nM, 3 nM, 10 nM, and 30 nM androgen concentration for 72 hours) and time-dependent (for 0, 24, 48, 72, and 96 hours at 1 nM androgen concentration) trials with these cell lines. Additionally, we screened for EGF receptor expression levels in PC3-200c and PC3 controls. Our results indicate that PC3-200c and PC3 controls are both sensitive to androgen stimulation at optimal androgen concentrations 1 nM, and 3 nM, respectively, and that PC3-200c cells are significantly more sensitive to androgen stimulation (with 250% relative growth rate) than PC3 controls (below 110% relative growth rate). We also show that that EGF receptor is down-regulated in PC3-200c cells compared to PC3 controls.

Although preliminary, these findings have important clinical implications, as androgen inhibitors are common treatments for early stage androgen-sensitive prostate cancer tumors. Owing to the dearth of effective treatments for metastatic prostate cancer, this research may provide insight into the use of currently available therapies for typically incurable tumors. However, the relationship between androgen sensitivity and EGF receptor regulation in metastasis warrants future investigation. *[Acknowledgement: This study was funded in part by an NSF REU grant awarded to the Tuskegee University IBS REU program.]*

Faculty Advisor: Dr. Clayton Yates, cyates@mytu.tuskegee.edu

OA #4
Novel Therapeutic Approach for Glioblastoma Multiforme

Rhonde'e Caldwell, University of Virginia
Ryon Clarke and Kevin Lee, Ph.D, University of Virginia

Glioblastoma Multiforme (GBM) is the most common and lethal primary brain tumor in humans. These tumors are characterized by rapid proliferation, cellular atypia, and angiogenesis. Because of its rapid growth and resulting lack of blood supply, GBM tissue often exhibits areas of ischemia and necrosis. These areas provide serious obstacles for clinical treatment because of the increased resistance to radiation and chemotherapy, due, in part, to phenomenon called preconditioning induced tolerance. One of the major molecular players in this phenomenon is hypoxia-inducible factor-1 (HIF-1), a transcription factor with a number of downstream target proteins responsible for cell survival, proliferation, apoptosis, and angiogenesis. The aim of this study was to determine whether transient oxygen delivery to hypoxic tumor tissue would make cells more vulnerable to radiation and whether this resistance was caused by the alteration of expression of HIF-1. Hypoxia (1% oxygen) in a C6 glioma cell line was achieved in a tri-gas incubator sealed with 94% N_2, 1% O_2 and balance CO_2. Previously hypoxic glioma cells were treated with radiation following a 20-minute reoxygenation protocol and subsequent return to hypoxic conditions. HIF-1α expression level was verified by Western blot analysis. Surviving tumor cell fraction was quantified using a clonogenic assay. In control glioma cell group, there was a surviving fraction of approximately 10% after radiation treatments. In hypoxic glioma cells, there was a surviving fraction of approximately 20%. However, the surviving fraction was decreased to approximately 3% when cells were transiently exposed to normoxic conditions prior to radiation. Western blot analysis indicated a high expression of HIF-1 in hypoxic glioma cells after radiation. However, HIF-1 expression was abolished in glioma cells that were transiently reoxygenated and then treated with radiation under hypoxic conditions. The results of the study indicate that resistance of hypoxic glioma cells to radiation treatment may be reversed by a transient exposure to normoxic conditions. *[Acknowledgement: Funding provided by University of Virginia Summer Research Internship Program.]*

Faculty Advisor: Kevin Lee, kev79lee@gmail.com

OA #5
Tocotrienols Induce Autophagy in MDA-MB 231 Breast Cancer Cells by Modulating the mTOR Pathway

Habib Kedir, University of the District of Columbia
Francisco R. Saenz, Anh Thu Tran, Evegeny Makarev, and Deepak Kumar, Cancer Research Laboratory, University of the District of Columbia

Autophagy, an evolutionary conserved mechanism in all eukaryotes, is employed to engulf and degrade long-lived proteins and defective organelles in response to nutrient deprivation or cellular stressor agents. In cancer cells, autophagy has a dual outcome as it is cytoprotective as well as it leads to cell death depending on physiological conditions. Prolonged autophagy often results in cell death. Our study aimed to determine if Tocomin and γ-Tocotrienol individually

induce autophagy in MDA-MB 231 human breast cancer cells and to assess the effect of autophagy on apoptosis induced by Tocomin and γ-Tocotrienol. Cell proliferation was measured using WST-1 assay. Protein expression was detected by Western blot. Autophagy was observed using fluorescent microscopy. Exposure of MDA-MB 231 cells to Tocomin and γ-Tocotrienol at 40 and 80μM for 24 hours results an up-regulation of LC3B II (14kDa), suggesting that both Tocomin and γ-Tocotrienol induce autophagy in MDA-MB 231 cancer cells. Furthermore, when MDA-MB231 cells were transfected with EGFP-LC3 and treated with both Tocomin and γ-Tocotrienol for 24 h, an accumulation of punctate LC3 and an increase of LC3II protein were also detected. In addition, poly ADP-ribose polymerase (PARP) cleavage was detected. There is extensive evidence that autophagy is negatively regulated by mTORC1. Our data shows that phosphorylation of Akt and mTOR were inhibited as a result of treatment with 40 and 80μM of both Tocomin and γ-Tocotrienol for 24h. Our data also indicates that the level of Raptor and Rictor, the companion of mTORC1 and mTORC2, respectively, are also downregulated. In conclusion, both Tocomin and γ-Tocotrienol induced autophagy in MDA-MB 231 cells. Preliminary data also indicate that the most likely pathway by which Tocomin and γ-Tocotrienol induce autophagy might be through the modulation the Akt/mTOR signaling pathway. *[Acknowledgement: MARC U*STAR Honors Program]*

Faculty Advisor: Deepak Kumar, dkumar@udc.edu

Cell and Molecular Biology

OA #6
The Role of Rheb1 in Epidermal Differentiation

Loubna K. Elhelu, Johns Hopkins Medical Institute
Akshay Sood, Paul F. Worley, Bo Xiao, and Tamara L. Lotan,
Johns Hopkins University School of Medicine, Baltimore, MD

The skin epidermis serves as a barrier to prevent the loss of body fluid and to separate the body from most environmental insults. In response to external signals, the epidermis develops from a single layer of proliferative keratinocytes to a multi-layered stratified epithelium consisting of a basal layer, spinous layer, granular layer, and stratum corneum by E15. Multiple signaling pathways contribute to this process, including Notch, Wnt and BMP signaling, however the role of mTOR (mammalian target of rapamycin) signaling in epidermal maturation is unknown. We created early embryonic epidermal-specific Rheb1 and TSC1 loss-of-function transgenic mouse models to examine the role of mTORC1 signaling in epidermal differentiation. We found that early-embryonic loss of Rheb1 results in early perinatal lethality from dehydration due to inadequate epidermal barrier function. Rheb1 inactivation resulted in a thinned epidermis, with an intact basal layer, but with a marked decrease in suprabasal differentiation, with decreased spinous, granular and corneal layers. In contrast, TSC1 loss-of-function was compatible with life, but resulted in a markedly hyperplastic epidermis, with increased thickness predominantly in the spinous and granular layers by 6 weeks of age. We conclude that Rheb1 function is required for suprabasal differentiation in the epidermis, and that TSC1 loss (and subsequent Rheb1 activation) promotes suprabasal differentiation. Given the striking similarities between the phenotypes of Rheb1 and Notch pathway inactivation in the skin, future studies will examine whether Notch activation lies downstream of mTORC1 function in the developing epidermis. *[Acknowledgement: This study was supported by the University of the District of Columbia's MARC U*STAR program in providing stipend for the principal investigator. The actual research was funded by NIH fellowship grants.]*

Faculty Advisor: Tamara L. Lotan, tlotan1@jhmi.edu

OA #7
Orexin Receptor and the Trace Amine Associated Receptor

Stephanie Faroul, Shaw University
C. Njue and Helen Asemota, Shaw University

The orexin receptor and trace amine associated receptor 1 are two G-protein coupled receptors of interest. The orexin receptor is located in the central nervous system of the brain in the lateral hypothalamus. It is responsible for appetite, food intake, alertness and sleep phase. The antagonists of the orexin receptor can inhibit food intake in laboratory animals and may be a potential therapeutic target for obesity. However, agonists of the orexin receptor stimulate arousal and may be a potential therapeutic target for sleeping disorders. The trace amine associated receptor 1(TAAR1) also located in the brain acts as a modulator.

This study is designed to measure changes in internal calcium levels which are the key components to classify new drugs for their ability to either activate or block specific receptors. If orexin-A is able to increase calcium levels then trace amine associated receptor will decrease calcium levels in a cell acting as an antagonist.

The result is that the known agonist orexin-A increases calcium levels through the orexin receptor. Compound A, a novel drug, was able to block the calcium signal caused by orexin-A indicating that the trace amine associated receptor also was able to increase intracellular calcium in a concentration response manner. Moreover, compound acted as an antagonist at the orexin receptor, not the trace amine associated receptor. *[Acknowledgement: This project is supported by a NSF HBCU-UP grant awarded to Dr. D. Sharma, Shaw University, Raleigh NC 27601.]*

Faculty Advisor: H. Asemota, hasemota@shawu.edu

OA #8
Mitofusin-2 Protects Renal Epithelial Cells Under Stress

Chinaemere Igwebuike, Boston University School of Medicine / University of the Virgin Islands, St. Thomas, VI

The proximal tubule of the kidney is rich in mitochondria, double-membrane organelles that generate ATP and integrate cell signaling events that result in apoptosis. Mitochondria are dynamic and constantly undergo fusion and fission events that alter their morphology and may perhaps, regulate apoptosis and organ function. We hypothesized that Mitofusion-2 (MFN2), a mitochondrial fusion protein, is important in the renal epithelial cell stress response. To test this hypothesis, the MFN2 floxed gene was conditionally knocked out in the murine kidney. Despite marked mitochondrial fragmentation in the kidneys of juvenile MFN2-cKO mice, renal histology, development and organ function did not differ from wild type. In contrast, primary cultures of MFN2-cKO kidney epithelial cells subjected to chemical ischemia were significantly more susceptible to mitochondrial membrane injury, caspase 3 activation and apoptosis than wild type ($P < 0.05$). Bax, a major cause of apoptosis in these cells was equally activated, but far greater mitochondrial Bax accumulation was detected in MFN2 KO cells. We conclude that MFN2 protects renal epithelial cells by preventing Bax accumulation on the mitochondrial membrane. *[Acknowledgement: NIH-NIDDK (RO1 #DK53387) Award to Steven C. Borkan, M.D. NIH MBRS-RISE Grant Award M061325.]*

Faculty Advisor: Dr. Steven Borkan, sborkan@bu.edu

OA #9
Effects of Gravitational Changes on HOBO Transposon in Eukaryotic Fruit Flies

Monicah Jepkemboi, Southern University at New Orleans
Dr. Illya Tietzel, Southern University at New Orleans, Department of Natural Sciences

The majority of eukaryotic genomes have mobile DNA elements known as transposons. The mechanism of transposition can be either copy and paste or cut and paste. This can cause mutations altering the cell genome that can lead to species differentiation or diseases. More importantly, little research has been done to address the issue of gravity on transposon activity considering human's desire for space flight. We hypothesize that gravitational changes relative to gravity of the earth can affect the activity of transposons in Eukaryotes. To test our hypothesis, we used the HOBO transposon and a eukaryotic fruit fly (Drosophila melanogaster) by placing it into different centrifugal forces to monitor the changes in activity of transposons. The control groups were not centrifuged and experimental groups were exposed to 0.84, 2 and 15.4 g. We measured the transcript of HOBO transposons. These methods were used sequentially as follows: (1) cultivation of fruit flies and centrifugation, (2) isolation of RNA, (3) Reverse Transcription of RNA, (4) conventional PCR and (5) Real Time PCR (RT- PCR) for the HOBO transposon. Flies at 0.84 g had detectable HOBO transposon of 180 bp in conventional PCR. HOBO was not detected for some fly groups from 2 g, which might suggest an influence of changed gravity. 15.4 g detected clear bands of HOBO. More experiments are to be conducted at 2 g where expression of HOBO transposons was reduced in order to confirm reproducibility of the findings. *[Acknowledgement: The research was funded by LSAMP and LaSPACE.]*

Faculty Advisor: Dr. Illya Tietzel, ITietzel@suno.edu

OA #10
The Effects of Retinoic Acid on Ilyanassa

Arshaqui Johnson, University of Rochester
Dr. David Lambert, University of Rochester

Deficiency of vitamin A can lead to a range of mild or severe health aliments. In order for an individual to avoid any health aliments dealing with vitamin A, a significant amount of vitamin A should be obtained. Vitamin A is a fat-soluble vitamin that promotes cell differentiation, cell division, bone growth, reproduction and vision. Vitamin A is acquired through diet since the body cannot synthesize it by itself. When vitamin A is naturally synthesized, Retinoic acid is the byproduct. Retinoic acid (RA) is a metabolite of vitamin A (retinol) and mediates the function of vitamin A in growth and development. Retinoic acid is categorized into three types: 9-cis, 13-cis and all-trans. Studies have shown that an abnormal concentration of retinoic acid can cause developmental defects in various locations.

There is plenty of evidence showing that RA affects the development of vertebrate embryos. However, there is not a lot of information or research being done about the effects of retinoic acid on invertebrate animals. Many embryological methods and specific gene knockdown methods can be done with Ilyanassa, thus making it an excellent model for this study. The Ilyanassa embryos were exposed to 9-cis RA at concentrations of 10-5M, 10-6M, and 10-7M. At the concentration of 10-5M, the embryos were unaffected when they were exposed to the retinoic acid on days one and six. They died during development when they were exposed to retinoic acid on day two to four and had developmental defects when they were exposed to retinoic acid on day five. At 10-6M of retinoic acid the embryos showed no effect of RA on day one, two and six. On days three to five the embryos had abnormal responses to the retinoic acid. Retinoic acid did not have an effect at all on the embryos from days one to six at the concentration of 10-7M. This research illustrates that retinoic acid does affect invertebrates and the use of Ilyanassa as a model gives an insight into its process in patterning the animal. *[Acknowledgement: Ronald E. McNair Post-baccalaureate Achievement Program]*

Faculty Advisor: Dr. David Lambert,
dlamber2@bio.rochester.edu

OA #11
Hepatic Immune Activation in the SIV/Macaque Model of HIV

Phoebe Lewis, Johns Hopkins School of Medicine
Joseph L. Mankowski, Suzanne E. Queen, and Jamie L. Dorsey, Johns Hopkins School of Medicine, Baltimore, MD

The liver regulates many aspects of systemic innate immune responses including responses to viral infections such as HIV. Resident macrophages in the liver, known as Kupffer cells, and recruited macrophages that arrive from the blood are crucial cellular players in this process. Recent evidence has shown that hepatic macrophage immune activation also can trigger inflammation in the brain, linking systemic immune responses to CNS immune activation associated with dementia. The SIV/ macaque model of HIV is well-suited for examining macrophage activation in the liver to determine whether hepatic macrophages play a role in regulating systemic and CNS immune responses. HIV infection induces potent innate immune responses during acute viral infection and at later stages of disease. In these studies, we determined that hepatic macrophage activation develops during progressive stages of infection in SIV-inoculated macaques by measuring CD68 and CD163 expression as morphologic markers of macrophage activation in liver. We also measured expression levels of SIV and inflammatory cytokines in liver tissue by real-time RT-PCR and identified potential soluble mediators of macrophage activation. Further studies are needed to determine how the immune activation in the liver correlates with CNS immune response. *[Acknowledgement: The Johns Hopkins School of Medicine Summer Internship Program made this work possible.]*

Faculty Advisor: Dr. Jonathan Coleman, jkcoleman@lunet.edu

OA #12
The Study of ER Stress in P23H +/- RHO Transgenic Mice

Christina Randall, Texas Southern University

Rhodopsin gene mutations are one of the most prevalent causes of Retinitis Pigmentosa. The human P23H Rhodopsin (RHO) is a misfolded protein that leads to Autosomal Dominant Retinitis Pigmentosa (ADRP). This mutation causes protein mis-folding which causes endoplasmic reticulum (ER) stress and activates the unfolded protein response (UPR) which may lead to apoptosis and eventually result in rod photoreceptor degeneration. Exploring ER stress will engender key information for pathology of ER stress related retinopathies. Endoplasmic reticulum stress activated indicator (ERAI) was developed to facilitate the analysis of ER stress. The purpose of this study is to track the progression of ADRP caused by P23H mutation by using ERAI as a tool to visually observe ER stress as green fluorescence. The P23H +/- ERAI+/- RHO +/+ mice were selected for this study and were generated by crossing the P23H +/- RHO +/+ and ERAI+/- RHO +/+ (ERAI) mice. The ERAI mice carry the human XBP1 and Venus (a variant of green fluorescent protein) transgene and were purchased from the Riken BRC Company (Japan). The transcripts from ERAI constructs are spliced under ER stress. The spliced mRNA is translated into an XBP1 fused with a Venus fusion protein, which can be detected by direct observation of the fluorescence of the Venus. The P23H +/- ERAI+/- RHO +/+, wild-type (RHO+/+) and ERAI mice were sacrificed at postnatal day 21 and 30. Retinas were fixed in 4% parafalmaldehyde and then were sectioned with a cryostat (12µm). The green fluorescent protein was observed by direct microscopy and by fluorescence microscopy after immunohistochemistry with antibodies against the GFP and rhodopsin proteins. Direct microscopy observation of the GFP protein and immunohistochemical analysis of the P23H +/- ERAI+/- RHO +/+, wild-type (RHO+/+) and ERAI retinas demonstrated that the fluorescence was predominantly observed in the outer segments of the P23H +/- ERAI+/- RHO +/ + photoreceptors. No other retinal cell types of the P23H +/- ERAI+/- RHO +/+ retina or retinas from different mouse strains expressed the fluorescent protein. This finding indicates that the P23H+/- rhodopsin in the RHO+/+ mouse photoreceptors causes ER stress and activates the UPR at P30. In previous study no fluorescence was observed at postnatal day 15. Further study is required to determine the initial time point of the ER stress in P23H transgenic mice. We also conclude that the ERAI mouse is a valuable model to study the ER stress signaling in animal models of retinal disorders. *[Acknowledgement: This study was supported in part by grant number 1R01EY020905 of the National Institutes of Health.]*

Faculty Advisor: Renard Thomas, thomas_rl@tsu.edu

OA #13
Biomphalaria Glabrata: Genetic Variability Between Non-Susceptible (Resistant) Strains

Michael Smith, University of District of Columbia

Biomphalaria glabrata, the intermediate host to Schistosoma mansoni, is a major participant in the life of this flatworm. There is much phenotypic diversity within this species of snail. Several laboratories stains are resistant to the invading schistosome which always proposes the possibility of them serving as a curtailing agent for the life cycle if they were to replace the susceptible snails in the field. We have found several phenotypic differences in the variety of snails that we have previously examined. For example LAC-Line, a resistance snail, loses its resistance when mated for multiple generations. The loss in resistance appears to be coupled to major abnormalities in its albumen gland. It is felt that there maybe a correlation

between the resistant phenotype and reproductive capabilities. The objective of this study was to examine four strains of Biomphalaria glabrata snails, resistance at the molecular level to determine their genetic variability and at the ultrastructural level to examine details of their albumen glands. These procedures would be done in resistant snail strains at baseline (as soon as eggs are produced) and after having mated or selfed for two generations. BS-90 (resistant) and LAC (variable in its susceptibility) were the strains examined and their albumen glands extracted and processed for transmission electron microscopy. DNA was extracted from another set of the same snails using lysis buffer containing 2% CTAB and incubated with proteinase k following the standard phenol/chloroform extraction. Four different primers were used to perform DNA amplification by PCR. The PCR products were run on polyacrylamide gel electrophoresis and silver stained. Products from 3 of the 4 presented polymorphic makers lineage and the albumen glands showed variations among the different organisms. *[Acknowledgement: NIH Grant 1R25CA129-035]*

Faculty Advisor: Carolyn Cousin, ccousin@udc.edu

OA #14
Pharmacological Action of L-Cysteine on Bovine Isolated Irides

Destinee Stroud, Texas Southern University
Madhura Kulkarni, Ya Fatou Njie-Mbye, and Sunny E. Ohia, Department of Pharmaceutical Sciences, College of Pharmacy and Health Sciences, Texas Southern University

Evidence from the literature has shown that hydrogen sulfide (H_2S), a colorless gas with a pungent odor, can exert pharmacological effects on mammalian smooth muscles. Studies in our laboratory report that H_2S (using H_2S-releasing compounds) can relax pre-contracted porcine irides, an effect that is dependent on the biosynthesis of H_2S. In the present study, we further investigated the relaxant action of L-Cysteine, a substrate for the production of H_2S on isolated bovine irides.

Iris smooth muscle strips were removed from freshly excised bovine eyeballs and set up in 25 ml organ bath containing oxygenated Krebs buffer solution (pH 7.4) at 37°C. The smooth muscle preparation was connected to a Grass FT03 transducer under resting tension of 1g and allowed to equilibrate for 30 mins. Changes in isometric tension were recorded and displayed on a computer using the Grass PolyView software. The relaxant action of L-Cysteine on basal and carbachol-induced tone was studied in the presence and absence of inhibitors of cyclo-oxygenase and H_2S biosynthesis enzymes. The basal tone of the bovine irides served as the control for the experimental results.

L-Cysteine (0.1 nM –100 μM) elicited a concentration-dependent relaxation of both basal and carbachol-induced tone in bovine irides. In contrast, L-Cysteine (30 μM - 1 mM) had no relaxant effect on basal tone in porcine irides. Inhibition of cyclo-oxygenase with flurbiprofen (3 μM) had no significant effect on relaxation induced by L-Cysteine on basal tone in bovine irides. The inhibitor of cystathionine β-synthase (CBS), aminooxyacetic acid (30 μM) significantly (p <0.02) reduced the relaxation of bovine irides induced by L-Cysteine.

L-Cysteine can relax basal tone of isolated bovine irides, an effect that is dependent on intramural biosynthesis of H_2S. Furthermore, prostanoids are not involved in this relaxant effect induced by L-Cysteine on basal tone. Bovine irides appear to be more sensitive to the inhibitory action of L-Cysteine than its porcine counterpart, indicating that species differences exist in the magnitude of this response. Future research includes investigating the role of biosynthetic enzymes of H2S pathway in the relaxant responses elicited by L-Cysteine on isolated bovine irides. *[Acknowledgement: Undergraduate Research Program]*

Faculty Advisor: Dr. Bobby Wilson, wilson_bl@tsu.edu

OA #15
The Interaction Between Vahona Aloe Macroclada and Yeast DNA Using Fluorescence Methods

Nichell Thompson, Shaw University
Shacoya Ross, Shaw University
Letitia Beckett, Dr. Mialy Rabe, and Dr. Karoui Abdennaceur, Shaw University

The Interaction between Vahona Aloe macroclada and Yeast DNA Using Fluorescence Methods Nichell Thompson, Shaw University, Raleigh, NC, Letitia Beckett, Shaw University, Raleigh, NC, Dr. Mialy Rabe, Shaw University, Raleigh, NC, Dr. Karoui Abdennaceur, Shaw University, Raleigh, NC Vahona, Aloe macroclada is a powerful traditional medicine utilized in the island of Madagascar to prevent and heal tiredness, asthenia, cardiovascular diseases, hypertensions, bronchopulmonary infections, renal infections, rheumatism, digestive troubles, obesity, circulatory problem, pre-cancerous states, and many other illnesses and yet has never been scientifically studied. Fluorescence spectrometry and ultra-violet (UV) spectrometry were used to investigate the interaction between Vahona solution and yeast DNA. We hypothesized that Vahona Aloe macroclada active ingredients are powerful to give high absorbance thus strong groove with the fluorescence method. The control consisted of applying no Aloe macroclada solution to the Yeast DNA. The addition of yeast dsDNA to Vahona Aloe macroclada solution indeed resulted in a strong fluorescence quenching. Both the Stern-Volmer and the Scatchard plots of the fluorescence quenching showed a curve with two threshold DNA concentration of about 100μl.L-1. The interaction between Vahona and the dsDNA was found to be a groove binding mode by UV spectra, the influence of ion strength and I- quenching effect. This mode was independent on DNA concentration. However, the increase in DNA concentration changed by binding constant K of Vahona to yeast dsDNA and the number of binding

sticks in DNA base pairs (n). Further study could investigate the effects of Aloe macroclada defective Yeast DNA. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Rabe, MRabe@Shawu.edu

OA #16
Role of Ets Related Gene (ERG) During Different Phases of Cell Cycle

Dain Thorpe, University of the District of Columbia

The human ETS related gene (ERG) is over-expressed due to chromosomal rearrangements between androgen regulated TMPRSS2 gene promoter and ERG in 50-70% of all prostate cancer patients making it the most common genetic alteration identified thus far in human cancers. Previous studies have shown that ERG plays a critical role in the cell cycle transition of from G1-phase to the S-phase in a prostate cancer cell line VCaP with TMPRSS2-ERG rearrangements. The present study was undertaken to determine the role of ERG during different phases of cell cycle. An immuno-fluorescence assay was used to localize truncated ERG protein in VCaP cells and wild-type ERG in Human Endothelial Vascular (HuVEC) cells. The data shows that the ERG expression appears to diminish significantly during mitosis in both VCaP and HuVEC cells. Specifically in VCaP cells, ERG expression begins to reduce in metaphase, is completely lost in anaphase, and re-emerges in telophase. ERG expression also begins to lessen in HuVEC cells during metaphase and re-emerge in telophase. Unlike VCaP cells, ERG expression is never completely lost in HuVEC cells, instead, remaining as a peri-nuclear in the cytoplasm surrounding the nuclear material. Future experiments are planned to synchronize VCaP cells at different phases of the cell cycle and use Western blotting to confirm the results found in this study. Ultimately, the mechanism of ERG turnover in VCaP cells could possibly be used as a therapeutic target. *[Acknowledgement: Henry F. Jackson Foundation, Center for Prostate Disease Research]*

Faculty Advisor: Dr. Deepak Kumar, dkumar@udc.edu

OA #17
The Effects of P. Nigrum on Melanocyte Pigmentation in Vitro

Justin Williams, Langston University
Satya Tatapudi, Philippe Thuillier, and Amala Soumyanath, Oregon Health and Science University Portland, OR

Vitiligo is a dermatological condition that results in depigmented lesions on the skin, caused by the death of pigment giving cells between the dermis and epidermis known as melanocytes. Previous studies have shown that piperine causes proliferation of healthy melanocytes with healthy pigmentation and dendricity. This project tested piperine's effects on the pigmentation of human melanocytes *in vitro*. PIG1 cells were isolated from a person with normal melanocyte function. PIG3V cells were isolated from a patient who has vitiligo. Different concentrations of a solution of medium and piperine were used to see the effects on the pigmentation in the cells. Concentrations of 0.5mM, 1mM, and 5mM were tested as well as a control with no piperine. The hypothesis was that the cells with a higher dosage of piperine will be more pigmented than the cells with the lower dosage. The cells were cultured and distributed into separate Petri dishes. Each dish received a 100mL dose of its specific concentration of piperine for 7 days and incubated at 37˚C. Once the incubation period was over, the cells were pelleted and run through a melanin assay to test for pigmentation. The readings were near the most dilute standards of melanin, showing very little pigmentation at all, but a significant increase in the amount of pigmentation from the control to the 5mM sample. We concluded piperine *in vitro* did not stimulate much pigmentation in PIG1 and PIG3V cells. More trials need to be done to see if there was a problem with the cell line or if the little pigmentation that did occur was due to the cells being cultured *in vitro*. *[Acknowledgement: OK-LSAMPLINC (HBCU-UP) OHSU-CEDMA.]*

Faculty Advisor: Dr. John Coeman, jkcoleman@lunet.edu

OA #18
Mouse B Cells Treated with Bromelain Modulates the Expression of Cell Signaling Receptors in Vitro

Merone Zewde, Shaw University
Dr. Helen Asemota, Shaw University
Dr. Roger Thrall, Dr. Eric Secor, and Linda Guernsey, University of Connecticut School of Medicine; Department of Immunology

Natural products are the most single essential base for the development of drugs. Millions of people worldwide are making a shift from conventional medicine to natural alternative medicine and billions of dollars are spent each year for the study of alternative medicine. Bromelain is a proteolytic digestive enzyme extracted from the stem of a pineapple. It has been traditionally used by the Native people of South and Central America to ease stomach discomfort, to help with digestion and as anti-inflammatory medicine. It has been speculated that Bromelain can be useful in treating a wide range of conditions associated with chronic inflammatory diseases There are many studies being done investigating the therapeutic efficacy of Bromelain. This study is designed to investigate the impact of Bromelain treatment in specific B cell receptors. The B cell receptors selected are Cluster of Differentiation 19 (CD19), Immunoglobulin M (IgM), Cluster of Differentiation 45 (CD45) or also known as B220 (B cell isoform of 220 kDa of molecular weight) in mice.

This study was performed on B cells isolated from the spleens of female C57BL/6J naive mice. The protocols for the mice use and care were approved by the Animal Care Committee at the University of Connecticut Health Center. The female C57BL/6J naive mice were sacrificed under anesthesia with the injection of Ketamine/Xylazine. The spleen was surgically removed in the sterile environment. The spleen was processed then available numbers of cells were counted and cultured. The Bromelain treated cells, controlled cells and Bromelain plus E64 (Bromelain inhibitor) treated cells were cultured in a 24 well culture plate for time duration of 1, 2, 3, and 24 hours. The proteolytic action of Bromelain is inhibited by treating the cells by addition of trans-epoxysuccinyl-L-leucylamido-(4-guanidino) butane (E64). The cells were removed from the 24 well culture plates and were stained. Cells were counted again for viability using a nigrosin stain. At last the cells were labeled with antibodies for flow cytometry. Bromelain treatment, in vitro, of naive mouse B cells showed decreased expression of receptors CD19 and B220. These reductions came along with the proteolytic action of Bromelain, since it was blocked by the proteolytic inhibitor E64. IgM receptors showed no significant change. These results reflect the capability of Bromelain to reduce the B cell surface expression of key cellular receptors. *[Acknowledgement: The College Summer Fellowship Program at University of Connecticut School of Medicine, and partly by NSF HBCU-UP grant awarded to Dr. D.Sharma, Shaw University, Raleigh, NC- 27601.]*

Faculty Advisor: Dr. Helen Asemota, hasemota@shawu.edu

Chemistry (not Biochemistry)

OA #19
Preliminary Findings and Status of Human Afamin Deglycosylation Study

Nicole Arielle Peretti, California Polytechnic State University, San Luis Obispo
Christina A. Goode, Ph.D., California State University Fullerton
Reina Pisano, California State University Stanislaus
Hans Dieplinger, Ph.D. and Linda Fineder, Innsbruck Medical University, Genetics Department

Human Afamin, a member of the Albumin family, is a protein expressed in the liver and secreted into the plasma. Occurrence of this protein in several parts of the body has been investigated and has shown importance in various illnesses and diseases. To further investigate the structure and function of Afamin the protein must be prepared for X-ray crystallography. Deglycosylation of the protein prior to X-ray crystallography is required since the biantennary sugar complexes on the protein interfere with the production of crystals. In order to accomplish this we conducted small scale experiments using the enzyme Peptide: N-Glycosidase F (PNGase F) to determine a protocol that could result in adequate amounts of functional deglycosylated Afamin. The protocol was monitored by SDS-PAGE stained for protein and glycan. Incubation times and ratio of protein and enzyme were adjusted throughout the project based on experimental results. Final conditions that produced optimum results were with 1:25 enzyme to protein ratio (w/w) incubated 24 hours at 37°C. Successful deglycosylation was determined by a shift in Rf from Rf value of 0.357 (85 kDa) to Rf of 0.408 (74 kDa) and a lack of glycan staining on the sample that had been deglycosylated as shown by incubation with a standard glycan detection protocol. Deglycosylated protein was still recognizable after incubation with mouseantiafamin, detecting the protein, and goatantimouse, detecting the first antibody. This final protocol will now be used in larger scale experiments that we hope will result in adequate amounts of Afamin to crystallize, study, and understand the function of this multi-purpose protein. *[Acknowledgement: Work supported by National Science Foundation Grant HRD-0802628 LSAMP Cal Poly San Luis Obsipo]*

Faculty Advisor: Christina A. Goode, cgoode@Exchange.Fullerton.edu

OA #20
Micro-Fabrication of Polystyrene Bead Patterns with Photolithography

ShaRhonda Pickett, Langston University
David Schmidtke, Oklahoma University Chemical Engineering

Micro-fabrication of protein patterns is applicable in a variety of science fields such as biology and biosensors in terms of cell adhesion, cell proliferation, and protein microarrays for bacterial detection. The importance of this project was to observe controlled platelet adhesion to infections or injuries. The goal is to ultimately lead to effective treatments of bacteria. Previously, protein dot patterns were fabricated through a honeycomb structure of polystyrene beads where a monolayer of honeycomb micro-sized beads was placed on a clean glass slip, covering with protein-repellent poly ethylene glycol (PEG) solution, and later washed to remove beads and let protein fill patterns previously filled by beads. However, in order to change the dot size, the pattern spacing must also change and since protein dot patterns are limited, a new method of protein dot pattern fabrications is necessary. Therefore, my lab modified a previous photolithography procedure so that a 2.5 µm channel height and 6µm channel width was selected to accommodate the 5µm polystyrene beads chosen for the experiment. Plasma treated glass cover slips were utilized where the substrates underwent three new procedures; the subjects encountered heating, methanol, and water washes until covered with a layer of PEG. The results demonstrated that the channel measurements satisfy the requirements for the selected bead size to stay within the pattern channels and that the second protocol developed yielded the most favorable results. In the future, we hope to apply this procedure to a variety of bead

sizes. *[Acknowledgement: OK-LSAMP, University of Oklahoma CBME, HBCU-UP]*

Faculty Advisor: John Coleman, jkcoleman@lunet.edu

ECOLOGY

OA #21
Regulation of Populations of the Ladybeetle, Harmonia Axyridis, by Coccipolipus Hippodamiae

Briana Pettiford, Fort Valley State University
Ted Cottrell, USDA ARS; Byron, GA
George Mbata, Fort Valley State University

The lady beetle, Harmonia axyridis, is a natural enemy of several insect pests of crops. Incidentally, H. axyridis has large populations and is already attained a pest status in many areas including homes, crop farms especially peach orchards. This particular species of ladybeetles has natural enemies, which include pathogens and predators. The mite, Coccipolipus hippodamiae, which is predator of this ladybeetle is sexually transmitted has been found to generate mortality among the populations of H. axyridis. The reason for this research was to see if ladybeetles in the orchard population were infected by the mites. The hypothesis we are investigating is that the mite, C. hippodamiae, will be found infesting H. axyridis and will be able to regulate the populations of H. axyridis in peach orchard.

The methodology for this study involved collecting the ladybeetles with sweep nets. Following the collection of H. axyridis, each beetle was frozen, then transferred into a vial of ethanol, and examined for mites under a dissecting microscope. Examined specimens of H. axyridis were dissected and sexed in order to determine if the beetles were of the overwintering or spring populations.

Results showed that 240 ladybeetles were of the over-wintering population and 62 were of the spring population. The over-wintering population had 1 male ladybeetle infested with mites, while the spring population had 4 male ladybeetles infested with mites. In addition, H. axyridis infested with mites had also Hesperomyces virescens, which is a sexually transmitted disease of ladybeetles.

It is probable that more mites were found on the spring population compared to the over-wintering individuals because ladybeetles undergo reproductive diapause as adults. Future studies will involve carrying out this study over several seasons to determine if mite infestation of the ladybeetle will intensify during certain seasons. *[Acknowledgement: The authors acknowledge the support of NSF HBCU-UP Program (grant 0808851), which partially provided funding for this study.]*

Faculty Advisor: George N Mbata, mbatag@fvsu.edu

OA #22
The Impact of Nematode Infection and Hymenoptera Parasitism on Host CO2 Release

Audrea Ross, Fort Valley State University
David Shapiro-Ilan, USDA-ARS, SE Fruit and Tree Nut Research Unit, Byron, GA
George N. Mbata, Fort Valley State University, GA

The Indianmeal moth, Plodia interpunctella, is a major pest of stored grains, peanuts and other food products. Elimination of several chemical insecticides in the disinfestation of commodities is generating interest in the use the natural enemies and bio-pesticides in the management of stored-product insects like P. interpunctella. In addition, speedy turnover of generations of stored-product insects and their associated parasitoids lends credence to their use in studying interactions among hosts and parasitoids. Two biocontrol agents that offer potential as environmentally sound pest control solutions for P. interpunctella include the entomopathogenic nematode, Heterorhabditis indica and the hymenopteran parasitoid, Habrobracon hebetor. To develop effective pest management strategies, it is important to elucidate the interactions between these two biocontrol agents. In a prior study, differential infection of H. indica was observed in parasitized vs. non-parasitized hosts; specifically, the nematode showed a preference for infecting P. interpunctella that were parasitized with H. hebetor.

Our hypothesis for the preferential infection was that parasitized hosts are more attractive to nematodes because they emit more CO2 than non-parasitized hosts (nematodes are known to be attracted to CO2. This hypothesis was tested by measuring the CO2 release in four treatments: 1) healthy P. interpunctella (= the control), 2) P. interpunctella with nematodes only, 3) parasitized P. interpunctella (without nematodes), and 4) P. interpunctella with nematodes and parasitoids. CO2 was measured 1, 2, 3, and 4 days after exposure to nematodes.

On all sample dates, the level of CO2 released was higher in non -parasitized hosts than parasitized hosts. Additionally, CO2 release was higher in nematode-infected hosts than non-infected hosts in the first two days post-inoculation (which corresponds to the growth phase of the nematode's symbiotic bacteria).

Thus, the hypothesis was rejected, i.e., CO2 release does not appear to account for preferential infection by H. indica in parasitized hosts. An alternative hypothesis is that preferential infection is due to a suppressed immune system in the parasitized hosts; this hypothesis is currently being investigated. This study may have important implications on fundamental infection dynamics in entomopathogenic nematodes.

[Acknowledgement: The study was funded in part by funds from HBCU-UP NSF grant (0808851) awarded to Fort Valley State University.]

Faculty Advisor: George N. Mbata, mbatag@fvsu.edu

OA #23
Pair Bonding's Influence on Social Recognition

Brittany Stoutermire, Langston University
Tomica Blocker and Alex Ophir, Oklahoma State University

Social recognition and memory are important to the formation of social bonding in animals. In rodents, social recognition involves the neural processing of olfactory cues followed by the formation of social memory. Recognition is essential to distinguish between bonded and non-bonded conspecifics. Prairie voles (Microtusochrogastor) are monogamous rodents that form life-long pair bonds between mates. Considering the importance of differentiating between one's mate and a stranger, we suspect that pair bonded males will more quickly recognize conspecifics. In this study we investigate the effects of pair bonding on social recognition using a standard social recognition test. This behavioral test assumes that prairie voles investigate novel individuals longer than familiar ones (Winslow, 2003). To explore pair bonding's effects, we compared two groups in a social recognition test: 1) Pairbonded males - or males that were housed with a female for 72 h, and 2) Single males or males that were housed with a same-sex sibling for 72hr. Our preliminary results have indicated that pair bonded males will recognize novel females more quickly than single males. Further studies will include comparing factors that influence monogamous behavior of voles with similar factors for humans. *[Acknowledgement: LINC (HBCU-UP) OK-LSAMP]*

Faculty Advisor: Dr. Alex Ophir, ophir@okstate.edu

EDUCATION

OA #24
Sexual Health Awareness Program among College Students

Taylor-Brooke Mosley, Talladega College
Dr. Leonard Cole, Gladys Swain, and Syed Raza, Talladega College, AL

Sexual health awareness among college students is a growing problem. Insufficient sex education across America contributes to high rates of sexually transmitted diseases and teen pregnancy. Teen pregnancy is on the decline in the United States, yet the rate of teen pregency is still nine times higher than that of other developed countries. Sexually transmitted infections are increasing among adolescents especially females age 15-24; with African-American females adversely affected. Insufficient sex education among college students contributes to a high number of Sexually Transmitted Infections (STI) and teen pregnancy. The purpose of the research was to collect data on the level of sex education that students at Talladega College had received, and determine a need for sex education as a refresher course in the freshman curriculum. A pilot study was conducted based on three hypotheses. H1. Students are not learning sufficient information on sexual health issues. H2. Current sex education curriculum is used effectively. H3. Sex education or other media can be used to reduce number of teen pregnancies and STI infections.

A survey was conducted among Talladega College students between the age of 18 and older. The survey questionnaires were designed to obtain two objectives: 1) Measure the level of basic knowledge on STI and teen pregnancy. 2) Determine the awareness about sex education (STI and teen pregnancy). Survey data indicate, sixty-nine percent students received formal sexual health education. Out of sixty-nine percent, forty percent did receive their sexual health education at their senior level. Eight percent of the females were highly concerned about sexually transmitted infections (STI) and HIV/AIDS. Eighty percent of the freshman used peer advice and media to get formal education on xexual health issues.

The study showed that students at Talladega College have a general understanding of basic sexual health issues at their junior and senior year of college. There is a need to introduce a sexual health refresher course at the freshman year to avoid future health issue among students. Future research should focus on creating more positive sexual health discussion forums. Internet, TV, movies, and magazines should be used as a means to increase awareness among students. Non-profit and government agencies should be invited to Talladega College, specially to speak to the freshman orientation class to promote safe sex among adolescents. *[Acknowledgement: This study was supported by a grant from NSF/HBCU-UP awarded to Leonard Cole, Ph.D., Director of Sponsored Program, Talladega College, Talladega, AL 35160.]*

Faculty Advisor: Dr. Leonard Cole, lcole@talladega.edu

ENVIRONMENTAL ENGINEERING

OA #25
The Synthesis of Jet Fuel from Smaller Compounds Such As Esters

Britney White, Claflin University, SC

Biofuel is a fuel that is made from biological components. These particular components are needed to be more efficient in more ways than one for the demand due to the increase in transportation in the world. With fuel being produced from fossil fuels, which are non-renewable, an alternative way to

create fuel is significant. To have an abundance, as well, using smaller compounds would be ideal for the production of said fuel. The particular fuel we worked on was jet fuel. Esters were chosen because of their fatty acids that occur naturally due to the reaction that takes place to create the ester. We conducted an experiment with 5 esters and determined if a product could be made using the Wittig reaction.

First, all five esters were made that were used in the experiment. Each ester consisted of 50mL of an alcohol and 50mL of an acid. A few drops of sulfuric acid were added to the solution to speed up the process. The ester was refluxed for 3-4 hours. The esters were then poured into a beaker of ice and mixed thoroughly (as the ice melted into the water, the pH was corrected and raised to about 6 or 7 so the solution would not be as acidic; this was done by adding sodium hydroxide). The solution formed two layers, an organic and an aqueous layer; we extracted and used the organic layer. Sodium sulfate was added to the organic layer to make sure that all the water was removed. The solution was then pumped dry under vacuum filtration and the remains were stored for later use. Next, an NMR was obtained for each ester to ensure that it contained the number of carbons that it was suppose to. Distillation was the next step if the ester was not pure.

Next, for the Wittig reaction, the phosphonium salt was made; 50mL of Toluene was used and for every 2.62g of Triphenylphosphine used, 1.37g of Bromobutane was used. The salt was left to reflux overnight. The salt was then pumped dry and weighed. Next, the Wittig reaction took place where we added a 0.28g part of ester for every 1g of phosphonium salt; this was used in a methylene chloride solvent (a few mL of water was added to ensure two layers). This solution was refluxed under nitrogen for about 2-3 hours. The organic layer was extracted from the aqueous layer and pumped dry under vacuum filtration. We added hexane to the solid from the pumped solution, and the material that dissolved into hexane was the product that we needed; the hexane layer was extracted and pumped dry and the final liquid was the final product. The reactions were successful, but due to time, not all the esters were able to be tested.

From our work, we have resolved our problem of creating a 12 carbons product from smaller starting materials. The product from the butyl butyrate gave us 12 carbons and the product from the Propyl butyrate gave us 11 carbons, both which are close to the desired amount. Due to our time perimeter, we were not able to finish making the products for the other three esters, but this experiment will be continued in the coming school year. The Butyl Product and the Propyl product were both triumphant in production. Now that we have found that a product is possible, we now can try to figure how to make the product on a larger scale, meaning to improve the yield. Particularly for jet fuel, other materials, not just esters, are being looked at as other outlets to create new forms of fuel for air transportation. *[Acknowledgement: NNSA]*

Faculty Advisor: Pamela Shuler, pshuler@claflin.edu

MICROBIOLOGY/IMMUNOLOGY/VIROLOGY

OA #26
Generation of Thymic Nurse Cell Lines from Balb/c Mice

Justina Bradley, Tuskegee University
Marcia Matinez, Tuskegee University

Thymic nurse cells (TNCs) are epithelial cells located within the cortex of the thymus. TNCs express both class I and class II major histocompatibility (MHC) proteins on their cell surfaces. TNCs are evolutionarily conserved cells that interact closely with developing T cells or thymocytes that are CD4+ CD8+ TCRlo. Following these interactions greater than 95% of thymocytes become apoptotic and are degraded within vacuoles in TNCs. TNCs were also found to contain macrophages that interact only with viable thymocytes within the TNC vacuole. Additionally, all mouse models of systemic lupus erythematosus (SLE) studied have shown severe reductions in TNC number with the onset and progression of the disease. As a result of these observations, it was hypothesized that TNCs and macrophages work together to present self antigens to developing thymocytes during T cell education. To demonstrate if TNCs provide a microenvironment for T cell selection, TNC lines must be prepared. The thymi of five Balb/C mice were removed, fragmented, and then disassociated in a collegenase/trypsin/ DNAsae 1 enzyme digest solution to release TNCs. Cells were allowed to plate down at 37°C in a humidified atmosphere with 5% CO2 and 95% air for two days. Cells were then immortalized through SV40 viral infection. Anti-SV40 antibody staining was used to determine if cells were infected. Results showed cells were positively stained indicating that they were infected with SV40. Cells were then cloned by selecting and plating a single cell into each well of a 96-well plate. So far, approximately 1,080 clones have been prepared and these clones are currently being expanded. Once the expansion is complete clones will be tested for their efficiency of binding to thymocytes and they will be used in in-vitro studies that examine the consequences of TNC/macrophage/thymocyte interactions. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Marcia Martinez, Justinad@live.com

OA #27
Diversity of Microcrustaceans in Ponds and Lakes of the Southern San Joaquin Valley, California

Ronnie Capaldi, California State University, Bakersfield

The populations of amphibians, within the foothills of the Sierra Nevada and parts of the southern Central Valley of California have been declining rapidly. The chytrid fungus Batrachochytrium dendrobatidis (Bd), an emerging fungal

pathogen that resides also in California and many other parts of the world has a threatening effect on the lives of amphibians by destroying the keratin in their skin. In a freshwater habitat filterfeeding Microcrustaceans are the natural enemy of the motile spores of the fungus, but many Microcrustacean species are also declining because of habitat alterations. Especially fish and shrimp that were introduced into many ponds and lakes, as well as eutrophication that changes the diversity of microorganisms including microalgae in the water has negatively affected many Microcrustaceans (e.g. in Lake Tahoe). In this project I want to i) investigate the diversity of Microcrustaceans in freshwater and sediment (presence of diapausing eggs) of different ponds in Bakersfield and the surrounding foothills of the mountains, and ii) investigate the presence of the chytrid fungus. Six samples were taken (two replicates) over a one year period (2011) to investigate seasonal changes in the Microcrustacean diversity and the presence of the chytrid fungus. The methods that were used include microscopy of Microcrustaceans and molecular tools such as DNA extraction, Polymerase Chain Reaction (PCR) with primers for Bd and Microcrustaceans. PCR fragments of Microcrustaceans were separated by Denaturing Gradient Gel Electrophoresis to obtain banding profiles of the Microcrustacean community in the water and sediment. In the near future I will be comparing the sequenced material collected from the water and sediment samples from all five testing sites to the sequences of the individual Microcrustacean species (e.g. copepods, cladocerans, and ostracods) in order to identify each species that was present. All information obtained with microscopy and molecular methods will be combined to assess the diversity of the microcrustaceans and over the seasons. The aim of this project is to better understand the reasons behind the amphibian decline based on chytridiomycosis, the disease caused by the fungal pathogen. *[Acknowledgement: I, Ronnie Capaldi, gratefully acknowledge financial support from NSF under grant HRD-0331537 (CSU-LSAMP).]*

Faculty Advisor: Dr. Antje Lauer, alauer@csub.edu

OA #28
Hurricanes and Infection of Killifish with Mycobacterium marinum

Ciara Green, Southern University at New Orleans
Illya Tietzel Southern University at New Orleans

Hurricanes frequently disturb the Gulf coast, causing extreme damage and increased amounts of microbial pathogens that affect fish and humans. The goal of this research is to confirm a relation between hurricanes and the infection of Killifish with Mycobacterium marinum. Mycobacteria are rod-shaped bacteria that cause fish tuberculosis. In humans, mycobacteria cause tuberculosis and leprosy. It is hypothesized that hurricanes increase infections with Mycobacterium marinum. A culture of Mycobacterium marinum was used as a positive control. In quantitative Polymerase Chain Reaction (qPCR), the positive control was used to test the reconstituted primers on three separate occasions to ensure accuracy of results. A fermentation test using Sucrose, Maltose, and Dextrose was also performed using the positive control E. coli and Mycobacterium marinum as the unknown. After one week of room temperature incubation, Mycobacterium marinum displayed microbial growth and a change in pH in Sucrose, suggesting fermentation. Acid Fast stains that detect mycobacteria indicated a presence in fish. Fish gills from September, October, and November 2010 were streaked onto Tryptic Soy agars and incubated at 37°C. Evidence of Mycobacterium marinum were found in microbes from the right gill of a September fish, an October fish's left gill, and an October fish's right gill using qPCR. More fish from previously indicated months were streaked onto Lowenstein-Jensen agars and incubated at 37°C. In conclusion, qPCR is effective to detect mycobacteria in killifish. Future research will analyze more fish. *[Acknowledgement: This research was mentored by Dr. Illya Tietzel and sponsored by NSF URM and S-STEM grants.]*

Faculty Advisor: Illya Tietzel, ITietzel@suno.edu

OA #29
Molecular Dtection of Rickettsia sp. in Rhipicephalus Sanguineus (the brown dog tick) From Dogs in the United States Virgin Islands

Akacia Halliday, University of the Virgin Islands

Rhipicephalus sanguineus is a species of tick common throughout the world. In addition to its commonality, R. sanguineus is known to carry bacterial pathogens such as Bartonella sp., Anaplasma sp., and Rickettsia sp. (just to name a few). When R. sanguineus bites a person or animal, it may transmit these pathogens. Spotted fever group rickettsiae are known to cause severe illness in humans. SFG rickettsiae largely affect travelers and people who visit high incidence areas. To evaluate the risk of human or animal infection with vector-borne pathogens in the U.S.V.I., a local veterinary clinic provided us with R. sanguineus collected from dogs. We tested the specific hypothesis that SFG rickettsiae are present in R. sanguineus in the U.S.V.I. Molecular assays, specifically PCR analyses, using Rickettsia-specific primers were employed to test our hypothesis. One set of PCR primers target the citrate synthase (gltA) gene specific to the Rickettsia sp. A second set of primers target a fragment of the outer membrane protein A (rompA) gene that is only present in SFG rickettsiae. Total DNA was extracted from 22 individual adult ticks using the Qiagen DNeasy Blood and Tissue Kit, and the PCR assays were employed to screen the DNA extracts for the presence of rickettsial DNA. Preliminary results indicate the presence of Rickettsia sp. within 22/22 (100%) of the tick DNA extracts by DNA agarose gel-based visualization of an amplified DNA fragment of the expected gltA fragment size (381 bp). Interestingly, when the PCR products

were separated by gel electrophoresis, additional amplified DNA bands were present. These bands were both larger and smaller that the expected 381bp fragment targeted by the gltA PCR primers. However, our rompA PCR results demonstrated an absence of amplified DNA fragments from R. sanguineus DNA extracts when PCR reactions were visualized by DNA gel electrophoresis even though controls indicated PCR was working properly, suggesting that that the gltA band may not originate from Rickettsia DNA. We plan to further investigate the nature of the ~381 bp fragments generated in the gltA PCR by DNA agarose gel purification and DNA sequencing. Sequences of the gel-purified fragments and results from PCR screening of additional R. sanguineus DNA extracts will be presented. *[Acknowledgement: College of Science and Mathematics, University of the Virgin Islands]*

Faculty Advisor: Jennilee Robinson, jrobins@uvi.edu

OA #30
Metabolic and Genetic Fingerprinting of Gut Microbes of Fish after BP Spill

Darrell Hayward, Southern University at New Orleans
Illya Tietzel, Southern University at New Orleans

Metabolic fingerprinting with the BIOLOG system was successfully used previously to analyze microbial communities. Similarly, Terminal Restriction Fragment Length Polymorphism (T-RFLP) was successfully applied using genetic fingerprinting. After the BP oil spill of 2010, it is hypothesized that oil associated microbes will change microbial communities and their metabolism inside the intestinal tract of local fish. This research is important, because fish are a major part of the food chain of humans, a fertilizer, processed animal feed and a component of cosmetics. Gulf Menhaden fish were caught from the Gulf of Mexico one, two and 3 months after the oil spill then measured and weighed. Reference fish from before the oil spill were caught in 2009. Using aseptic techniques, the fish intestines were removed. Sections of intestine were used to isolate microbes and microbial DNA. With the BIOLOG reader the metabolism of isolated microbes was analyzed. A test run was done using E. coli as positive control and water as a negative control. Metabolic activity of E. coli was detected. Metabolic profiles of microbial samples were different between Gulf Menhaden and Atlantic Croaker. For the isolation of microbial DNA of fish intestine, products from MoBio were superior. Genetic fingerprinting with T-RFLP of microbial communities of fish intestine was initiated. Commercial DNA of E. coli was used successfully as positive control for restriction digest of T-RFLP. A test run with universal primers for T-RFLP of 16S rRNA was successful. Future research will analyze fish specimen for microbial changes. *[Acknowledgement: This research was funded by NSF MCB-1051237.]*

Faculty Advisor: Dr. Illya Tietzel, ITietzel@suno.edu

OA #31
Impact of BP Oil Spill 2010 on Atlantic Croaker and the Intestinal Microbes

Gawain Kiffin, Southern University at New Orleans
Illya Tietzel, Southern University at New Orleans

Besides natural oil spills manmade oil spills are catastrophic for marine environments, especially fish. The Atlantic Croaker is native to the Gulf of Mexico where the oil spill occurred. As a bottom feeder fish, it might be exposed to both dispersed oil and oil deposited at the sea bed. Intestinal microbes are influenced by uptake of oil and ingested microorganisms. Alcanivorax borkumensis can metabolize oil and was found at spill sites. Therefore it is hypothesized that (1) the BP oil spill affected the Atlantic croaker, (2) that oil microbes such as Alcanivorax borkumensis or its genes such as alkB might be present in the intestine. To study effects of the BP oil spill on the fish, Atlantic Croakers were captured during field trips after the spill. Numbers, weight, length and height were recorded. Negative controls are specimens from outside oil spill areas. Real Time polymerase chain reaction (PCR) specific for the gene alkB served detection of oil microbes. Alcanivorax borkumensis with the alkB gene for catabolism of oil was cultured as positive control, E. coli is negative control. Specimens from the Gulf showed changes of length and weight over time. Cultivation of Alcanivorax borkumensis is currently repeated because of contamination. Future research should investigate whether changes were aided by the presence or absence of alkB gene or associated oil microbes. *[Acknowledgement: The research was sponsored by NSF MCB-1051237.]*

Faculty Advisor: Dr. Illya Tietzel, ITietzel@suno.edu

OA #32
Phenotypic Changes and Proliferation Status of SIV-Specific CD8+ T Cells in Response to SIVΔnef Immunized SIVmac251 Challenged Rhesus Macaques

Mohamaed Mohamed, University of Minnesota, Twin Cities

The AIDS pandemic is the most widespread pandemic in recorded human history, it has claimed the lives of millions and new infections continue to outpace the global response. There is a real need for new and better long-term prevention tools, such as vaccines. SIV infection in rhesus macaques is widely used as an animal model of HIV infection. Live-attenuated lentiviruses have been the most successful vaccines in SIV model to date and have provided protection in rhesus macaques challenged with pathogenic SIV.

To design effective vaccines, we need to understand the immune correlates of protection against pathogenic SIV strains in the immunized animals. CD8 T cells play an important role in controlling viral infections. Understanding SIV-specific CD8 T cell

phenotypic changes and proliferation status will help us understand the role of virus-specific CD8 T cells in controlling viral replication in vivo. We investigated the in situ phenotypic changes in lytic granule contents and proliferation status of simian immunodeficiency virus (SIV) - specific T cells from SIV-infected macaques immunized with SIVDnef and challenged intravaginally with SIVmac251 using MHC Class l tetramers.

We specifically investigated the Mamu-A*01-restricted immunodominant epitopes, Gag CM9 and Tat SL8, because the response to these two epitopes accounts for the majority of detectable CD8 T cell responses in Mamu-A*01-positive macaques. We stained these sections with Mamu-A*01/Gag CM9 tetramers and counterstained sections with CD20 antibodies (B cell markers), CD8 antibodies, IgM, granzyme B and Ki67 antibodies. Digital images of the tissue sections were collected using a confocal microscope. We found tetramer staining cells in situ expressed CD8 molecules present in tissues prior to challenge. We also observed little to no increase in Ki67 expression in SIV-specific CD8 T cells in response to challenge with pathogenic SIVmac251 in spleen tissue, suggesting that the SIV-specific CD8 T cells did not expand post-challenge in spleen and genital tissues. These results indicate that protection is associated with 1) SIV-specific CD8 T cells present in tissues at time of challenge, and 2) does not require an expansion of SIV-specific CD8 T cells after challenge. This study provides a better understanding of immune correlates of protection from SIVΔnef vaccine model and contributes to our understanding of what is needed to create a successful HIV vaccine. *[Acknowledgement: This research project was made possible by Louis Stokes Alliance for Minority Participation at the National Science Foundation.]*

Faculty Advisor: Pamela J. Skinner, skinn002@umn.edu

OA #33
Estimating the Prevalence of Coxiella Burnetii (Q-Fever) in Milk Samples from Indiana Diary Goats

James Mungin, Purdue University / Tuskegee University
Ramesh Vemulapalli, BVSc, MVSc, PhD, Jamie Fink, and April Johnson, DVM, MPH, PhD, Purdue University School of Veterinary Medicine

Q fever is a zoonotic disease of ruminants caused by the bacterium, Coxiella burnetii. It is an obligate intracellular bacterium possessing high environmental stability and resistance to physical and chemical agents. Infected ruminants can shed the bacteria through feces, urine, milk, and reproductive fluids during parturition. Ruminants infected with Q fever usually show no clinical signs of illness; however, they may experience abortions and infertility. Infected humans can experience flu-like symptoms, pneumonia and hepatitis. A small percentage may become chronically infected with endocarditis occurring months to years later. These cases have a higher fatality proportion. At a national level, the prevalence of Q fever is about 3 percent in people and ranges from 6 to 44 percent in ruminants, depending on the study. Within the state of Indiana, cases of Q fever have been identified in sheep, cattle, goats, and people, but the prevalence among each is unknown.

In order to estimate the prevalence of Q fever in dairy goats, a cross sectional study was performed in June 2011. It was hypothesized that 0 percent of milking does were shedding the bacterium. Milk samples were collected from 317 goats from 31 farms in the state of Indiana. Each individual farm was administered a questionnaire to collect data about the farm and individual milking doe. Samples were transported to Purdue University on ice and later refrigerated until processing. Next, 2-10 samples were pooled and DNA was extracted for analysis by real time PCR to identify the DNA from the Coxiella burnetii. Results found that 10 out of 317 (3.2%) goat milk samples contained the bacteria. Two out of 31 farms (6.45%) studied had goats that tested positive for Q fever. Eighty-one percent of farms (25/31) reported using the milk raw for human or pet consumption, a known method of transmission of the bacteria from animals to people. This suggests that goat owners in the state of Indiana may be at risk of infection with Q-fever. Education of these individuals may help result in reduction of transmission of disease. *[Acknowledgement: Purdue University SROP Program / NIH-MARC Program]*

Faculty Advisor: Dr. Marcia Martinez, mmartinez@mytu.tuskegee.edu

OA #34
Increased Expression of Toll-like (TLRs) Receptors 7 and 9 in Systemic Lupus Erythematosus (SLE) Patients: Potential New Targets for Therapeutic Drugs

Jarren Oates, University of Arkansas at Pine Bluff
Edward Treadwell, East Carolina Brody School of Medicine, Greenville, NC
Beverly Word and Beverly D. Lyn-Cook, National Center for Toxicological Research, Jefferson, AR

Systemic Lupus Erythematosus is an autoimmune disease that affects many parts of the body. The immune system attacks the body's cells and tissues which result in inflammation and tissue damage. The immune system produces antibodies against itself, autoantibodies. The production of these autoantibodies is formed due to impaired survival/apoptosis signals which result in an accumulation of apoptotic bodies. Toll-like receptors are activated in response to accumulation of apoptotic bodies. These receptors play critical roles in innate immune systems. These receptors have broad specificity and can recognize many related molecular structures called, pathogen-associated molecular patterns (PAMP). These PAMPs can include bacteria and viral components, as well as dsRNA and ssRNA. Lupus occurs in females at a ratio of 12:1 when compared to men. African American and Hispanic/Latino women have higher

incidence of lupus then European women. Hypothesis: Increased levels of TLRs 7 and 9 would occur in lupus patients compared to healthy non-lupus controls and furthermore, African American women would have an even higher level. Methods and Samples: Total RNA was isolated using a Paxgene kit from peripheral blood mononuclear cells of African American and European American blood samples obtained from East Carolina Brody School of Medicine with IRB approval. Quantative real-time PCR using the CFX real-time system were conducted on all samples. Results: Toll-like receptor 7 ($p<0.0407$) and 9 ($p<0.0018$) significantly increased expression in lupus patients compared to age-matched controls. African American women with lupus had a 2-fold increase in expression level when compared to their healthy controls. Conclusion: Toll-like receptors are involved in a number of autoimmune diseases. Increased expression in lupus patients provide an opportunity for targeting this pathway with toll-like receptor antagonist as a new target for systemic lupus erythematosus. *[Acknowledgement: This study was supported, in part, by a grant from the Food and Drug Administration Office of Women's Health to Dr. Beverly Lyn-Cook, National Center for Toxicological Research, Jefferson, AR.]*

Faculty Advisor: Dr. Beverly Lyn-Cook, Beverly.Lyn-Cook@fda.hhs.gov

OA #35
Phylogenetics and Molecular Epidemiology of the Emerging Pathogen Streptococcus parauberis as it Relates to M-Like Protein

Cory O'Neal, Norfolk State University

Streptococcus parauberis is a gram-positive bacterium, which causes mastitis in dairy cattle and streptococcosis in fish. This project was undertaken to identify and characterize a virulence factor called the M-like gene in virulent and non-virulent strains of the bacterium. Amplification of the gene via polymerase chain reaction and subsequent cycle sequencing was used to determine the nucleotide sequence from six strains originating from striped bass (Morone saxatilis) from the Chesapeake Bay and from packaged chicken. These data were compared to previously collected data from cattle strains. A single nucleotide polymorphism (SNP) was revealed that encodes an amino acid change in the M-like protein of the non-virulent, Chesapeake Bay strains of the bacteria. The change in the C-terminus of the protein immediately precedes the LPXTG motif that defines the cell-surface anchor. Our results suggest that this SNP may limit the function of this protein, leading to a naturally attenuated strain of S. parauberis that might be applied as a vaccine in aquaculture settings. *[Acknowledgement: NSF-STARS grant]*

Faculty Advisor: Dr. Ashley Haines, anhaines@nsu.edu

Physics (not Nanoscience)

OA #36
Fibre-Optic Light Pipe Probes in Medicine and Biology

Letitia Beckett, Shaw University
Daphne Hauser, Lou Yak, and R. Kumar, Shaw University

Photon energies ($E = h\nu$) of infrared radiation induce vibrational motion of covalaletly bonded atoms or groups in organics solids such as drug formulations and powders. Organic molecules in these sample solids undergo therefore a rich and complex variety of vibratory motions characteristic of the composition of the sample. Infrared spectrometers with ATR set -up for beam delivery to and from the sample including its absorption path provide unique capability for the analysis of these vibration frequencies ($\nu = E/h$) - stretching , bending and hydrogen bonded group vibrations. The attenuated total reflection, ATR sampling technique measures energy changes that occur in the totally internally reflecting beam after interacting with the sample. Diamond ATR probe accessories provide excellent spectral reproducibility with virtually no sample preparation for drug powders and liquid samples. We have measured polymorph sensitive infra-red active modes in Carbamezepine, C15H12N2O1 molecule, and a bioactive drug ingredient in aqueous environment. Diamond crystal provides a versatile light pipe for delivery of the infrared beam because of its total transparency in the mid-infrared range and easy coupling with optic grade fibers. *[Acknowledgement: This study was supported, in part, by a grant from NSF HBCU-UP awarded to D.D.Sharma, Ph. D. , Director for Academic Excellence Project, Shaw University, Raleigh, NC 27601]*

Faculty Advisor: R. Kumar, rkumar@shawu.edu

Physiology and Health

OA #37
Colour Discrimination Under Different Wavelengths of Light

Idris Aziz, Harris-Stowe State University

Polychromatic light is the most common source of illumination used in day-to-day life. The aim of our study was to figure out if polychromatic and monochromatic sources of illumination had any effect on color discrimination among people of two different age groups. People from two different age groups (above and below 40 years) were selected to distinguish different colors from each other under monochromatic source of illumination which involved use of red, green and blue wavelengths of light and polychromatic source of illumination which involved use of white light. Our results indicated that there were no significant differences in color discrimination using either source of illumination. Age also was not a significant factor in distinguishing different colors from each other under

different wavelengths of light as illumination sources. Our next step in undergraduate research will be to work on the color disorders or physiological errors in color discrimination by human eye. This research was presented at ABCRMS conference held on November 2011 in St. Louis). *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Anbreen Bashir, Harris-Stowe State University

OA #38
Transendothelial in Human Microvascular Endothelial Cells (H.M.V.E.C)

Darius Robinson, Southern University at New Orleans
Travis Dogett and Dr. Jerome Breslin, Louisiana State University

Endothelial cells are thin layers of cells that line the interior surface of blood vessels, forming an interface between circulating blood in the lumen and the rest of the vessel wall. Essentially, endothelial cell line the entire circulatory system from the heart to the capillaries. Endothelial barrier functions (permeability) are defined as the ability to allow substance into and out of the blood vessels. Under certain conditions, barrier functions can either increase or decrease. When permeability is decreased, it can cause bacteria and other unwanted substance to enter the blood stream, which can result in sepsis and other diseases of the blood. In this review, we discuss the effects of alcohol and small Guanosine triphosphate (GTPases) in their role on barrier functions with specific concentrations on Human Microvascular Endothelial Cells (H.M.V.E.C) and Human Umbilical Vascular Endothelial Cells (H.U.V.E.C). We tested these cells under both increased and decreased permeability and used different factors such as time and different concentrations. Small GTP from the ras super family, primarily Rho GTP (RhoA, Rac1, Cdc42) or Rap1 are known to regulate cell adhesion, therefore a compound called E-Pac activator (activator of Rac1) was used to increase permeability and alcohol was used because of its negative effects on barrier functions. *[Acknowledgement: LSU Health science center, e3MAS]*

Faculty Advisor: J Olubadewo, jolub@suno.edu

OA #39
Investigating Termite Behavior and Digestion of Cellulose Based Thermo-responsive Nanofibers to Determine Cellulase Activity

Tariq Taylor, Morehouse College
Arishaun Donald, Duane Jackson, Ph.D., and Juana Mendenhall, Ph.D., Morehouse College

Termites happen to be an extremely energy efficient example 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. This research entails feeding reticulitermes species worker termites a combination of cellulose and synthetic fibers, known as poly (N-vinyl caprolactam), labeled with the fluorescent tag dichlorotriazinylaminofluorescein (DTAF) that helps detect cellulase enzyme activity. Specifically, it involves exploring the difference between three combinations of cellulose and synthetic fibers (PVCL) used to map digestion in terms of termite consumption, preference, and toxicity. It was predicted that the termites used in the study would prefer the PVCL-3 sample, which is more biocompatible due to its terminal carboxylic groups.

The procedure of this experiment consisted of three phases: conjugating cellulose into the PVCL sample, conducting the feeding experiment, and imaging under a fluorescent microscope to map the digestion. Using the Observer XT 9.0 program, an automated system used to collect observations of behavioral patterns in animals, data was collected on frequency and duration of contact with each sample.

Although the study is currently in the initial stages of research, preliminary data from the Observer XT 9.0 program has concluded that the PVCL-1 sample is preferred due to the high number of contacts and duration of these contacts, which is contradictory to the hypothesis. Fluorescent imaging showed cellulase activity was easily detected within the abdomen of the termite after six days of feeding the termite groups PVCL-1, PVCL-2, and PVCL-3, with PVCL-3 yielding the clearest example of cellulose activity. Once the preference for a specific PVCL sample is determined, future research can be conducted that focuses on the digestive pattern and process of cellulose degradation inside of the termite. The study is expected to yield more comprehensive data as the research continues and all of the contributors to the research are excited about its potential application to the manufacturing of bioethanol. *[Acknowledgement: This study was supported by the Morehouse Wide Initiative for Sustainable Energy (M-WISE), a grant from the National Science Foundation awarded to Lycurgus Muldrow Ph.D., Director of Integrated Programs, Morehouse College, Atlanta, GA , 2010. Additional funding for equipment was provided by the Howard Hughes Medical Institute.]*

Faculty Advisor: Dr. Duane Jackson and Dr. Juana Mendenhall, djackson@morehouse.edu, jmendenh@mit.edu

OA #40
Health Knowledge and Contemplation Project as A Means Towards Reducing Health Disparities

Derejew Tessema, University of the District of Columbia

Eliminating health disparities in the District of Columbia cannot be achieved until there is a reduction in incidences of deaths due to preventable risk factors that are experienced by the District's minority population. The National Library of Medicine (NLM) online health resources is one mechanism to address the problems of eliminating health disparities, by improving African American's health literacy and knowledge. Many of these individuals seek health information from sources that lack authenticity. This easily accessible online service contains many databases, all of which are accurate and easily comprehended by lay people. The objective of this project was to train African American senior citizens to use the NLM and to help and reinforce this information by conducting monthly support group meetings.

This project, designated as "The Health Knowledge and Contemplation Pilot Project" was conducted to thoroughly engage the community in obtaining health knowledge via this health resource. The project began with the acquisition of a church coordinator from each of the four churches (Berean, Emmanuel, Zion, and Shiloh Baptist) that had been selected. This was followed by the implementation of four focus groups consisting of members of each of the churches. The focus groups took place immediately prior to a four- hour training session on the use of the NLM. At the focus group sessions, pre-questionnaires were disseminated and completed by each participant.

To reinforce the information learned during the training session, an eight-month intervention involving monthly activities using the NLM Online Health Resources was conducted. The church coordinators, the participants, outside speakers and other health professionals designed and conducted these monthly sessions. At the end of the eight-month period, post-questionnaires were completed and compared with the information accrued from the pre-questionnaires.

The data from the pre-questionnaires from some sites indicated that many of the participants possessed a high level of health literacy and knowledge, which may account for the lack of significance obtained when comparing the data from the pre and post questionnaires. There was a positive correlation between education and income levels in each of the sites studied. It is concluded that in order to have a significant health-literacy-acceleration, the participants selected should not be random and a limit should be placed on the education attainment of these individuals. *[Acknowledgement: NIH Grant 5R25CA129035-04]*

Faculty Advisor: Dr. Carolyn Cousin, ccousin@udc.edu

Plant Research

OA #41
Bioactive Properties of Six Medicinal Plants from the Dominican Republic

Jephter Buahen, Bowie State University
Anne Osano PhD, Bowie State University
MariaLaux, PhD and Manuel Aregullin PhD, Cornell University

The medicinal potencies of many tropical plants are beyond doubt. These plants may contain some secondary compounds such as alkaloids and terpenes that may have many pharmacological attributes required to combat diseases and infections. Studies suggest that plants provide unparalleled chemical diversity and bioactivity thereby leading to the discovery of hundreds of pharmaceutical drugs. In this study, six medicinal plants were selected from the Punta Cana ecological reserve in the Province of Altagracia and the city of Higuey in the Dominican Republic. The plants that were studied include: Momordica charantia L., Chrysophyllum caniato, Piper marginatum, Lepianthes peltatum, Piper aduncum and Pimenta racemosa. The local people use the plants to treat diseases such as diabetes, fever and pain relievers. Previous studies on these plants suggest that these plants contain a number of phytochemicals that are medicinally beneficial.

The current study was undertaken to investigate the antimicrobial, antimitotic and cytotoxic activities of the six selected plants and subsequently predict potential medicinal significance and to test the hypothesis that these plants possess basic bioactive properties that may give them medicinal properties. This study is necessary in part because it will give the preliminary screening for the basic bioactive properties of the plants and lay the foundation for further research.

Crude extracts from the leaves were prepared by using two organic solvents, methanol and dichloromethane. In order to find the biological and chemical active compounds, a bioassay procedure is needed to find a particular type of biological activity in the crude extract. The crude extracts were used for disc-diffusion assay (antimicrobial), Brine Shrimp Assay-Cytotoxicity, Brine Shrimp Assay-Behavior and Sea Urchin embryo Assay (antimitotic).

Each plant showed some various potencies against cells in either of the bioassays. Strong inhibition against the microbes was observed for the methanol extract from Momordica charantia. All the crude extracts exhibited strong, moderate or weak growth inhibition against the microbes indicating that the plants possess antimicrobial activities. *[Acknowledgement: This study was supported by a grant from NIH awarded to MHIRT (Minority Health and Health Disparities International Research Training program at Cornell University) and Bowie State University.]*

Faculty Advisor: Manuel Aregullin PhD, ma35@cornell.edu

OA #42
Modeling Genetic and Environmental Influences on Resource Allocation Traits of Arabidopsis lyrata

Erika Helgeson, University of North Carolina, Greensboro / Gonzaga University, Spokane, WA

As climate change becomes a concern, it is apparent that more needs to be understood about how plants evolve in changing environmental conditions and how this can affect both the ecosystem in general and food crops specifically. One of the most efficient ways of gaining insight in this area is through mathematical modeling. Our hypothesis is that resource allocation tradeoffs and other trait correlations are generated by cause-effect relationships between traits expressed during development. In this study, we simulate resource allocation traits expressed in the life history of Arabidopsis lyrata as a causal network in order to better understand how phenotypic evolution is shaped by environmental and genetic variation. In addition to generating values for specific phenotypic traits the model was also used to generate survival predictions and total reproductive output values, which are components of plant fitness. If the model was representative of how genetic and environmental variation influence phenotypic traits, we predicted that the correlations between phenotypic traits generated by the model would be similar to correlations found in field data. We found that the correlations generated from the model and those found in field data were in fact similar, indicating that this model could be a useful tool for understanding how tradeoffs in plants arise. The model also gave novel insights into how alleles associated with increased vegetative growth could be advantageous for survival in certain environments whereas alleles associated with increased reproductive growth could be advantageous in other environments. This finding provides a mechanism to explain adaptive evolution in resource allocation strategies, which has been found in reciprocal transplant field studies.
[Acknowledgement: National Science Foundation, University of North Carolina at Greensboro Office of Undergraduate Research]

Faculty Advisor: David Remingtom, dlreming@uncg.edu

OA #43
Optimizing Micropropagation in Vitis Vinifera

Keeona Lawrence, Fort Valley State University

Vitis vinifera, better known as grape vine, commercially produces fruit for wine consumption and is known to have advantageous medicinal properties. With over 5,000 varieties of wine grapes, Vitis vinifera can be found on every continent on Earth, except Antarctica, giving each species unique fruit qualities. Conventionally, breeding methods have been used to increase drought resistance, ripening time, and other similar factors. To help with research and breeding programs, a dwarf variety of Vitis vinifera "Pixie" was developed as a model system for research, investigating protocols for regeneration and transformation. The objective of this project was to increase the regeneration and genetic transformation rates of known Vitis vinifera species. Basic micropropagation on Pixie and Chardonnay, and Agrobacterium-mediated transformation was tested in Pixie. Immature leaves from the top segment and growing tips were excised from upper portions of in-vitro grown Chardonnay grapevines and placed on selective media for direct shoot regeneration. After 4 weeks, regeneration started to occur on the leaf lamina and some wounded areas of Chardonnay explants. In addition to direct shoot regeneration, Agrobacterium was utilized to introduce genes into leaves and growing tips of in-vitro grown Pixie. After 4 weeks on selective media, there was a very small percentage of surviving explants that appeared to have started to regenerate. This could be possibly due to the high levels of antibiotic in the selection media or the pretreatment of the explants. In conclusion, the expression of GUS (β-glucuronidase) in Pixie was indicative of genetic transformation success. Also, direct shoot regeneration of chardonnay explants was a success, although the survival of plantlets is of great concern. Focus will be directed toward establishing an efficient regeneration and Agrobacterium-mediated transformation protocol for all varieties of Vitis vinifera. Particle bombardment will also be utilized in future studies involving grapevine species. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #44
PCR to Distinguish Diploid and Triploid Forms of Butomus Umbellatus

Amy Stiffarm, Salish Kootenai College
Elizabeth Rutledge PhD, Salish Kootenai College, MT

Butomus umbellatus (flowering rush) is an invasive species in Flathead Lake that was first documented in 1964. Currently there are no treatment methods against the invasion of flowering rush. To help find a method of control, the particular form of population needs to be determined: diploid form (26 chromosomes) or triploid form (39 chromosomes). The chromosome squash technique to count the number of chromosomes is the current method, but is cumbersome and depends on obtaining rapidly dividing cells in root tips. This research is aimed at establishing an alternative method utilizing Polymerase Chain Reaction (PCR) to distinguish diploid or triploid forms of flowering rush. PCR is a simple, quick method that requires only plant DNA, that is easily isolated and stored at -80°C to be readily available. The method utilizes a single nucleotide polymorphism (SNP). In order for a SNP to be

located, regions of the plant genome need to be sequenced. There is very little sequence data on flowering rush, therefore primers were designed based on conserved genes inside predicted exon boundaries in organisms related to flowering rush.

Thus far, two amplicons were obtained using a zinc transporter gene found from Allium cepa (onion). One of these PCR products was purified and sequenced, revealing a 185 base pair product and a possible SNP. Another amplicon was acquired using a xyloglucan endotransglucosylase/hydrolase gene from Sagittaria pygmaea (dwarf arrowhead). The PCR products revealing these amplicons were ligated into the plasmid pCR2.1-TOPO and transformed into TOP10F' chemically competent cells. Plasmid DNA was isolated from six of the clones. Four of the plasmids contained inserts verifying successful ligation and transformation of two of the PCR products. However the area that was sequenced and possesses the possible SNP was not inserted into the vector for the samples analyzed thus far. Optimization of PCR reactions will be conducted by using a gradient temperature for the annealing step and a gradient time for the extension step.

Further sequencing reactions will be conducted to look for other SNPs. Primer design will continue until a SNP within a single copy region has been verified. Fluorescent TaqManTM probes can then be designed to the individual alleles to verify diploid or triploid form of the flowering rush. *[Acknowledgement: The National Institutes of Health, NIGMS RISE Program R25-GMO76323, provided funding for this research.]*

Faculty Advisor: Elizabeth Rutledge, elizabeth_rutledge@skc.edu

OA #45

Agrobacterium-Mediated and Biolistic Transformation Methods Were Used to Confer Resistance to Stress Cold of Jatropha Curcas Using Reporter Genes (GUS and GFP) and CBF3 Gene With a Stress Inducible Promoter (rd29A)

Aurellia Whitmore, Southern University at New Orleans

Jatropha curcas is a non-food, perenial biofuel crop geographically limited to the tropical and subtropical world. To confer resistance to cold stress, we transformed Jatropha using Agrobacterium-mediated and biolistic transformation methods. We used reporter genes (GUS and GFP) and CBF3 gene with a stress inducible promoter (rd29A) in the transformation studies.

Successful transformation with GUS and GFP were demonstrated using GUS staining and microscopic observation of green fluorescence respectively. GUS transformants were PCR positive and molecular analysis is being carried out on putative CBF3 transformants. *[Acknowledgement: Thank you to the National Science Foundation for their fellowship, Pennsylvania State-Harrisburg (Ben Tabatabai, Dr. Puthiyaparambil Josekutty, Dr. Sairam Rudrabhatla), Southern University at New Orleans, (Dr. Murty Kambhampati, Dr. Illya Tietzel).]*

Faculty Advisor: Illya Tietzel, itietzel@suno.edu

OA #46

Diversity, Biogeography and Evolution of Macrolobium (Leguminosae-Caesalpinioideae) of the Guiana Shield

Vincent Williams, University of the District of Columbia

The Leguminosae (650 genera/~18,000 species) is the third largest family of flowering plants and the second most economically important family. Macrolobium (ca. 70-80 spp.) is economically important, morphologically diverse and taxonomically challenging. Richard Cowan circumscribed the genus in 1953; no recent taxonomic or phylogenetic studies have been untaken. We surveyed 4 molecular markers, trn-L, psba-trnH, CNGC4 (cyclic nucleotide gated channel-like protein) and ITS (internal transcribed spacer region), for phylogenetic utility and evolutionary reconstruction for 10 species of Macrolobium found on the Guiana Shield. A total of 11 outgroup taxa were selected including one taxa from the punitive sister genus, Paramacrolobium, which is found only in Africa. DNA was isolated using Qiagen Plant DNeasy kits and amplification using PCR and fluorescent sequencing was done following established molecular methods (Redden et al., 2010).

DNA sequences were aligned using standard two-step procedures of automated alignment (Clustal) followed by manual refinement (Se-Al) and phylogenetic inference was done by parsimony (NONA and PAUP). We explored partitioned and combined molecular datasets to detect the level of information provided by different types of data and their potential incongruence. The strength of support for individual nodes in the trees was evaluated by jackknife and bootstrap. We found that the two plastid markers, trn-L and psba-trnH, had the most sequence variability. For the species found on the Guiana Shield, two major clades were recovered in the total evidence analysis; one clade containing species with four sepals and another clade with species with five sepals.

The data indicate that these Macrolobium group within the Brownea clade and are most closely related to the African Paramacrolobium. This supports the current hypothesis that a number of legume taxa originated in Africa and radiated to South America. Future research will include increased taxon sampling of this genus, incorporation of addition molecular markers, and inclusion of morphological characters. (*Redden, K.M., P.S. Herendeen, K.J. Wurdack, and A. Bruneau, 2010).* Phylogenetic relationships of the Northeastern South American Brownea clade of tribe Detarieae (Leguminosae: Caesalpinioideae) based on morphology and molecular data. Systematic Botany 35: 524-533. *[Acknowledgement: This study was supported by a grant from NSF/HBCU-UP awarded to the STEM Center, University of the District of Columbia.]*

Faculty Advisor: Dr. Karen Redden, kredden@udc.edu

Social Sciences/Psychology/Economics

OA #47
Effects of Serotonin Depletion in Rats: Impaired Reward Learning, Intact Motivation

Kathleen Carlos, California State University, Los Angeles

Aside from the well-known influence of serotonin (5-HT) on emotional regulation, in recent years a growing body of data has unmasked the role of this neurotransmitter in cognition. In experimental animals, manipulations of 5-HT vary from pharmacological, genetic, lesion, and dietary with diverse assessments in the domains of learning, memory, and decision making. Parachlorophenylalanine (PCPA) depletes 5-HT by inhibiting tryptophan hydroxylase, the enzyme required for 5-HT synthesis and, if administered at sufficiently high doses, can result in a depletion of at least 90% of the brain's 5-HT levels. Few studies have investigated the effects of 5-HT depletions on cognitive flexibility.

This study assessed the effects of widespread 5-HT depletions on effortful decision making and visual discrimination reversal learning in rats, two cognitive flexibility tasks that require updating choices to changing cost and contingency, respectively.

We administered PCPA or saline (SAL) on two consecutive days (single injections of either 250 or 500 mg/kg, i.p.) and assessed their performance on these tasks. Consistent with previous reports investigating the role of 5-HT on effortful decision making, large doses of PCPA left effortful choices unaffected: rats continued to climb increasingly tall barriers to obtain larger rewards and were not work-averse compared to SAL-treated rats. Despite intact motivation to work for food rewards, rats receiving the largest 500 mg/kg dose of PCPA were impaired on autoshaping and pretraining compared to SAL-treated rats, spending significantly more time on these stages. The group receiving the 250 mg/kg dose of PCPA was unimpaired and learned at a comparable rate to SAL-treated rats. High performance liquid chromatography confirmed depletion of serotonin in select rat frontocortical subregions.
[Acknowledgement: Funded by CSU-LSAMP which is supported by the National Science Foundation under Grant HRD-0802628 and the CSU Office of the Chancellor. Also funded by National Institute of General Medical Sciences (NIGMS) of the National Institutes of Health (NIH) Grant R25 GM 61331.]

Faculty Advisor: Dr. Alicia Izquierdo, aizquie@calstatela.edu

Chemistry & Chemical Sciences

Biochemistry (not Cell and Molecular Biology and Genetics)

OA #48
The Effect of Calcium on Chloride Inhibition and Activation of Oxygen Evolution Activity in Higher Plants

Jeremiah Johnston, University of North Carolina at Greensboro

Oxygen produced by photosynthetic organisms is a product of the oxygen evolution complex (OEC) of photosystem II (PSII), the region responsible for regenerating the high-energy electrons of photosynthesis through the oxidation of water. Experiments examining the OEC in higher plants (Spinacia oleracea) have found that two inorganic ions, calcium and chloride, are both necessary for activation of the reaction to occur. Further experiments using bisubstrate models of enzyme kinetics have shown that, at high concentrations of chloride relative to a constant calcium concentration, the two ions no longer follow the trends expected by the model, and that the rate of oxygen evolution decreases. These observations suggest that, while the concentration of calcium remains constant, chloride may behave as an inhibitor to the OEC at high concentrations. In order to explore the properties of the apparent chloride inhibition, a primary investigation was conducted to test the hypothesis that chloride inhibition would be relieved in the presence of increasing concentrations of calcium.

In order to test this prediction, chloride activation curves of PSII, modeled after bisubstrate enzyme kinetics, were constructed over a range of 0.0 to 50.0 mM chloride at calcium concentrations of 0.5, 1.0, and 4.0 mM. These activation curves were plotted and fit to a Michaelis-Menten substrate inhibition model using SigmaPlot 11.0 software. Values of Vmax, Km, and KI were compared between each curve. The values of Vmax for the calcium concentrations 0.5, 1.0, and 4.0 mM were 2.7x10^2, 3.0x10^2, and 3.4x10^2 µmol O2*mg^-1*h^-1, respectively. The Km values were 0.6, 0.8, and 0.5 mM, and the KI values were 50, 40, and 90 mM for each of the aforementioned calcium concentrations, respectively.

Although it was observed that Vmax values correlated positively with increasing calcium concentrations, suggesting that calcium may set the upper rate of oxygen evolution in PSII, the values observed for both Km and KI were not consistent with any pattern of activation or inhibition, respectively, suggesting that chloride activation and inhibition of the OEC reaction behave independently from calcium concentration. Future exploration into this topic may include the refinement of the experimental procedures in order to introduce statistical tests into the analysis of the data and to improve the characterization of the role of chloride and calcium function in the OEC.
[Acknowledgement: Funding for the project was provided to the University of North Carolina at Greensboro via NSF REU grant

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Faculty Advisor: Alice Haddy, aehaddy@uncg.edu

CHEMISTRY (NOT BIOCHEMISTRY)

OA #49
Speciation of Some Tributyltin Compounds in Anacostia Sediments Using 119SnNMR Spectroscopy

Andrei Callejas, University of the District of Columbia
Xueqing Song, University of the District of Columbia
Robert Pike, College of William & Mary, VA

Triorganotins are the most toxic of organotin compounds, with tributyltin compounds being most toxic towards marine life. The speciation of Three tributyltin compounds (TBTs), tributyltin chloride (TBTCl), Bis(tributyltin) Oxide (TBTO) and tributyltin acetate (TBTOAc) under varying pH conditions (5, 7 and 9) was studied by NMR spectroscopy in both anaerobic and aerobic Anacostia River sediments. All TBT were found to first convert to a hydrated TBT species and then further decomposition depends on the speciation time and the nature of the sediments. The 119Sn NMR chemical shifts of the spiked sediments indicated that changes in the pH did not affect the speciation of the tin compounds in either aerobic or anaerobic sediments. Dealkylation to mono/dibutyltin species was observed when speciation time is 4 weeks or longer. This dealkylation is very limited as the signal around -341 ppm is very weak for all sediment samples. This would suggest that the decomposition of toxic TBTs to low toxic DBT or MBT should take more than 8 weeks in sediment. A comparison of the strength of signal of dealkylation species and undecomposed TBT species revealed that only less than 5% was decomposed to less toxic DBT or MBT. Future work may include speciation of some Triphenyltin compounds (TPTs) in Anacostia or Potomac River sediments. *[Acknowledgement: This study was supported in part by a grant from DC Water Resources Research Institute WRRI awarded to Dr. Xueging Song Ph.D., Professor for the Department of Chemistry and Physics, University of the District of Columbia, Washington, DC 20008. Further funding awarded by the MARC U*STAR Honors Program.]*

Faculty Advisor: Dr.Xueqing Song, xsong@udc.edu

OA #50
Synthesis of Gold Nanorods and Their Nanoscale Ionic Materials

Vashti Campbell, Cornell University

The electromagnetic, catalytic, and optical applications of nanoparticles are numerous. The use of nanoparticles in devices, industry, and medicine is on a rapid incline. Some uses are in bio-imaging, drug delivery, and solar cells. We hypothesize that upon synthesizing metallic nanoparticles at different aspect ratios their properties will vary. Organic synthesis was utilized via seed mediated growth to produce gold nanorods. The rods separated from the spheres using centrifugation and were functionalized with mercapto-3-propane sulfonate (MPS). The rods were also used to make ionic liquids. Nanoscale ionic materials (NIMs) are hybrid organic-inorganic composites. Combination of the materials creates a fluid nanocomposite material inheriting both properties of the components. The properties of the functionalized nanoparticles and ionic liquids were measured using UV-Vis, FTIR, TEM, Raman scattering, TGA, and DTGA. We found that we can tune the optical properties of gold nanorods according to surface functionalization. Also, nanofluids change alignment when sheared and this gives rise to new optical properties. Lastly, different organic materials can be used for the surface functionalization of noble metals which leads to new composites. This project is ongoing. *[Acknowledgement: The National Science Foundation, Cornell University, Cornell Center for Materials Research, Professor Emmanuel Giannelis, Professor Christopher Umbach, Dr. Panos Dallas, and The Giannelis Group.]*

Faculty Advisor: Panos Dallas, pd238@cornell.edu

OA #51
Design and Synthesis of Benzimidazole for DNA intercalation

Alisha Fisher, Spelman College

According to the American Cancer Society there is a higher incidence of breast cancer among African American women than in any other race. With such significant health disparities, it is necessary to find therapeutic drugs that can inhibit the growth of breast cancer cells. Benzimidazoles are organic compounds that have been highly suggested to inhibit growth in cancerous cells by binding to DNA in between its base pairs to cause buckling or unraveling of the substrate via a process known as DNA intercalation. Based on this statement, it is hypothesized that a Benzimidazole-based molecule can be used to develop drugs that prevent survival in breast cancer cells by acting as DNA intercalators. The specific goal of this project is to develop a synthesis for such compounds. The first step of the synthesis is a Suzuki coupling using a boronic acid and a thiadiazole compound. The second step of the synthesis is a lithium aluminum hydride reduction. The critical third step of the synthesis is the ring forming reaction. Four traditional and microwave reactions were explored for this step. The first reaction used lead oxide and nitrobenzaldehyde at room temperature, the second and third reactions used nitrobenzaldehyde in the microwave and at room temperature, and the final reaction was done in the microwave using sodium hydrogen sulfite, dimethylacetemide, and nitrobenzaldehyde.

Each step was characterized using flash chromatography and TLC. It was found that the microwave procedures gave better outcomes. The results of synthetic strategies will be presented. Further exploration of this topic will include how the reaction conditions can be modified to increase the yield.
[Acknowledgement: This investigation has been funded in part by a grant from NIH/National Center on Minority Health and Health Disparities 5P20MD000215-5070002 MBRS-RISE Grant Number 2R25GM060566-09A1 Teledyne ISCO Grant #2425.]

Faculty Advisor: Dr. Winfield, lwinfield@spelman.edu

OA #52
Refractive Index Sensitivity of Dye-Doped Silica-Coated Gold Nanorods

Kayla Love, University Texas at Austin
Karole L. Blythe, Kathryn M. Mayer, and Katherine A. Willets, Langston University / University of Texas at Austin

Noble metal nanoparticles have distinguished optical properties that can be beneficial for biological applications, surface enhanced spectroscopy, and catalysis. The nanoscale size of these particles can be both beneficial as well as can pose various limitations. It is known that silica coated gold nanorods (AuNRs) have a linear wavelength response to increasing refractive index; however, there is a limit to how much an image can be resolved due to the size and shape of a particle. The size of the particle adds to the difficulty in detection. The Localized Plasmon Resonance (LSPR) of the dye-doped silica-coated AuNRs changes in different solvents. Gold nanorods that are rinsed in organic solvents demonstrate specific trends that help identify the environment of the nanorod. Broadening the ability for detection of the AuNRs should invariably increase the probe capability of the nanorods. The present study was to increase the fluorescence of the silica coated gold nanorods rinsed in various organic solvents using Nile red dye and then to show that presence of the dye will not affect these trends. This will then lead to additional probes for detecting the AuNRs. We synthesized gold nanorods, then etched them using hydrochloric acid for size adjustment. We then silicacoated the nanorods and imbedded Nile red dye into the pores of the silica shell. Next, we took the UV-Vis spectrum of the silica coated nanorods in different solvents and plotted the wavelength of maximum absorbance against refractive index. Our results indicated that the linear trend for the refractive index and LSPR were indeed maintained. Our future studies will include conducting tests using the coated AuNRs and rinsing them in organic solvents with and without Nile red dye to help determine if the Nile red dye is a contributing factor in the established trend.
[Acknowledgement: HBCU-UP, LSAMP, Welch Foundation, REU Program]

Faculty Advisor: Dr. Coleman, Jkcoleman@lunet.edu

OA #53
Effects of Titanium Dioxide Carbon Nanotubes on Human Fetal Osteoblast Cells

Shantell Phillips, Texas Southern Univerisity
Perla Gonzalez, Edidiong C. Obot , Renard L. Thomas, and Bobby L. Wilson, Texas Southern University

Regenerative medicine is the process of creating functional tissues to repair or replace tissue or organ function lost due to damage. Bone diseases are very common today; many are untreatable and if able to be treated take 6-12 months to fully heal. A need for a bone regenerating scaffold is way past due. Carbon nanotubes have already been discovered as a bone regenerating agent due to their flexibility and high structural form. Titanium dioxide has also been discovered to have a strong affinity to carbon, and titanium by itself is the most common metal used for cementless implants. Through the process of electrodeposition, carbon nanotubes are coated with a layer of titanium dioxide, forming titanium dioxide carbon nanotubes (TiO2-CNTs). The creation of this new material is prepared with anticipation that these two powerful metals will work as a team to become one strong scaffold. This experiment tests and compares the toxicity of single walled carbon nanotubes (SWCNT) and titanium dioxide carbon nanotubes (TiO2-CNT) and their effects on Human Fetal Osteoblast (hFOB). A dose-response assessment is done to measure the different concentrations as well as analyze the toxic effect each concentration has on the hFOB cells. After the exposure of the TiO2-CNTs and SWCNTs, a Neutral Red Assay is performed to determine the percent cell viability which is crucial for understanding the cellular response of hFOB cells during the exposure of TiO2- CNT. Due to the results of both experiments, this study discovered that the effect of SWCNTs on hFOB cells is greater when hFOB cells are exposed to a lower concentration of SWCNTs. The SWCNTs were found to be nontoxic to the hFOB cells and future studies will determine the toxicity of TiO2 when exposed to the hFOB cells. This research predicts that the TiO2-CNTs will have an effect on the hFOB cells and increase their strength. If TiO2-CNTs are found to be non-toxic to the hFOB cells and cause improved cell growth, this nanomaterial will have the potential to become a bone enhancing agent.
[Acknowledgement: National Science Foundation HBCU-UP]

Faculty Advisor: Renard Thomas, thomas_rl@tsu.edu

OA #54
Analysis of Drug-Protein Binding Phenomena Using Nuclear Magnetic Resonance

Ekundayo Platt, Savannah State University

As the most abundant protein in human blood, human serum albumin (HSA) plays a major role in drug delivery and exhibiting its pharmacologic effects. HSA is an important protein in drug

research because of its high affinity for binding with numerous ligands. The fact that a drug can only exhibit its pharmacologic effects when free from protein such as human serum albumin is the basis for this research study. The focus of this project was to use NMR to analyze whether an increase in the concentration of the anti-depressant Imipramine resulted in more of the drug being free from human serum albumin. This research addressed a topic that is important to public health. The development of drugs with moderate or weak binding to HSA would be beneficial.

We hypothesized that as the concentration of Imipramine is increased the molar fraction of imipramine bound to HSA will decrease. And this was verified by 1H NMR pulsed-field-gradient (PFG) diffusion measurements. The experimental procedure consisted of preparing solutions that contained a constant concentration of HSA (0.5mM), and varying concentrations of Imipramine. The concentrations of Imipramine that were coupled with 0.5mM human serum albumin were 12.0mM, 21.78mM, 32.19mM, 44.19mM, and 56.19mM. The samples were inserted into the NMR spectrometer and data was obtained from their 1-dimensional and diffusion spectra. The diffusion spectra were used to determine the diffusion constant of the different samples. A larger diffusion constant is attributed to a smaller molecule and in our case it also meant Imipramine was less bonded to HSA.

Our results showed that an increase in the concentration of Imipramine leads to a larger observed diffusion constant which suggests that a larger portion of Imipramine remains free from human serum albumin at higher concentrations. In conclusion, this research was able to show that an increase in a drug's concentration decreases its relative binding fraction to human serum albumin. The binding is also pH-dependent. The binding information obtained from such study can be important for improving the efficiency of drugs and development of new drugs. *[Acknowledgement: PS-LSAMP]*

Faculty Advisor: Dr. Zhiyan Song, songz@savannahstate.edu

OA #55
Mobility of Hydrogen on Catalytic Metals

Tiorra Ross, Howard University

Pyrolysis oil is one of the most widely used complex mixtures in the chemical industry. However, pyrolysis oil contains a variety of highly reactive oxygenates, which makes upgrading necessary for real world usage. By implementing hydrodeoxygenation (HDO), oxygen-containing groups are replaced with hydrogen, and water is formed as the only side-product. However, more stable catalysts are needed to improve hydrodeoxygenation (HDO).

Hydrodeoxygenation (HDO) requires hydrogen to be dissociated on the surface of the catalyst. For our experiment, characterizations of reducible oxide catalysts were studied. Hydrogen-Deuterium exchange on reducible oxides was analyzed to characterize the availability of hydrogen on the surface of the catalyst. The catalysts were heated in a tube reactor in the presence of argon gas. Rates of hydrogen and deuterium gas were injected into the flow and the reactor was monitored for H_2, HD, and D_2. The formation of Hydrogen-Deuterium was observed and discussed. *[Acknowledgement: REU-SURE Program, Georgia Institute of Technology School of Chemical and Biomolecular Engineering]*

Faculty Advisor: Carsten Sievers, sievers.carsten1@gmail.com

OA #56
The Study and Investigation of Natural Insecticidal Properties of Capsaicin

Rickeia Q. Selmon, Southern University at New Orleans
Carl P. Johnson, Southern University at New Orleans

An insecticide is a pesticide used to exterminate insects. The active component in insecticides usually targets insect's inhalation and causes stomach poison. An insecticide's toxic chemicals kill the insect intended as well as other animals. Although, insecticides are effective, most pose serious harm to the ecosystem and human life. Designing an insecticide that is natural, but effective will be essential for humans and other animals. This research goal is to design, study, and investigate capsaicin (8-methyl-N-vanillyl-6-nonenamide) as a potential insecticide. Medically, capsaicin is used to treat poor circulation, high cholesterol, heart disease, and atherosclerosis. However, this research focuses on the study and investigation of natural insecticidal properties of capsaicin. *[Acknowledgement: This research was funded by the National Science Foundation HRD-0928797.]*

Faculty Advisor: Dr. Carl P. Johnson, cjohnson@suno.edu

OA #57
Metal Complexes in Flourescence Sensing of Arsenic (III)

Jessica Simpson, University of Georgia

In this study, a real time methodology for detecting arsenic III in the environment was attempted to be developed. This aspect of measure is important for the principle of detecting metal pollutants present in the environment, particularly water sources in this case. Today elemental arsenic exists in the environment in oxidation states (III) and (V) with As (III) posing a major health threat due to its high level of toxicity. Different techniques including colorimetry, spectrometry, and electrochemistry are commonly used for arsenic sensing. Test results from these methods may take weeks depending on certain factors such as selectivity and concentration. In contrast

to this, fluorescence detection has a number of benefits with high sensitivity and selectivity over other pollutants (Cd, Hg, Pb, etc.) being primary. To date, arsenic has been detected using substances that are only organic soluble. For potential sensing in drinking water sources this poses a dilemma. The use of metal complexes in the sensing of arsenic (III) is a promising methodology that would allow for the detection of the pollutant in moist environments. Upon contact with the poisonous element, displacement of a metal will take place and as a result turn on the fluorophore. Fluorescence occurs as the outcome.

To achieve this, the metal complex, (ZnF2), was synthesized by reacting organic compound, (F2), with a zinc salt under anaerobic conditions. Qualitative characterization of the final product indicates a mixture of both unreacted F2 and ZnF2. Qualitative testing suggests that there is a need for the mixture of the two compounds for overall stability purposes of the zinc complex. *[Acknowledgement: National Science Foundation SURO]*

Faculty Advisor: Dr. Dwayne Danels, danielsd@fvsu.edu

OA #58
Characterization of Human Serum Albumin Interaction with Zinc Phthalocyanine Tetrasulfonic Acid by Circular Dichorism Spectroscopy

Lana Thomas, Savannah State University

A circular dichroism method was developed for monitoring the interaction of the protein, human serum albumin (HSA), with the photosensitizer, zinc phthalocyanine tetrasulfonic acid ($ZnPcS_4$). The primary requirement for binding analysis by this technique is that there must be a change in CD signal accompanying ligand binding. Complexation between the two species causes no discernable changes in the CD spectrum of the protein. However, thermal denaturation of HSA at 80.0°C resulted in a significant change to the CD signal of the protein. As an alternate method, the thermal unfolding of HSA was monitored at 225 nm as the temperature of the sample compartment was increased from 25 to 100.0 °C. The CD signal produced exhibited a sigmoidal transition of the protein with its native conformation shown at low temperatures and its unfolded conformation shown at temperatures above 80.0 °C. The data was fitted to dose-response curve to determine the transition midpoint, T_m of the protein. A shift in T_m toward higher temperatures was expected because energy is needed not only to unfold the protein, but also to disrupt the protein-ligand complex formed at room temperature. Binding between the protein and ligand was monitored by a shift in T_m as the protein was titrated with $ZnPcS_4$. The shift in T_m may be used to calculate a dissociation constant for the protein-ligand complex at T_m. The key calorimetric parameters needed for affinity calculations are the enthalpy change, ΔH and the heat capacity change ΔC_p for the interaction. *[Acknowledgement: National Institutes of Health]*

Faculty Advisor: Dr. Cecil Jones, jonesce@savannahstate.edu

NANOSCIENCE

OA #59
Self-Assembling Peptides with Embedded Fluorescent Cores

Mary Bedard, Elon University
John D. Tovar, Dr. William L. Wilson, Brian Wall, and Dr. Stephen R. Diegelmann, Johns Hopkins University, Baltimore, MD

Self-assembling peptides which incorporate p-conjugated units within the peptide backbone have shown potential for bridging the gap between electronic and biological interfaces. Once assembled, the peptide units act as insulation, shielding the inner p-electron rich portion. This assembly process forms fibers which are 1-5 nm in diameter and in excess of 1 micron in length, very similar to β amyloid plaques. This produces overlap of the internal p-electrons in the center of the assembled fibers. Meanwhile, the peptide chain forms the outer section of the fiber and is free to interact with cells.

The present study sought to engineer various peptide chains with embedded chromophores that demonstrate the self-assembly process in order to probe characteristics of the process and to examine the possibility of further assembling these fibers into macroscopic noodles, or nanowires. Elucidating the process of assembly of amyloid fibers may provide insight into the emergence of β amyloid plaques associated with diseases such as Alzheimer's and Parkinson's. Peptides were synthesized by solid phase synthesis and purified with High Performance Liquid Chromatography (HPLC). Rapid extrusion of approximately 10 µL of slightly basic 1 wt. % purified peptide solution into 1 M HCl successfully yielded aligned, birefringent noodles. Uniformly aligned noodles were identified with Polarized Optical Microscopy (POM) and Scanning Electron Microscopy (TEM). Feasibility of aligned noodles as nanowires was examined by incorporation of sequences associated with neuronal cells, specifically IKVAV, into the peptide unit. Human Neuron Crest Stem Cells seeded on top of a random peptide gel yielded increased neuron differentiation and network growth, indicating minimal toxicity to cells. Characteristics of the self-assembly process of amyloid fibers were studied with Fluorescence Correlation Spectroscopy (FCS), with aggregates observed in basic peptide solutions upon addition of acid or exposure to acid vapor.

Overall, the data indicates successful creation of self-assembling peptides, a method of assembly to produce noodles constituted of aligned amyloid fibers and the possibility of their implementation in a biological setting. Future research focuses on continuation of FCS analysis to understand the mechanics of the self-assembly process and further cell work to determine the

viability and efficiency of the nanowires. *[Acknowledgement: This study was supported, in part, by the Research Experience for Undergraduates (REU) program offered by the Institute of Nanobiotechnology at Johns Hopkins Universtiy with funding from NSF.]*

Faculty Advisor: Dr. John D. Tovar, tovar@jhu.edu

OA #60
Characterization of Self-Assembled Monolayer of Gold Nanorod on Silicon Wafer and Its Application as Raman Sensor

Kinyata Cooper, Howard University
Dr. Charles Hosten and Maraizu Ukaegbu, Howard University

Gold nanorods have distinct optical and plasmonic properties which can be applied to the design of bio-imaging equipment and biosensors. These unique properties of the Au nanorods can be utilized in the design of Raman sensors which probe the structure and orientation of self-assembled monolayers. Gold nanorods were synthesized using the seed mediated growth method. The nanorods were characterized using UV-visible spectrophotometry. Peaks were observed at 530 and 760 nm in the absorbance spectra of the nanorods and are indicative of rods having a length of 45 nm and a diameter of 15 nm. The gold nanorods were assembled on silicon wafers and the morphology of the resulting surfaces was characterized using SEM. This surface was used in surface-enhanced Raman (SERS) studies of adsorbed 2, 3-dichloro-1, 4-naphthoquinone (DNQ). The orientation of DNQ adsorbed on the Au nanorod surface was deduced from the SERS spectra. Density functional theory and potential energy distribution calculations will be performed to provide additional support to the conclusions derived from the SERS studies. *[Acknowledgement: This material is based on work supported by the National Science Foundation under Grant HRD-0410328 which funds the Howard University Science, Engineering and Mathematics (HUSEM) Program. The goal of the HUSEM program is to promote academic achievement as well as increase the numbers of underrepresented minorities who receive baccalaureate and graduate degrees in science, technology, engineering and mathematics disciplines.]*

Faculty Advisor: Charles Hosten, chosten@howard.edu

PHYSICS (NOT NANOSCIENCE)

OA #61
Evanescent Wave Laser Spectrometry-Improved Design Considerations

Daphne Hauser, Shaw University
Lou Yak and R. Kumar, Shaw Universty

Light waves incident at an optical interface after reflection recombine to produce sinusoidal standing wave patterns normal to the interface boundary. Evanescent waves are generated in the interface that propagate through the overlaid medium (sample in this case) with attenuated amplitudes eventually decaying to a depth of few microns, 0.5µ - 5µ . The evanescent wave field amplitude attains a maximum value at the critical angle, finally decreasing to zero at 90 degrees. This conceptual framework is the basis of Evanescent Wave Laser Spectroscopy, EWLS, and this first principle knowledge base is the focus of this investigation. It allows us to create proof of principle data to interrogate the limitations and capabilities of EWLS equipments. This is also well-known total internal reflection optical phenomenon that is finding applications in diverse disciplines such as in medicine and biology, and table-top plug-and-play versions have been designed to ease the data collection and analysis in undergraduate STEM laboratories. Optical fibers are transparent in the mid infra-red spectral range, and thus further improving the design consideration from single reflection diamond evanescent wave sampling to multiple reflection sampling techniques. One specific state-of-the-industry laboratory equipment from Bruker Optics, ALPHA FT- IR Spectrometer sampling solids, liquids and gases will be discussed. *[Acknowledgement: This study was supported, in part, by a grant from NSF HBCU-UP awarded to D. Sharma, Ph.D, Academic Excellence Project, Shaw Unversity, Raleigh, NC.]*

Faculty Advisor: R. Kumar

OA #62
Low Spin-High Spin Transition Materials for Spintronic Applications

Kevan Julye, North Carolina State University / Shaw University
Will Rice and Frank Sui, University of North Carolina at Chapel Hill
David A. Shultz , North Carolina State University

Transition metal elements particularly Fe, Co, Mn are well known for stabilizing a variety of mixed valence inorganic complexes exhibiting ferromagnetism . Transition metal complexed organic molecules show somewhat robust spin-only magnetism, and a switch between low and high spin states under external stimulus is very desirable for spintronics applications in high technology computer and communication devices. One such metal complex Co(dioxolene)2(4-X-py)2, X being a ligand atom or molecule has been synthesized in crystalline form in Professor Shultz's laboratory, Chemistry Department of NC State University; and is observed to undergo a reversible transition between ls-CoIII (S = ½) to hs –CoII (S=3/2), and is a potential candidate material for producing a magnetic switch signal in spintronic devices. The ligand X is believed to trigger the low spin-high spin transition by inducing a change in molecular geometry, and this inter-conversion has been tested by incorporating different ligand substituents. This ligand attachment improves the substrate attachment in thin film preparation, and in configuring the elements of spintronic

device fabrication. This rapid structural inter-conversion producing low spin-high spin transition is supported by thermal, magnetic, and susceptibility measurements. We have also measured current-voltage characteristics of a model device structure by four-point Kethley semiconductor measurement system, and its non-linearty is promising for further studies. *[Acknowledgement: This project was funded by a grant from the NSF: ECCS-070731.]*

Faculty Advisor: Dr. Dubroy, tdubroy@shawu.edu

COMPUTER SCIENCES & INFORMATION MANAGEMENT

COMPUTER SCIENCE & INFORMATION SYSTEMS

OA #63
Navigating Programmed Mobile Robots through a Maze

Husni Agri, Elizabeth City State University

Robots are becoming increasingly popular in the 21st century. People have been incorporating them in different industries from space exploration, manufacturing, and even in their daily lives. The objective of this project is to assemble and program an iRobot Create to execute a series of tasks, where they may be applicable in different environments; as we know people use robots for human substitution in places where it may be dangerous for humans to maneuver. Some of these environments include: extremely hot temperatures, bomb diffusions and nuclear reactors. There is a strong interest in personalized robots to do house hold duties as we are rapidly engaging in newer and more sophisticated technology. Some of these duties include: security purposes, experimental activities, taking out the trash to vacuuming a floor. Therefore the goal of this project is not only to program the robot, but also to modify it by incorporating real life useful functions and to serve as a platform for improving society.

The first initial step when programming the iRobot Create was to download the appropriate software. The software that was utilized throughout daily research is called Realterm. Realterm is terminal software that allows communication from the computer to the robot. This program was used to send scripts and commands created for the robot to begin moving. Other applications such as C, C++, Open Interface Command Reference, etc., were commonly used in developing a true understanding of how to program the robot. In the end, the complete robot was capable of turning in different angles, playing songs and being able to correctly maneuver through a maze at different speeds and find its destination. *[Acknowledgement: Our Mentor Dr. Moayed Daneshyari]*

Faculty Advisor: Dr. Moayed Daneshyari, mdaneshyari@mail.ecsu.edu

OA #64
Gene Expression Recognition of AML vs ALL

Carien Anderson, Mississippi Valley State University

This project involves working with a dataset of gene expression profiles that are saved in a Microsoft Excel worksheet. The project idea and data were obtained from [KDNuggets 2010] and is based on the pioneering work of MIT biologists described in [Golub, et al. 1999]. The task is to use Tiberius, a data mining and visualization tool for Windows to build prediction models, to distinguish between patients with acute myeloid leukemia (AML) and acute lymphoblastic leukemia (ALL), using gene expression data. Acute myelogenous leukemia (AML) is a fast-growing cancer of the blood and bone marrow. Acute lymphoblastic leukemia (ALL) is a fast-growing cancer of the white blood cells. We split the data to create ten different Excel files, five for training and five for testing. After running multiple sets of data through Tiberius, using a different training and test file combination, it was found that the M28170 Gene is the most important factor in determining whether someone has ALL. It was also concluded that X95735 Gene is the most important factor in determining whether someone has AML. Future testing would include testing more genes, for better specifications, and classifications of determining whether someone has ALL or AML. *[Acknowledgement: This project is sponsored by Mississippi Valley State University's Bioinformatics Institute located in Itta Bena, Mississippi, under the supervision of Dr. Abigail Newsome, and Dr. Charles Bland.]*

Faculty Advisor: Dr. Constance Bland, cgbland@mvsu.edu

OA #65
Brain-Computer Interface: A Physiological Approach For Measuring Engagement in Educational Video Games vs. Conventional Learning Techniques

Marvin Andujar, Kean University, NJ
Josh Ekandem, Ignacio Alvarez, Melva James, and Juan Gilbert, Clemson University, SC

This paper investigates the benefits of learning from educational video games compared to learning by reading from a text document. The participants were exposed to Lewis and Clark expedition via a video game or text document. During the learning task, playing the game or reading, participants wore the Brain Computer Interface (BCI) noninvasive Emotiv EPOC device to gather their level of engagement physiologically. After the learning sessions, post-experiment questionnaires were used to assess the amount of information retained after each session. The results of this study suggests that the educational video

games might not be significantly engaging, and also that learning by reading a handout may be better for retaining information. Furthermore, this paper briefly discusses the BCI device, and how it can be used to measure engagement of the participants. This study is important because it helps the current and future educators to measure physiologically the engagement levels of their students while learning specific information through any learning style. *[Acknowledgement: This material is based in part upon work supported by the National Science Foundation under Grant Number CNS-0914666. 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 National Science Foundation.]*

Faculty Advisor: Dr. Juan Gilbert, juan@clemson.edu

OA #66
Earth on the Go: A Mobile Website for Data Visualization

John Bell, Mississippi Valley State University

Being able to access information and other data at any given time is becoming increasingly critical in today's society. Through its website, the Environmental Visualization Laboratory (EVL) works to provide the public with detailed visuals and reports regarding past and present environmental conditions as well as future outlooks. However, the site's graphics-intense layout and imagery resolution is not ideal for mobile devices. Within the past 10 years, mobile phones have transitioned from being only a telecommunication device to a popular mode of obtaining information. In an effort to keep NOAA up-to-date with current technological standards, this project focused on developing a modified version of the existing website capable of being accessed through cellular phones and other mobile devices. Completion of such a task required extensive research and knowledge of computer languages utilized by various mobile web browsers. In addition, testing was conducted on multiple mobile platforms. The results of this project demonstrated how to successfully integrate selected features of a standard website into a mobile version, while also identifying the best practices for the future design of other mobile websites for NOAA. *[Acknowledgement: This study was funded by the NOAA Office of Education/Educational Partnership Program.]*

Faculty Advisor: Darrell James, djames@mvsu.edu

OA #67
Implementing a Wireless Sensor Network using the MEMSIC's Professional Kit

Lorson Blair, Grambling State University
Stephen Ellis, Grambling State University

Sensor networks consist of a large number of distributed nodes that organize themselves into a multi-hop network. These nodes implement a multi-hop networking protocol known as X-mesh, and are deployed under a Built-in Sensor Network Management Tool known as X-serve. Sensor motes have the capability to obtain various data types via radio frequencies and allow for storage of this data in a database for further analysis and empirical statistics.

The various data types these motes are able to monitor include light, acceleration, heat, and humidity. The range of the network motes peak at 100 meters and as such require the location of the nodes and their distance between each other as well as the base station to constantly vary from 10 meters to 90 meters to have allow motes to communicate with each other successfully. Motes are programmed two ways, (1) via USB-connection and (2) Over-The-Air-Programming (OTAP). Using the OTAP method, implementations to change the radio frequency motes use to communicate, (*the sampling rate motes are supposed to collect data, or to cause blinking LEDs),* are accomplished using programs known as MoteConfig. The deployment of the WSN requires a minimum of 2 Sensor Motes, a Base Station, a Processor/Radio Module, a Data Acquisition Board, and an USB Programming Board. On the basis of software, TinyOS and MoteWorks, NesC compiler, Cygwin, AVR Tools, Programmer's notepad, XSniffer, MoteConfig, Graphviz, PuTTY and TortoiseCVS and MoteView are components to sufficiently monitor, manage and manipulate a wireless sensor network on a PC with Windows XP SP2.

The implementation of this sensor network led to success in the following objectives:

- Decrease/Increase the sampling rate of the motes.
- Toggle the LED (red, yellow and green) on each mote.
- Configuration and experimentation of path costs between motes to the base station based on the network topology or the placement of the motes from each other.
- Collection and analysis of different data samples such as humidity, light and heat.
- Results: Using MoteView, historical data referring to the last transmission of data from a mote is recorded and tabulated. The data captured from our experiment show the categories of data types received and demonstrate the changes in the environment in different scales (i.e. light, humidity, pressure and etc). Future research will lead to encrypting data packets sent from node to node and creating a security table for finding malicious nodes.

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Faculty Advisor: Yenumula B. Reddy, ybreddy@gram.edu

OA #68
Emergency Airplane Evacuation Using Game Development Toolkit

Aaron Boothe, Bowie State University
Dr. Sharad Sharma, Department of Computer Science, Bowie State University

In order to maintain high standards for safety, airlines prepare for plane crashes through aircraft evacuation drills. However, real world aircraft evacuation drills are costly, time intensive, and are unable to simulate real dangers. The aircraft evacuation simulation that we have developed is designed to address these problems. Our objective is to create an experimental design setup for assessing human behavior in emergency evacuation of an aircraft among a team of players in a game set in a virtual environment. Our proposed airplane evacuation setup is created using a game development tool called Unity3D. It is a multi user environment to allow participants in different geographical locations to connect and experience the simulation together.

The program can be loaded onto any PC and creates a simulated aircraft populated by avatars controlled by living participants as well as computer controlled actors. The developed simulation is able to create a crash scenario with dangers such as fire, smoke, and injured and panicked passengers. The application could be used as a training tool for airline staff and emergency personnel as well as a tool for planning and testing the design of new aircrafts. We will conduct user studies and Virtual Reality experiments with virtual crowd to study human behaviors under panic, anger, stress situations that cannot be evaluated in real life situations. *[Acknowledgement: HBCU-UP]*

Faculty Advisor: Sharad Sharma, ssharad@gmail.com

OA #69
Analyzing Sink Mobility Models Based on Random Movement, Maximum Number of Uncovered Neighbors, and Maximum Energy of Uncovered Neighbors

Richard Fletcher, Mississippi Valley State University

The purpose of this research is to analyze three sink mobility models: the random sink movement, the maximum number, and the maximum energy of uncovered neighbors models and determine the model with the best overall performance. The random sink mobility model proved to be better when compared to the maximum number and maximum energy of uncovered neighbors models. This research is important because it covers conserving energy in mobile ad hoc network. Our research has lead us to creating three sink mobility models and determine which of the three has the best overall performance, in terms of reliability and energy conservative. Depending on the given conditions, each model calculated the average number of stops per round, the average number of data aggregation per round, the average number of data aggregation per stop per round, the total energy lost per round, the total distance traveled by the sink, and the average number of rounds for first node failure. Although maximum number and maximum energy of uncovered neighbors models performed better on certain conditions, they performed worst on other conditions; whereas, the random sink mobility model performed the same given any condition. In conclusion, mobile ad hoc network is working on conserving energy through creating and testing different models that collect data in different ways. In experimenting with these simulations, the model with the best overall performance will be the model that we will continue to build on for future references. Future research questions will include the introduction of newer data gathering models and how efficient those models will be when compared to the previous models. *[Acknowledgement: Natarajan Meghanathan]*

Faculty Advisor: Constance Bland, cgbland@mvsu.edu

OA #70
Techniques for Analyzing Software Safety: An Approach to Quality Safety

Courtney James, Mississippi Valley State University

For software-dependent systems in which failures can result in significant property damage, injury, or death, software safety must be a principal consideration. Software engineers involved with such projects in both the government and private industry require an understanding of existing software safety standards and practices, as well as an awareness of emerging trends and developments in the area. The task was to create a set of instructional materials appropriate for software engineers no matter what our previous level of experience with software safety implies. The first is to survey existing procedures and techniques, including software hazard analysis, fault tree analysis (FTA), failure modes and effects analysis (FMEA). Approaches to estimate the cost of including safety in software requirements will also be examined. The second is to review and analyze software-related accidents. Examples are the crash of a Korean jet (1997) and an American Airlines jet (1995), explosion of the Ariane 5 launcher (1996), loss of the Mars Climate Orbiter (1999), destruction of the Mars Polar Lander (2000), and the power outage across the Northeastern U.S. and Canada (2003). The role of software in these accidents was examined, and ways to avoid these problems in the future will be suggested. The third is to understand the limitations and problems of software safety standards such as NASA-STD-8719.13A, Military Standard MIL-STD-882D, DO-178B, and others. Documented lessons learned from these standards were demonstrated as a repository of the 'state of the art' as well as reported pragmatic issues of applying such standards in practice. As an example, in PowerPoint form, a process was show in one of the four major procedures used by engineers. This technique was verified as

the process of SFTA using the traffic light system using research of hazard, verification and validation analysis. These findings indicated that software safety is very essential not just to the field of computer science but also the analysis and knowledge of how engineers carefully design, prepare, and conduct a quality experience in inventions. Also many standards and procedures apply to the issues that refrain accidents *[Acknowledgement: This study was supported, in part, by a grant from NSF/Summer REU: Verification and Validation for Software Safety awarded to Eric Wong, Ph.D., Associate Professor in Computer Science, University of Texas at Dallas, Richardson,TX.]*

Faculty Advisor: Dr. Constance Bland, cgbland@mvsu.edu

OA #71
App Inventor: Tool for Serious Application Development?

Danielle Mason, Virginia State University

The presence of visual programming environments has been increasing over the past few years with the development of new technologies. Applications such as Scratch and now Google's App Inventor allow non-programmers the capability to produce their own casual games and applications. One of the main questions that arises when it comes to these environments is whether they are sufficient to create applications that are more powerful than the simple projects created by novices.
For this research, the development potential of Google's App Inventor was tested by attempting to produce a user-friendly Android phone application that allows farmers access to onsite farm data from a sensor network. The complexities of this application such as connectivity to a constantly changing database, parsing of JSON data, live updates, and a non-simple user interface with many capabilities allowed the programming limits of this visual language to be tested. App Inventor is composed of the Designer and the Blocks Editor. The Designer is used to create the user interfaces for the application under development. This capability already exists for a wide variety of languages using various integrated development environments such as Visual Basic and Eclipse. However, to develop the program logic, programmers normally are required to write perhaps thousands of lines of code using a precise syntax. App Inventor, on the other hand, allows the developer to drag-and-drop components that represent program logic and assemble like pieces of a puzzle. While this approach prevents the programmer from having to attend to minor syntactic details, it was found that the visual environment of the Blocks Editor presents its own challenges, particularly when creating applications of greater complexity. One challenge was that all the components must be contained within a single workspace making organizing and finding certain parts of the program's logic difficult. Another challenge was that there was no capability to dynamically create user interface components and data structure elements. As it stands, Google's App Inventor is not yet a suitable replacement for conventional coding. There is more that must be done to improve the ease of use for implementation of complex applications. Future research can be done to explore new methods to overcome the limitations indicated by the above results. *[Acknowledgement: This research is supported through the WBHRA-LSAMP program funded by NSF.]*

Faculty Advisor: Dr. David C. Walter, dwalter@vsu.edu

OA #72
Analysis of IP and DNS Traffic for Improved Cloud Network Security

Dwight Nelson, Tennessee State University

In all areas of computing and networking, security is of the utmost importance to efficiency and ease. Networking in today's market is changing because businesses are adopting the system called cloud networking. This system allows users to easily access shared materials through an external database. While the improvement in productivity and convenience is extraordinary, the increase in security concerns can be just as great. This research was put in place to test the hypothesis that an audit of the network's incoming IP and DNS traffic will produce useful information for security. This was done by developing a software system that reads incoming IP addresses and queries multiple databases. Through these queries information is gathered for the IP Geo-location, DNS info, blacklist details, and data types. This data is displayed in a graphical user interface that allows a network administrator to view and utilize the information for necessary security measures. Future research will implement a data mining subsystem that will allow administrators to recognize patterns of attack.
[Acknowledgement: This study is supported by a grant from NSF HBCU-UP Targeted Infusion grant awarded to Tamara Rogers Ph.D., Associate Professor in the Computer Science Department, Tennessee State University, Nashville, TN.]

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

OA #73
Birds of a Feather (BOF), Anomaly Detection using Time Series Analysis in Electronic Medical Records (EMRs)

Mostafa Shamsuddin, Tennessee State University
Dr. Bradley Malin, Vanderbilt University, TN
Dr. Sachin Shetty, Tennessee State University

Healthcare institutions have always been susceptible to the insider threat, but digitization of Medical Records has made vast quantities of data portable, magnifying the potential for insider threat. Electronic Medical Records (EMRs) provides a convenient and efficient way for Health care organizations to electronically store, and modify patient's records. However, if accesses given

to these systems are not managed properly, it can lead to doctors, nurses, and hospital staff accessing unauthorized patient records. With millions of daily access logs it becomes very difficult to manage access roles. It is critical to use Data Mining in the process of discovering new patterns from the data, and to analyze those patterns for a possible insider threat. Most current anomaly detection methods only detect users with abnormal behavior, not when their action deviates from prediction. In this paper we introduce a method called Birds of a Feather (BOF) to detect intruders. Because users are extremely temperamental, and quite variable in their behaviors, it is extremely difficult to watch them. BOF sets the patient as a threat and looks at a single patient over a course of a day or two to understand how users congregate on this patient and assesses if the patient deviates from the expected model. *[Acknowledgement: This study is supported by a grant from NSF HBCU-UP Research Initiation grant awarded to Sachin Shetty Ph.D., Assistant Professor at the Electrical and Computer Engineering Department, Tennessee State University, Nashville, TN.]*

Faculty Advisor: Sachin Shetty, fmostafa006@gmail.com

OA #74
Web Accessibility Analysis of Popular Content Management Systems

Joseph Shanahan, Auburn University
Daniela Marghitu, Auburn University, AL

This work presents data results from a web accessibility analysis of popular content management systems (CMS): Wordpress, Joomla, Drupal, Plone, Microsoft Sharepoint, YouTube, and Facebook. This analysis rates each of the CMSs based on their conformance to accessibility standards and evaluation tools including Section 508, WCAG, WAVE, Jaws Screen Reader, and color-blind testing. Furthermore, included are results from a K-12 computer camp that introduces students with disabilities to computer science. Specifically, this includes qualitative reports of a physically disabled student's use of Microsoft Kodu. Kodu is a 3D game maker that teaches programming and allows uploading to the web. More reports are included of another student with Asperger's syndrome as she uses the web. The work includes data collected from sources about people with disabilities, a graph explaining the increase in the need for web content that is accessible, data tables that outline the performance of popular content management systems and a Boolean test that determines whether or not they pass the most important accessibility standards. More information will be included about content management trends, the importance of accessible CMSs and a vision of an accessible internet. It contains a qualitative analysis and important results from a study of students with disabilities during a K-12 computer camp at Auburn University. Web Accessibility is a hot topic as we approach 2012. Over 21 percent of the U.S. population are visually or hearing impaired (ages 65 and over), and 6.8 percent who are from age 15-65[1]. And this does not include other web accessibility impairments such as physical, cognitive, neurological, and speech impairments. On July 26, 2011, The White House recommitted itself to enforcing and protecting civil rights with a special focus on Section 508: a web accessibility requirement for both inside and outside the government [2]. Modern trends in web development include The Protocols and Formats Working Group (PFWG) publishing of WAI-ARIA 1.0 on January 18th, 2011 [3]. This new development suite allows web developers to create Accessible Rich Internet Applications (ARIA) and make the web more accessible to people with disabilities [3]. This study is a comprehensive investigation of these important web accessibility issues. *[Acknowledgement: This study was supported by a grant from NSF/AASD-STEM during a summer internship program.]*

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Faculty Advisor: Daniela Marghitu, marghda@auburn.edu

OA #75
Analysis of Survey Results by Geographic Sector and Zip Code

Kendra L. Thompson, Mississippi Valley State University

The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) is committed to serving the needs of all of its customers. The NWS sponsors an annual Customer Satisfaction Survey for its users. The survey looks at various shared and unique aspects of the weather services provided, and request that its respondents rate the NWS's effectiveness in meeting their forecast and weather data needs. The survey produces ample data that aids NWS to improve or modify their services. The results of the National Customer Satisfaction Survey, particularly the open-ended comments that allow respondents to offer a "free-form" response for recommendations or suggestions about the quality and usefulness of NWS forecast products and services, are used to improve approaches made to reduce loss of life, property, and distribution of high-impact events.

Different methods were used to associate geographic sectors with zip codes within every sector. The open-ended comments of the survey were captured and evaluated by postal zip codes and geographic sectors. Common themes such as keywords

were derived to analyze recurring themes that are important to the NWS customers. A Visual Basic application was created to search on keywords associated with the different sectors mentioned in the Customer Satisfaction Survey to evaluate the use of the open-ended comments. The development of a C++ code was another method used to analyze the survey results; the code was designed to correlate postal zip codes with geographic sectors. The final phase of the project will result in presenting visual and simple interpretation of the survey results. Overall, the analysis of the survey results was intended to help NWS strive to make the world a weather-ready nation! *[Acknowledgement: This study was supported, in part, by a grant from NOAA Office of Education/Educational Partnership Program, awarded to Kendra L. Thompson, Mississippi Valley State University, Itta, Bena, MS.]*

Faculty Advisor: Kudikyala Udai Kumar, ukudi@mvsu.edu

OA #76
Producing Microsoft Excel Reports as Accessible PDFs

Daman Wandke, Western Washington University

People with vision and learning disabilities can only read PDF documents if the PDF is accessible. Tagging PDF documents for accessibility and verifying that the resulting reading order is correct allows software applications, known as screen readers, to read the documents aloud. Conversion of Excel documents to PDF creates tags, but not in the correct order for accessibility. The goal of this research was to create a time-efficient method for retagging PDF documents after conversion as accessible PDFs. Researchers hypothesized that retagging through automation with custom scripts and layouts simplifies conversion of Microsoft Excel documents to accessible PDFs.

The U.S. Department of Agriculture publishes most of its reports in PDF format, many of them from Microsoft Excel documents. Therefore, one of the USDA's reports provided the control for this project. The original report was converted from Excel to PDF. Tags that created accessibility problems were documented as the control. The impact of various layout changes on the PDF's tags were then analyzed. The research team compiled the layout changes that improved accessibility into a new Excel report template. Using the template improved the tags, however did not achieve the necessary accessibility features and required retagging in Adobe Acrobat X Pro.

The second method was combining layout changes with a custom retagging script. The layout selected must balance the ease of use for the report author and the complexity of retagging needs. With this concept in mind, the team created a custom script, which automated the necessary keystrokes to modify the tags documented for the selected layout, retagged the selected automated layout, and documented each tag modification. Researchers tested the script functionality and then implemented it into the report publishing workflow. The custom script required no manual retagging minimizing the risk of errors and reducing the time cost of the procedure. USDA and other organizations can use this custom script to improve the accessibility of PDF documents created from Excel accessibility. Future research will apply this method to a broader set of spreadsheet templates with various layouts. *Acknowledgement: Support for this research from USDA Agricultural Marketing Service: Dairy Programs.]*

Faculty Advisor: Sarah Buikema, Ph.D,
Sarah.Buikema@ams.usda.gov

ECOLOGY, ENVIRONMENTAL & EARTH SCIENCES

SUBCATEGORY: CELL AND MOLECULAR BIOLOGY

OA #77
Cryopreservation of BY-2 Cells

Calvin Johnson, Fort Valley State University

BY-2 cells are nongreen, fast growing plant cells that were from the pith of Nicotiana tabacum L cv. Bright Yellow #2. These cells are a major tool in understanding basic issues of cell cycle progression, cytokinesis, and cell organization in modern day science. They can multiply in numbers up to 100-fold within one week in adequate culture medium and good culture conditions. The model plant system is comparable to HeLa cells for human research. Because the organism is relatively simple and predictable it makes the study of biological processes easier, and can be an intermediate step towards understanding more complex organisms. They are used by plant physiologists and molecular biologists as a model organism. Cryopreservation refers to the storage of a living organism at ultra-low temperature such that it can be revived and restored to the same living state as before it was stored. The purpose of this research experiment is to develop a low-tech system for cryopreservation and rejuvenation (thawing) of BY-2 cells. Actively growing cells were maintained in the dark on a rotating shaker at 140 rpm at 28°C. The suspension cultures were subcultured every 7 days by taking 3 mL of cells and adding them to 25 mL of fresh BY2 media in a sterile 125 mL Erlenmeyer flask or 6 mL cells to 50 mL BY2 media in a sterile 250 mL Erlenmeyer flask. The cells were tested for viability by using a 5% solution of TTZ which indicates active respiration. Cells (5 mL) were taken from the 7-day old cultures and subcultured in 0, 0.3, 0.4, and 0.5 mannitol BY-2 solutions. The cells' viability were tested at different temperatures (0°C, 10°C, 20°C, 30°C, -10°C, and -80°C). The samples of the cultures were pre-frozen in isopropanol and placed in a -80^{o}C freezer overnight in order to allow the cells to freeze at the designated temperature. The cells did show viability after each time interval, and that the cryosolution was not damaging or killing

the cells. The 0.3M mannitol solution with cells showed the only positive results from this experiment. The 0.3M solution works best in cryopreserving the cells. Cells showed viability after liquid nitrogen and tested positive for GFP. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

Civil/Mechanical/Manufacturing Engineering

OA #78
Feasibility Analysis of a Potential Pedestrain Bridge in Bahir Dar, Ethiopia

Samuel Kirk II, Howard University

The Abay Mado bridge in Bahir Dar, Ethiopia is well past its design period. Abay Mado bridge crosses the Blue Nile and is the only route to North Ethiopia within an approximate 200 km radius, so the bridge plays host to continuous traffic. Since it is the only route, it is trafficked by walking pedestrains, cyclist, heavy vehicles, small vehicles, and animals carrying large loads. Due to the inordinate amount of traffic loads, the bridge has detoriated faster than expected. The designing of a pedestrian bridge has been proposed in order to decrease congestion and loads that the bridge experiences, hopefully extending the longevity of the bridge. A feasibilty analysis will determine the best possible corridors and overall feasibility of the proposed bridge. Feasibility will be determined by conducting soil analysis, river surveying, and traffic data studies. The pedestrian loads that the current bridge experiences are projected by performing a traffic data study. We assumed 3.6 KPa as the weight of the average human crossing the bridge and multiplied it by the calculated peak hour flow (PHF). The bridge experiences more than just walkers; there are many cyclists and animals crossing the bridge. For bikes we assumed an average weight of 13.6 kg. The amount of animals that crossed were negligible so we neglected the weight of the animals, but will prepare the bridge with a safety factor that will mitigate the dismissal of any animal weight. A desktop study and many site visits were required to find the appropriate corridor to cross the very alluvial Blue Nile River. Soil was extracted during site visits to determine the type and strength of the soil. The soil tests were performed to assess the necessary characteristics of the soil and find the optimal moisture content (OPM). Ultimately to design the bridge we needed to determine the type of bridge required. The three bridges considered in the analysis were truss, arch, and box girder bridges each had their pro's and con's. All determinations were made base on a decision matrix where aesthetics, economics, and safety served as the major criteria. Ultimately the bridge is very feasible however the primary issue would be funding. The box girder bridge is the most feasible based on the soil and height of the river banks. Future research questions are how the project will be funded, ability to construct roads on either side of the river, and mobilization of available skilled workers. *[Acknowledgement: This material is based on work supported by the National Science Foundation under Grant No. HRD-1052861 which funds the Global Engineering, Awareness and Research Undergraduate Program (GEAR-UP). GEAR UP is a collaboration of Howard University with 6 Universities in Africa, Southeast Asia and South America.]*

Faculty Advisor: Lorraine Fleming, lfleming@howard.edu

Climate Change

OA #79
Climate-Induced Energy Demand Changes in California

Yanelly Molina, NOAA CREST Center, The City College of New York / City University of New York
Pedro Sequera, Osei Rhone, and Jorge E. Gonzalez, NOAA CREST Center, The City College of New York, City University of New York
Amanuel T. Ghebreegziabher and Robert Bornstein, Department of Meteorology and Climate Science, San Jose State University

An analysis of summertime months, June, July, August (JJA) and May, June, July, August, September (MJJAS), electric power demand and consumption was undertaken to show differing energy demand trends in coastal and inland California. The work follows previous findings by Lebassi et al. (2009) in which the authors, through analysis of summer surface JJA mean monthly maximum air temperature trends between 1950-2005 for two California air basins, detected cooling trends at low elevation coastal areas open to marine air penetration and warming trends at inland and high elevation coastal areas.[1]

Data was obtained from the California Energy Commission (CEC), Energy Information Administration (EIA) and Federal Energy Regulatory Commission (FERC). Linear regressions show select coastal sites have increased peak hourly energy demand per year and decreased peak hourly energy demand per capita from 1993 to 2004. Select inland areas have increased peak hourly energy demand per year and increased peak hourly energy demand per capita from 1993 to 2004. Plots for coastal and inland county California electric power consumption per capita were created with 2005 to 2007 average total monthly consumption as well as 1990 to 2009 yearly residential consumption. Results show monthly and yearly consumption per capita for coastal counties are lower than inland counties. In addition, coastal county and inland county monthly consumption per capita differences increase during MJJAS, with a peak in August. Future work will include correlations between electric power consumption per capita, maximum monthly temperatures and cooling degree days for all counties in California.

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[1] Lebassi, B., J.E. Gonzalez, D. Fabris, E. Maurer, N.L. Miller, C. Milesi, P. Switzer, and R. Bornstein, 2009: Observed 1970-2005 Cooling of Summer Daytime Temperatures in Coastal California, Journal of Climate.

Faculty Advisor: Dr. Jorge E. Gonzalez, gonzalez@me.ccny.cuny.edu

ECOLOGY

OA #80
Gastropod Abundance and Effects on Forest Plants in Hawaii Tree Plantations

Martin K. Ennis, University of Hawaii at Hilo
Aaron B. Shiels, USDA, APHIS, National Wildlife Research Center, Hilo, Hawaii

Introduced gastropods (slugs and snails) threaten native Hawaiian plants and animals. Prior to European contact, Hawaii was slug free. Since then, introduced gastropods have affected several species of endemic birds, snails, and plants through herbivory and in some cases predation. Our project investigated composition, distribution and micro-habitat of native and non-native gastropods in census plots among three different forest types. Our census methods included timed searches above ground, amongst leaf litter, and also the installation of beer traps within census plots. Controlled studies were tested in a greenhouse assembling microcosms to test relative impacts of common introduced gastropods, Achatina fulica and Veronicella cubensis, on native and non-native seedlings. Based on earlier gastropod census data and forest litter quality, we hypothesized that abundances would be greatest in the Queensland Maple forest, intermediate under Tropical Ash, and lowest within the Eucalyptus forest. We also anticipated slugs to be mainly located on the ground in leaf litter, whereas snails would be found on foliage and on the ground.

In the greenhouse study, we hypothesized that both types of the native seedlings would suffer the greatest mortality compared to non-native seedlings. Our findings show that the Queensland Maple forest had significantly fewer slugs than the other two forest types, and no significant difference was found in snail abundance among forest types. Ninety-six percent of slugs observed were located on the ground, and 78% of the snails were observed on vegetation. Over 80% of the snails recorded were native species types. The greenhouse trial showed that the native plant Mamaki (Pipturus albidus) suffered the most damage; the seedling mortality rate was 100% within 6 days of snail exposure and 13 days for slugs. In our control microcosms where no gastropods were introduced, survival across all seedling types was 100%. We suggest future research on the effectiveness of ground based organic pesticides to control slug populations at planting sites. *[Acknowledgement: This study was funded in part by a grant from NSF/REU to the University of Hawaii at Hilo.]*

Faculty Advisor: Pelikaokamanaoio Andrade, pelikaok@hawaii.edu

OA #81
Behavioral Ecology of Eastern Box Turtles in the Long Island Pine Barrens

Jasmin B. Jenkins, Southern University at New Orleans

Eastern Box Turtles are the most common terrestrial turtles native to the Long Island Pine Barrens (LIPB). Box turtle behavior varies according to their environment, habitat disruption, nesting, and temperature. With box turtles being diurnal animals, weather may play a key role in their daily activity. They prefer the early morning and evening to forage when the heat is less intense. They have also been known to travel more frequently after a rain fall. Box turtles have been known to travel in areas less than four hectares, but studies show that some have traveled significant distances. A study was conducted at Brookhaven National Laboratory (BNL) to observe how the weather affects the behavior of box turtles. We hypothesize that during the summer when the temperature is at its lowest, the turtles will forage, mate, or nest and burrow in shrubs or leaf litter when the temperature is at its highest. Each turtle that was captured was weighed, measured, and shell notched for identification. Radio telemetry equipment was used to track 6 turtles daily and using a global positioning system (GPS) each point was recorded and imported into a geographic information system (GIS). Data was collected for a total of 7 weeks, and compiled on a weekly basis. Observations showed that the turtles' greatest distances traveled were when the temperature was at an average of 23.4°C and relative humidity at 58.2%. Statistics of the data collected showed that on an average of 24.4°C and higher the turtles would burrow in the leaf litter, and on an average of 21.1°C and lower is when the turtles would forage. Data from the GIS showed that female turtles travel further distances than the male turtles which can be the result of the females needing a greater home range than the males for nesting purposes. During our observations, we observed some of our turtles favoring barberry bushes, ferns, and blueberry

bushes. We assume that within the dense bushes there is a certain temperature and light exposed to the turtles. For future studies we want to investigate the micro climate of the vegetation understory using Pen dent data loggers that record temperatures and light. This study furthers our understanding of eastern box turtle behavior in the LIPB. *[Acknowledgement: This work was supported by NSF (grant HRD-0928797 and DUE-0806894) for financial support and DOE/BNL for facilities.]*

Faculty Advisor: Murty S Kambhampati, mkambham@suno.edu

OA #82
Effects of Algal Diversity on Productivity, Light Capture, and Grazing Resistance.

Garfield Tsz Fung Kwan, University of California, San Diego

Algae biofuel represents an attractive option to satisfy growing demands for economically viable renewable energy. Commercialization of algae biofuel faces the need to intensify production while minimizing losses to pests. One approach to increasing biofuel yields and reducing consumption is to co-culture multiple algal species. Polycultures can be more efficient at producing biomass while resisting grazers. Polycultures may be more productive than monoculture at capturing & utilizing a broader spectrum of light because they contain more photosynthetic pigments. We explored the effects of a diverse algal community on pigment composition, absorbance spectrum, and biomass prediction. Through calculation of chlorophyll-a by spectrometer, we see that two, five and ten species communities achieved above-average biomass than monoculture biomass, although the most productive monocultures generated similar biomass to polycultures. However, by measuring the survival rate of grazers in the experiment, results show that polyculture diversity reduces invasion by zooplankton grazers, suggesting that polycultures may out-perform monocultures only under field conditions where consumers are present. *[Acknowledgement: University of California, San Diego and the Department of Energy]*

Faculty Advisor: Dr. Jonathan Shurin, jshurin@ucsd.edu

OA #83
Coral Growth Rates Along a Water Quality Gradient at St Thomas, USVI

Kianna Phillip, University of the Virgin Islands
Dr. Angela Dikou and Dr. Marilyn Brandt, University of the Virgin Islands, St.Thomas

Over the past thirty years, many Caribbean coral reefs have succumbed to algae reefs due to detrimental factors pertaining to the decrease in water quality, reduction in herbivory, overfishing, and global increases in seawater temperature and acidification. It is for this reason marine scientists are becoming significantly more persistent in their endeavor to identify, operationalise, and measure those factors that contribute to coral reef resilience, i.e. their ability to bounce back after disturbance (Nyström and Folke 2001; Nyström et al. 2009). Coral recruitment is considered a primary component of coral reef resilience (Mumby and Steneck 2008). Quantification of rates and patterns (species relative composition) of coral recruitment in the Caribbean is very limited, (Rogers et al. 1984; Edmunds 2000; Kojis and Quinn 2001), and therefore growth rates of the dominant coral species on U.S. Virgin Islands (USVIs) reefs, namely *Montastrea annularis* species complex, *Agaricia agaricites*, *Favia fragum*, *Porites astreoides*, *Porites porites*, and *Siderastrea siderea*, are critically missing and urgently needed. A mensurative experiment was designed to quantify coral recruitment rates on artificial substrates (4'' solid concrete slabs; n=10 per site) during a one year cycle across an onshore-offshore water quality gradient. Seven shallow (≈5m depth) coral reef sites were chosen across the documented onshore-offshore gradient south of the St. Thomas Island. We expect that coral recruitment rates increase along the onshore-offshore gradient in water quality. We further intend to couple coral recruitment rates with available data on water quality and coral community composition and health across the same gradient to predict the trajectory of USVI coral reefs in the future. The end product would be of great value to the VI Department of Planning and Natural Resources. *[Acknowledgement: Funded by 2010/2011 VI EPSCoP Incubator Grant.]*

Faculty Advisor: Dr. Angela Dikou, adikou@uvi.edu

OA #84
Insect Herbivory on the Understory Shrub Adenocalymna Inundatum in a Pacific Coastal Forest in Costa Rica

Noor Saba, California Polytechnic State University

Young leaves of Adenocalymna inundatum (Bignoniaceae) were collected from plants growing in areas near to shore and areas farther inland, away from the maritime influence, in a coastal forest in Cabo Blanco Absolute Reserve, Costa Rica. Each leaf was assessed for herbivore damage, and was scored for the types of damage and the percentage of leaf area lost. A total of 7.0 % of leaves had no damage. Shore samples and inland samples were found to differ from one another in level of damage; shore samples had the least damage, followed by inland samples from sites with a dense understory, and finally inland samples with an open understory. The mean amount of leaf tissue lost, with all samples pooled, was 19.9%. The most common type of damage on Adenocalymna was from chewing insects, including those feeding on the leaf margin and in the center of the leaf. This was found consistently in all samples. There was a positive association within individual leaves between damage from chewing at the leaf margin and that from

chewing in the center of the leaf; those two types of damage tended to co-occur. All other types of damage tested were distributed independently of one another.

This study focused exclusively on young leaves. It is not known whether insects feed on older leaves of Adenocalymna as well. Observations of herbivory on leaves of various ages would be informative. During the process of field inspection, only five herbivorous insects were seen from 470 leaf samples. In contrast, during only 30 minutes of field observation at night, 53 insects were seen on Adenocalymna plants. It seems likely that most of the herbivory in this system occurs at night, although this remains to be tested. *[Acknowledgement: Support for this research was provided through the Chancellor's Office of the California State University and NSF grant HRD-0802628 from the LSAMP program of the National Science Foundation. I am grateful to Jessica Pourtaverdi and Michael Redman for assistance in the field. Diana Lieberman provided taxonomic information, statistical advice and editorial suggestions. I want to thank Mary Whiteford, Delores Lencioni, Diana Lieberman, and Milton Lieberman.]*

Faculty Advisor: Diana Lieberman, liebermv@racsa.co.cr

OA #85
Characterizing Embryo Heads for Loblolly Pine to Identify the Best Type of Embryo Head that will Yield the Best Quality Somatic Embryo

Yakia Voltz, Claflin University, SC

Somatic embryogenesis is a technique used in the laboratory to produce more mature embryos . Isolation of individual heads during the cell maintenance phase is a technique used to improve embryo maturation. This experiment was designed to determine if the type of embryo head selected based on its size can be used as a marker to predict the somatic embryo performance by the end of embryo maturation. Experimental error may have occurred in the isolation of the embryo heads or due to some contamination and manipulation during observations and handling. The results showed that size and shape do not affect the outcome of the embryo. There was no huge difference in the quality or growth rate of the embryos in any of the designated categories compared to the control sample. *[Acknowledgement: HBCU-UP SCAMP]*

Faculty Advisor: Pamela Shuler, pshuler@claflin.edu

Environmental Engineering

OA #86
Determining Effects of Wildfires using Multispectral Imaging

Nathaniel J. Morris, Central State University, OH

In order to determine the fire effects on vegetation and forestry, remote sensing is the best technique to use. The image sensor for remote sensing should be at an altitude of 36 km to capture a sufficient amount of affected areas. The payload will be mounted on the High Altitude Student Payload (HASP). The payload must conform to HASP's interface requirements and regulations. As HASP ascends to 36 km above sea level, the payload and its internal components must survive extremely low temperatures and near vacuum conditions. Since HASP is lifted by a small volume zero pressure balloon, the HASP platform is subjected to unpredictable rotations and tilting along its axes. The unpredictable movement of the HASP will be compensated for by the electronics inside the payload. The compensation for rotation and tilting is to guarantee an effective and a high quality remote sensing experiment.

The scope of the project is to develop a payload that fits within the HASP interface requirements and regulations while performing effective remote sensing on fire affected areas. The remote sensing will determine how "high-intensity fires" affect the health of vegetation and the restoration of forests. In order to gather data at low distortion and 30m resolution, a stabilization platform will be needed. The Stabilization platform will be implemented into the small student payload, mounted on HASP to control the image sensor's orientation. The stabilization platform will consist of 3 degrees of freedom (DOF) and be controlled by servo adjustments. For each image taken of the fire affected area, the orientation and the geographical center of the image must be recorded during the flight and extracted to be used in a geospatial analysis.

The two areas of concern in this project are the remote sensing and the 3 DOF image sensor's platform. In order to successfully collect images on fire affected areas, the platform that the image sensor is mounted on is required to self adjust for any rotation and axis tilt that the payload experiences. Therefore, there is a need for an orientation sensor and a rotation sensor. The orientation sensor is a 2 axis accelerometer and the rotation sensor is a digital compass. These two specific sensors are a perfect fit for this remote sensing application. Each axis that the 3 DOF platform has will be controlled by an individual servo. The axes are then defined by where the 2 axis accelerometer and the compass sensor are mounted on the 3 DOF platform. In this case, the 2 axis accelerometer is mounted on the XY platform that controls the overall tilt. The digital compass is isolated on a small rotating platform that extends from the XY platform where the image sensor is mounted on. The XY platform is then controlled by two servos that pivot this platform about a ball joint. The small rotating platform is controlled by one servo that is attached to the XY platform. Finally, the 3 DOF platform is completely compensated for along all three axes.

The servos, sensors, and payload health are interfaced with the electrical controls within the payload. Specifically, the servos are controlled by a PIC microcontroller that uses the sensors as input data. The results of the PIC microcontroller are outputs

that send positional commands to the servos. When the sensors fall within a tolerance that minimizes the distortion in the remote sensing data, the PIC controller sends a command to the image sensor to capture the data.

The remote sensing is the most important part of this project. The image sensor at an altitude of 36km is pointing directly down towards the earth's surface, capturing fire-affected areas. To verify healthy vegetation and restoration of fire-affected areas, the remote sensing has to be in specific wavelength bands. The two wavelength bands are the visible and near infrared. The wavelength range for visible is 400nm – 700nm and for near infrared is 750nm – 1400nm. These two wavelength bands were chosen because of how healthy vegetation reflectance varies dramatically from the visible to the near infrared. Variation in reflectance defines the reflectance profile for particular objects on the ground. Therefore, the two wavelength bands are a way to help differentiate between other objects and vegetation.

Since images are going to be collected after the fire has affected an area, there has to be a way the images can be compared to another source of images before the fire. One of these sources is the USGS satellite image database. The landsat 5 satellite does remote sensing at 30m resolution in visible and near infrared. Hence, the landsat 5 satellite images are a perfect source that can be used to compare with the payload's remote sensing images. Once the images from both soruces are obtained, a geospatial software ERDAS Imagine 2011 can be used to create overlays where the healthy vegetation is located after the fire and where it is located, before the fire.

The only result that has been currenlty determined, is the precision of the 3 DOF platform. The platform went through a performance test that resulted in an error of ± 0.05° along all three axis. Conclusively that means that the 3 DOF platform creates an error that is within the 30m resolution needed by the image sensor. Since the 3 DOF platform will not affect the payload image's location, the location of the image will match up well with USGS comparsion data. *[Acknowledgement: References: 1.) Arnold, L., Gillet, S., Lardiere, P., Schneider, J., "A test for the search for life on extrasolar planets", Astronomy & Astrophysics, September 2, 2002; and 2.) IPAC, "Near, Mid & Far Infrared", http://www.ipac.caltech.edu/outreach/Edu/Regions/irregions.html Accessed 05-01-2011]*

Faculty Advisor: Dr. Augustus Morris, amorris@centralstate.edu

OA #87
Off-Grid 10kW Solar Panel and 1kW Wind Turbine Hybrid Power System for a Small Rural Ethiopian Village

Paige Piggott, Howard University
Camille Carter and Brian Gibbs, Howard University

This project is the designing of a feasible off-grid hybrid solar photovoltaic (PV)-wind turbine system for a small rural village in Ethiopia using three years of solar data as well as wind data taken from Bahir Dar and applied it to a small theoretical village. The system built must contain a 10 kW solar panel and 1 kW wind turbine. Our objective was to design the complete hybrid energy system. The optimal designs were simulated using HOMER Software, an energy modeling software for hybrid renewable energy systems. HOMER compares the results to compile a realistic projection of their capital and operating expenses. The program also determined the economic feasibility of each system that it generated. The HOMER generated results were compared to the theoretically generated systems to then confirm the feasibility of the system. A wind turbine is a device that converts kinetic energy from the wind into mechanical energy which can be used to produce electricity. When designing the turbine, the parameters that we explored were: number and design of blades, upwind or downwind rotor, blade material, rotor diameter, drive selection, speed control, wind towers, generator, a charge controller, and batteries. Solar power is generated by converting solar energy into electricity. The PV effect is demonstrated when electrical power is converted from solar radiation into direct current using semiconductors. While designing the PV system, we designed an inverter, battery size, and panel size. Each component was computed using theoretical equations. At the completion, it was determined that the system was feasible, however, to optimize the use of the system the turbine would need to be placed at a higher altitude to produce more power, or the system should be used in conjunction with a generator. *[Acknowledgement: This material is based on work supported by the National Science Foundation under Grant HRD-1052861, which funds the Global Engineering, Awareness and Research Program (GEAR-UP). GEAR UP is a collaboration of Howard University with 6 Universities in Africa, Southeast Asia and South America.]*

Faculty Advisor: Dr. Lorraine Fleming, hugearup@gmail.com

OA #88
Zebra Mussels: A Nuisance or A Valuable Asset to Aquatic Systems?

Theodore Williams, Syracuse University
Mario Montesdeoca and Charles T. Driscoll, Syracuse University, Department of Civil and Environmental Engineering
Michael Spada, Upstate Freshwater Institute, Syracuse, NY

Zebra mussels (ZM) are an invasive species of filter feeders that deplete their aquatic surroundings of dissolved oxygen, decrease food supply for other aquatic species such as phytoplankton, while increasing total ammonia levels – toxic to other aquatic life. They also interrupt the business/commercial sector by clogging pipes and reducing flow to power plants costing millions of dollars. Besides their "nuisance behavior" due to limited predators, zebra mussels improve water clarity,

removing waterborne pathogens, microscopic algae, bacteria and suspended particles (Lucy, et al. 2010; Effler and Siegfried 1994). They have been acknowledged to be valuable monitoring organisms and accumulators of heavy metals (Voets et al. 2009) specifically mercury within their tissues and shells. This study investigates the permanent sequestration of total mercury (THg) and the efficiency of zebra mussels' shells as a percentage of the quantity of total mercury being sequestered. The experimental results yield a 5.2% of THg being permanently sequestered by the zebra mussels' shells and a range of 73-99% retention of THg under extreme laboratory conditions, modeled from Harbor Brook, Onondaga Lake, NY where THg concentrations are as high as 1426.4ng/g and 2.2 ng/g for zebra mussels' tissues and shells respectively.

This sequestration result percentage can be used to calculate the total quantity of mercury being permanently sequestered by zebra mussels' shells. This result can also be used to calculate the total mercury sequestration in the Seneca River where permanent THg sequestered concentration ranges from 27.9µg/m2 and 2.4µg/m2. *[Acknowledgement: Center for Environmental Systems Engineering]*

Faculty Advisor: Mario Montesdeoca, mmontesd@syr.edu

Geosciences and Earth Sciences

OA #89
Understanding Energy, Evolution of Use, and Design

Krystal Chandler, Harris Stowe State University
Dr. Jayashree Balakrishna, Harris Stowe State University, MO

This study addresses energy conservation in a world shifting consistently towards urbanization without relinquishing modern conveniences. This is important and timely in a world grappling with issues of climate change, pollution, and increasing demand for limited resources. A study of the evolution of human energy needs and how they were driven by technology use was necessary. It required an exploration of the nature, science, and sources of energy. I hypothesize that conservation can be achieved only through interdisciplinary study applying methods of heat transfer(physical science), animal adaptations(biology), and creative design (aesthetics, psychology, architecture) to modern building methods. Through general internet study and library resources we began by investigating animal adaptations, emphasizing thermal adaptations, and the link with survival. Next we explored how humans initially adapted to their climates through the use of local materials, the progression beyond local materials, and how this progress has been defined by a lack of apprehension about energy needs, consumption, or waste. Hypothesis supporting lab experiments with Newton's Law of Cooling and heat conduction identifying energy efficient materials for building and insulation were conducted. A trombe wall model showed how passive solar design works with methods of heat transfer even in small spaces. We did an objective comparison of CO2 output per square kilometer of different countries. The study of the evolution of energy and extensive physical science research confirmed the hypothesis that a multidisciplinary approach and an honest assessment of our corporeal and aesthetic needs are necessary to solve the global energy crisis. Replacement of energy inefficient technology, while maintaining conveniences, is attainable through the use of identified efficient technology. For future research, I plan to incorporate energy conservation, physical science, and parts of aesthetic design to find appropriate building concepts for my region.

Key references include: Lechner, N. (2009). "Heating, Cooling, Lighting: Sustainable Design Methods for Architects." Various internet resources on biological systems and creative space design.

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Faculty Advisor: Dr. Jayashree Balakrishna, BalakriJ@hssu.edu

OA #90
The Analytical and Operational Importance of Many Apparatus Used in Oceanography

Ebone Pierce, Dillard University, LA

Part of NASA's mission is to develop an understanding of the total Earth system and the effects of natural and human-induced changes on the global environment. Oceans play a major role in influencing changes in the world's climate and weather. Collecting and analyzing long-term ocean data from satellites is a relatively new field of exploration. Prior to satellite data, ocean data had come from infrequent measurements collected from ships, buoys, and drifters. Ship-based oceanographers are limited to sampling the ocean in a relatively small area with often a great deal of difficulty. Data from ships, buoys, and drifters are not sufficient to characterize the conditions of the spatially diverse of the ocean. The purpose of this type of research is to use the different apparatus in oceanography to make detailed maps of the seafloor before they start building subsea infrastructure, to map an area to determine if there are any mines, to monitor a protected area for new unidentified objects, to measure the concentration of various elements or compounds, the absorption or reflection of light, and the presence of microscopic life. Physical Oceanography consists of sound velocity and sea water density depends on temperature, salinity, or pressure will cause an increase in sound velocity. The following programs allow all physical oceanographic information to be displayed. Acoustical oceanography is the use of underwater sound to study the sea, its boundaries and its contents. Programs such as Acoustical Propagation Interface (API) perform a thorough analysis of the acoustical propagation conditions and perform quickly acoustical analysis of any area to generate transmission loss

rosettes. Arc GIS (Geographic Information Systems) is a computer-based system used for managing geographic data and solving problems using geographic data and can also to be used to view the result of acoustical data. Personal Computer Interactive Multisensor Analysis Training (PCIMAT) systems use scientific visualizations, three-dimensional graphics, and animations to illustrate complex physical interactions in mission-relevant contexts. Instruction concepts include radiated acoustic characteristics, propagation in range dependent environments, and sensor properties. Vehicle Interface Program (VIP) Software, used to help program underwater vehicles while they are in route to a set destination. Autonomous Underwater Vehicle (AUV) is a robot which travels underwater without requiring input from an operator that uses side-scan sonar to detect the sound propagation from the sea floor to reveal images of material on the sea floor and how far away substances are from the underwater vehicle. I used these different programs to prepare for mission situations when out at sea. These programs are currently used in the process of collecting data out at sea, but for future considerations some programs need to be completely accessible and given permission for other oceanographic offices to use. *[Acknowledgement: I would like to acknowledge the Science, Math and Research for Transformation Scholarship Program (SMART) and the Naval Oceanographic Office at Stennis Space Center, MS, for funding and sponsoring my research experience.]*

Faculty Advisor: Abdalla Darwish, adarwish@dillard.edu

Plant Research

OA #91
Effect of Genotypes on in vitro Propagation of Jatropha curcas

Ulysius Mcghee, Fort Valley State University, GA

Jatropha (Jatropha curcas L., Euphorbiaceae) is a drought tolerant, non-food, biodiesel crop widely grown in the tropical and sub-tropical regions of the world. It is a species regarded suitable to grow on unproductive agriculture lands as well as marginal lands and yields 30-40 oil by seed weight. However, it can't be grown as a crop in the temperate regions because of its susceptibility to cold stress. Cold tolerance can be introduced to Jatropha through genetic engineering with cold binding factors (e. g. CBF3). An efficient in vitro regeneration system is essential to develop cold tolerant J. curcas through genetic transformation. We hypothesized that a major reason for this variation could be the difference between genotypes. Therefore, we studied the in vitro regeneration potential of 10 genotypes J. curcas grown in the greenhouse at Penn State Harrisburg. We used young nodal segments (2.0-3.0 cm), and approximately 1.0 cm leaf segments from immature, fully opened leaves as explants. Explants were disinfected with a detergent was (10 min) followed by 5.0 min each in 10% bleach and 0.1% HgCl2 followed by 5.0-6.0 rinses with sterile water. Callus induction was achieved on CI medium; Murashige and Skoog 1962 (MS) medium modified with 1.5 mg/L Benzylaminopurine (BAP) and 0.05 mg/L indole-3-butyric acid (IBA). Axillary bud break was achieved in one week on SI medium; MS medium supplemented with 3.0 mg/L BAP and 0.1 mg/L IBA irrespective of the genotypes. MS medium supplemented with 2.0 mg/L BAP and 0.5 mg/L Kinetin (Kn) (SM medium) was used to generate multiple shoots. Callus induction occurred in 10-30 days depending on the genotype. By week 6, the rate of callus induction ranged from 17.65% in genotype (Jat2) to 75.56% in (Jat5). The axillary shoot multiplication rate varied from 2.0 – 4.0 shoots per explant amongst the genotypes studied. Only 4/10 genotypes regenerated directly from leaf explants cultured facing the adaxial side on the CI medium and the regeneration rate varied between 20%-60% among these genotypes. Callus induction and in vitro regeneration of J. curcas are genotype dependent. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA and NSF REU-Site grant 1063064.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #92
Metabolic Engineering of the Fusion Protein in Yarrowia Lipolytica

Xavier Price, Fort Valley State University

Resveratrol is a polyphenolic compound produced by a few higher plants, such as berries, peanuts and eucalyptus in response to outside stresses. Resveratrol possesses the special ability to increase the life span of some eukaryotic organisms, ranging from yeast, to fish, and obese mice. With demonstrated health benefits in humans such as being a potent antioxidant and antiviral agent, the increasing demand for resveratrol as a food and nutrition supplement has made high-yield microbial engineering technologies a key focal point in scientific research studies. The utilization of fusion proteins to reconstruct biosynthetic pathways in heterologous systems through the channeling of reactive intermediates between active sites to improve metabolic efficiency has produced favorable results in large scale production. Despite new research yielding 2.3g/l of resveratrol in an E. coli strain (Lim et al. 2011), E. coli strains are still impracticable for direct food application. This study focused on the viability of the highly osmotic resistant yeast Yarrowia lipoytica and the functionality of the fusion protein {4CL::STS} in producing resveratrol. Due to the nature of y. lipolytica and its past performance in producing compounds, we hypothesized that it would produce resveratrol in amounts that exceeded prior quantities obtained in other microorganisms. Two strains were produced for the experiment. The fusion protein was composed of the 4CL1 gene from Arabidopsis thaliana and the

STS gene from Vitis vinifera. The other strain was a separate construct that expressed the proteins individually and acted as the control. Comparison of the resveratrol levels in each strain showed that the Y. lipolyica expressing the fusion protein were higher than in the separate construct throughout both the cells and the media. Despite only obtaining about 51μg/l of resveratrol on average from fermentation, the fusion protein performed better than the traditional 4CL and STS expression construct even on a small scale. It was concluded that Y. lipolytica is not a fit host for mass production of resveratrol. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

OA #93
Phytoremediation of Copper Using Chickpea (Cicer arietinum L.)

Van Tu Vu, Southern University at New Orleans
Murty S. Kambhampati, Southern University at New Orleans

Phytoremediation is a promising, still emerging way of remediating contaminated soil and water. It is a cost effective and eco-friendly green technology. In this study the tolerance of Chickpea (Cicer arietinum L.) to Cu and its ability to phytoremediate Cu was tested. The hypothesis was that plants with higher concentrations of EDTA would uptake more Cu than plants with lower concentrations. Chickpea was planted in three replicates containing varying amounts of EDTA (ethylinediaminetetraacetic acid) and CuSO4.5H2O solutions. EDTA solutions ranged from 0, 5, and 10 mM. Cu solutions ranged from 0, 25, 50, 100, and 200 ppm. At the end of thirty days plants were harvested and analyzed for biomass, bioconcentration factor, translocation index, and other parameters. After passing the maximum tolerance level to Cu, the plants didn't translocate as much. We observed that plants with 200 ppm Cu were healthier than any other treatments. This might be because of some unknown interactions between Cu, EDTA, and other physical and or chemical factors which needed to be investigated further. The hypothesis was proven to be correct in that more plants at higher EDTA concentrations were able to uptake more Cu than plants with low levels of Cu and EDTA. Cicer arietinum L. is a very good hyper accumulator for Cu under the soil amendments of 100ppm Cu and 10mM EDTA as indicated by the bioconcentration factor, tolerance indices, and translocation indices. We were unable to discuss our results with earlier findings due to lack of publications on Cu phytoremediation by chickpea in peer reviewed scientific journals. Further research is needed to identify the interrelationships between biomass accumulation, soil media, and interaction of copper with other elements, including toxic metals. *[Acknowledgement: This study was supported by NSF funded HBCU-UP and STEM grants: grant HRD-0928797 and DUE -0806894.]*

Faculty Advisor: Murty S. Kambhampati, mkambham@suno.edu

MATHEMATICS & STATISTICS

CELL AND MOLECULAR BIOLOGY

OA #94
Co-Mediated HbS Polymer Melting

Crystal L. Bennett, North Carolina A&T State University

Sickle cell anemia is a disorder caused by a mutation in DNA that replaces the nucleic acid Glutamic with Valine. This replacement causes a change in the characteristics of hemoglobin that allows the monomers, the simplest units of chemically binding molecules, to stick together. These chains of monomers, called polymers, distort the shape and properties of the red blood cell. The malformed cells do not efficiently pass through capillaries or transport oxygen to the body's tissues. In order to make these cells more effective, the polymers must be broken apart. The process of breaking polymers apart is called melting. In the referenced study, the melting was induced by immersing the polymers in a buffer solution containing carbon monoxide. The mathematical model of this process was produced in a separate study. The purpose of this project is to analyze and reproduce the current mathematical model using various computational and numerical tools. *[Acknowledgement: Talent-21 STEM, iBLEND, I-cubed]*

Faculty Advisor: Dr. Liping Liu, lliu@ncat.edu

MATERIALS SCIENCE

OA #95
Proof a Maximal Antichain is a Quantum Cover

Karmen Tracy Yu, New York City College of Technology

In standard measure theory, the measure of a disjoint union always equals the sum of the measures. However, in quantum mechanics, one wants to measure things which do not satisfy this additivity condition. In this case, one turns to quantum measure theory, which obeys a more general additivity condition. Still, quantum measure theory has a downside: if the measure of every set in a cover is zero, it doesn't guarantee that the measure of the whole set is zero. Here, the concept of a quantum cover comes into play. A quantum cover is a cover for which if the measure of every set in the cover is zero then the measure of the whole set is zero. In my research, I am focusing on classification, examining what types of covers are quantum

covers. The current conjecture, by Surya and Wallden, is that every maximal antichain is a quantum cover. My first step has been to study an application of quantum measure theory to the triple-slit experiment, to see if the conjecture holds in this context. *[Acknowledgement: DIMACS Rugter REU program]*

Faculty Advisor: Katy Cragi, katycc@math.rutgers.edu

Mathematics and Statistics

OA #96
Melter Performance Tuning Using High-Fidelity Simulators

William Broughton, Claflin University, SC

The additions of the argon bubblers have changed the thermal dynamics of the Defense Waste Processing Facility Melter. The source code of the Melter Model was under intensive studies in order to understand the mathematical modeling and the interrelationship of the Melter Model variables and constants with the interconnecting systems in order to improve the correlation of the Melter Model dynamics to that of the production Melter. Using the PI data collection and analysis tool, the comparison of the thermal dynamics of the production Melter was taken to that of the simulator Melter Model. The following parameters were compared II3265, TI3275, TI3275G, TIC3271 and TI3271G. In the Melter there is the actual plant and the simulator which is the Melter model. During this stage the theoretical data of the simulator was equivalent to that of the real world process data. After the addition of the argon bubblers into the Melter to increase the canister production, I came to a realization. The Melter Model had to be tuned because the theoretical data didn't match to the real world process data that was being produced. During this stage, the operators use a high-fidelity simulator to train and be able to operate the plant more safely and efficiently. After intensive studies have been conducted, results show that the closing of the waste tanks reduces the risk to human health and the environment by stabilizing the waste in the tanks, reducing the potential for groundwater contamination. *[Acknowledgement: Ms. Pamela Shuler]*

Faculty Advisor: Ms. Pamela Shuler, pshuler@claflin.edu

OA #97
HIV-1 Sequence Prediction: Analyzing the Effectiveness of Point-Mutations Using the Bioinformatics Programs RNAMute and MultiRNAMute

Rudy Dehaney, Morgan State University

RNAMute is an application that predicts and analyzes mutations in RNA secondary structures. MultiRNAMute is a version of RNAMute that computes secondary structures for k-point mutations. Using the results of the mutation of the SL2 and SL3 segments of the HIV-1 virus from the software, we were able to obtain a viable prediction that disrupts the shape of the SL2 and SL3 structure. *[Acknowledgement: National Research Experience for Undergraduates Program an MAA activity funded by National Security Grant H98230-11-1-0215 and National Science Grant DMS-0845277.]*

Faculty Advisor: Asamoah Nkwanta, asamoah.nkwanta@morgan.edu

OA #98
On the Solutions of x_(n+1)=(f(x_n))/x_(n-1)

Mahoganye C. Galentine, Texas Southern University
Willie E. Taylor, Texas Southern University

This work investigates the solutions of the second order difference equation x_(n+1)=(f(x_n))/x_(n-1) where f is a piecewise linear function.

The major focus will be on examining how the initial values x_{-1} and x_0 determine solution behavior. The study will consider f when f is defined in the following ways:

(A) $f(x) = \begin{cases} Ax, x \geq 0 \\ Bx, x < 0 \end{cases}$ where $A > 0, B < 0$

(B) $f(x) = \begin{cases} Ax, x \geq 0 \\ Bx, x < 0 \end{cases}$ where $A > 0, B < 0$

(C) $f(x) = \begin{cases} Ax, x \geq 0 \\ Bx, x < 0 \end{cases}$ where $A > 0, B < 0$

[Acknowledgement: Willie E. Taylor]

Faculty Advisor: Willie E. Taylor, taylor_we@tsu.edu

OA #99
My Fascinating Journey with Perfect Numbers

Daniel Heslop, Savannah State University, GA

Number theory is one of the oldest branches of pure mathematics and is concerned primarily with the properties of numbers. Since the discovery of numbers, mathematicians have been fascinated in the patterns and properties surrounding them. They also noticed that certain numbers are equal to the sum of their proper divisors. Four numbers that exhibit this property are 6, 28, 496, and 8128. These are the first four perfect numbers. The search for perfect numbers began long ago as the ancients believed they had important numerological applications. In this paper we will investigate important properties of perfect numbers and prove important theorems which play key roles in the mathematical theory of perfect numbers. A simple method of finding perfect numbers using

basic number theory is given, which students who have not taken a calculus course would be able to understand. *[Acknowledgement: National Institutes of Health]*

Faculty Advisor: Dr. Mulatu Lemma, lemmam@savannahstate.edu

OA #100
Method of Undetermined Coefficients for Solving Some Functional Equations

Dot'Toya Jones, Southern University at New Orleans
Dr. T. Marinov and Dr. J. Omojola, Southern University at New Orleans

The purpose of this research is to study the method of undetermined coefficients to solve functional equations. Using this method, we solved the following types of functional equations:

f(x+k)=g(x) f(x)±f(x+b)=ax+b f(f(x))=g(x) ∝_1 f(x+b_1)+∝_2 f (x+b_2)+⋯+∝_k f(x+b_k)=c_m x^m+c_(m-1) x^(m-1)+⋯+c_1 x+c_0 for cases where ∝_1+∝_2+⋯+∝_k≠0 and ∝_1+∝_2+⋯+∝_k=0.

All functional equations were solved under the restriction that the solution is a polynomial function. Two propositions for identifying the degree of the solution without obtaining the exact form of the unknown function were proven. The use of SAGE, a public domain software, to simplify the calculation is also discussed. *[Acknowledgement: National Science Foundation.]*

Faculty Advisor: Dr. Joe Omojola, jomojola@suno.edu

OA #101
Turning the Lights Out: Matrix Solution of the Lights Out Puzzle Using SAGE

Gino Loverde, Southern University at New Orleans

The Lights Out puzzle, a seemingly innocuous child's game manufactured by Tiger Electronics *(c. 1995),* presents a mathematical conundrum, encompassing elements of linear algebra, number theory, and graph theory. We set out to find a way to solve the game, which as its name implies is to turn the lights on the game's array out. We analyzed the math that likely drove the game's microprocessor.

Starting with some configuration, we validated theorems presented by Anderson and Feil (1998), to verify whether or not the configuration was solvable, and if solvable, find the most efficient strategy to extinguish the array.

To simplify the calculations, we used SAGE, a web-based, mathematics software. We applied row reducing operations to the singular matrix embedded with the rules of button interaction, finding a "pseudo-inverse" using the record of row reducing operations (RRRO). Using the new interactions as defined by the RRRO, we were able to find the most efficient solution to any starting configuration.

In the future, we hope to look at variations of the array, as it relates to additional states of display, modified array shape, or the parameters of neighboring buttons. *[Acknowledgement: This research was conducted with funding by a grant from the National Science Foundation (HRD-0928797)]*

Faculty Advisor: Dr. Zheng Chen, zchen@suno.edu

OA #102
Mathematical Modeling of Genetic Counseling with Application to Sickle Cell Anemia

David Marango, Harris-Stowe State University
Dr. Ann Podleski, Harris-Stowe State University

This project looks at how genetic counseling affects prevalence of sickle cell anemia in different populations. We hypothesize that genetic counseling will result in deviation from random mating and deviation from Hardy-Weinberg Equilibrium (HWE) for sickle cell genotype. The research is important because it enables us to quantify the effects of genetic counseling on the genotype frequencies of sickle cell anemia in various populations.

Using computer simulation based on probability models, we model different levels of non-random mating. We examine the deviations from HWE for the different levels of non-random mating and compare with our control of a random mating model.

Results from our simulated models are compared with actual data to see which of our models fit the data for populations with different characteristics from data in the centers for disease control and prevention (www.cdc.gov).

For future research we plan to extend our work to model diseases with different genetic characteristics, such as diseases with gene/environment interaction effects. *[Acknowledgement: This research project is supported by NSF HBCU-UP Implementation grant 0811219.]*

Faculty Advisor: Dr. Ann Podleski, podleska@hssu.edu

OA #103
Using Random Walk to Find a General Equation for Stationary Probabilities

Kwasi O. Platt, Savannah State University, GA

Most phenomena in our nature don't have formulated functions in a closed form. Instead, there are differential equations with certain common properties which can explain natural phenomena.

Any arbitrary nth order equation $y^{(n)} = F(t, y, y', \cdots, y^{(n-1)})$ can be transformed into a system of n first order equations,

$x'_1 = F_1(t, x_1, x_2, \ldots x_n)$,
$x'_2 = F_1(t, x_1, x_2, \ldots x_n)$,
$x'_3 = F_1(t, x_1, x_2, \ldots x_n), \ldots x'_n = F_n(t, x_1, x_2, \ldots x_n)$,

and solutions of this system of equations can be considered as a set of n dimensional parametric equations. For a given time, $a < t < b$, these n dimensional parametric equations give n coordinate values,
$x^i = (x_1 (t_i), x_2 (t_i), \ldots x_n (t_i))$

at arbitrary time $a < t_i < b$ and it can be viewed as one point, x^i in the space.

These values are changing generally as time is changing. The collection of these points corresponding to the given time forms a curve which is called a trajectory. In this research, x^i is jumping to a randomly chosen point x^{i+1}, which can be interpreted as a random walk on a trajectory when we divide the given time into finite n sub-intervals,

$a = t_0 < t_i < \ldots t_n = b$, therefore a stationary distribution could be found for the random walk on a trajectory in 3 by 3 and also could be extended to n by n. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Sujin Kim, kims@savannahstate.edu

OA #104
Are the Regression Models Published in the Field of Environmental Science Reproducible?

Tiaria Porche, Southern University at New Orleans
Fred Rispoli and Vishal Shah, Dowling College, Oakdale, NY
Timothy Green, Brookhaven National Laboratory, Upton, NY

This study focuses on the use of statistical analysis in research concerning environmental science projects, which were published in various scholastic journals during 2004-2010. The main objective of this study was to validate the regression models presented in the published articles. We hypothesize that all of the articles will not contain all of the necessary information to reproduce the published regression models and may further identify some type of error. A total of 266 biological articles were selected and analyzed. Screening for articles using regression analysis as the statistical method narrowed down the search to 26 articles. The data given in the 26 articles was used to develop the regression model using Microsoft Excel and compared to the published models. Only four of the articles have been validated 100% with the simulated/constructed models. On the contrary, the other twenty-two regression models failed to be reproduced using the published data. We found that in many publications the amount of information provided was not sufficient to reconstruct the model. In some publications, we believe that there were errors associated with the model development leading to non-reproducible models. The errors expressed may have occurred during the input of data into the software.

Further studies are being carried out to understand the errors involved and elucidate the minimum information required to obtain the model from the publications. The advantage of being able to reproduce the given information validates if the statistical methods are used in the most effective and correct way possible. *[Acknowledgement: The research study was funded and supported, in part by, the National Science Foundation grants HRD-0928797 and DUE-0806894; and the Department of Energy.]*

Faculty Advisor: Murty Kambhampati, murtykam@gmail.com

OA #105
Feedback Loops Analysis for a 2-Dimensional Differential System and Application to Dynamic Game Theory

Maleik Hassan Pride, Virginia State University
Dr. Bourama Toni, Virginia State University

This study will design a 2-dimensional differential system du/dt = F(u), F a differentiable mapping of the plane into itself, in terms of the signs of the Jacobian matrix entries. These signs define an interaction graph consisting of feedback loops or graphics. We derive a stability analysis of the system based on the interaction graph.

The study will show how the existence of at least one positive loop leads to the appearance of multiple equilibria (stationary states) or differentiation, that is, the appearance of multiple zeros of the mapping F. This system could be seen as a model to describe a regulatory network of two genes where gene A is an activator (respectively a repressor) of the expression of a gene B, as well as a game-theoretic model of two players in a strategic interaction using techniques from Dynamic Game Theory. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Bourama Toni, btoni@vsu.edu

OA #106
My Journey with the Fascinating Mulatu Numbers

Kahntinetta Pr'Out, Savannah State University

The Mulatu numbers are sequences of numbers of the form: 4, 1, 5, 6, 11, 17, 28, 45, … The numbers have wonderful and amazing properties and patterns. In mathematical terms, it is defined by the following recurrence relation: Mn= { 4 if n=0, 1 if n=1, and Mn-1 + Mn-2 if n>1. The first number of the sequence is 4, the second number is 1, and each subsequent number is equal to the sum of the previous two numbers of the sequence itself. That is, after two starting values, each number is the sum of the two preceding numbers. In this paper, we provide a summary of some fascinating properties and patterns of the Mulatu numbers. *[Acknowledgement: The National Science Foundation]*

Faculty Advisor: Mulatu Lemma, lemmam@savannahstate.edu

OA #107
Examination of the Predominance of Certain Diseases in the Minority Population

Rispah Sang, Southern University at New Orleans
Dr. Joe Omojola, Southern University at New Orleans

It has been observed that certain diseases are more common in the black population. According to the report from the Health Power website (www.healthpowerforminorities.com), some of the most frequent minority health issues in Louisiana are heart diseases, diabetes, hypertension, and HIV/Aids. In this project we examined available data to determine the predominance of certain diseases in the minority population. Our study encompasses the use of correlation analysis to decide if higher percentages of minorities in the population, in different parishes in Louisiana, resulted in increased incidences of certain diseases. Diseases analyzed are those of the heart, malignant neoplasm, cerebro-vascular diseases, accidents adverse effects and diabetes mellitus. We will discuss the results of our findings in this presentation and more data will be obtained to confirm the results. *[Acknowledgement: The research was funded by LSAMP.]*

Faculty Advisor: Dr. Joe Omojola, jomojola@suno.edu

OA #108
Applications of Convex Optimization to Weighted Generalized Fermat-Torricelli and Heron Problems

Vicente Valle, The University of Texas - Pan American
Mau Nam Nguyen, The University of Texas - Pan American

In the Fermat-Torricelli problem, a point is to be found such that the sum of the distances from this point to the three given target points is smallest. The Heron problem asks for a point on a line such that the sum of the distances to two target points is minimal. These problems can be solved by differential calculus or geometry. In this research project, we study generalized versions of the classical Fermat-Torricelli and Heron problems. Our idea is to replace the given points and line in these problems by given sets. Additionally, we modify the sum of the distances to points by a general weighted sum of distance to sets. The new problems are mathematically interesting and have promising applications to location science and optimal networks. Using convex analysis and optimization, we are able to study these problems from both theoretical and numerical viewpoints as well as to shed new lights to the classical Fermat-Torricelli and Heron problems. *[Acknowledgement: This material is based upon work supported by, or in part by, the NSF-Louis Stokes Alliance for Minority Participation (LSAMP) program.]*

Faculty Advisor: Dr. Mau Nam Nguyen, nguyenmn@utpa.edu

OA #109
Simulation Methods and Applications in Disability Income Insurance

Shonte Walton, Dillard University, LA

In this research, three important simulation methods and algorithms including: Empirical Probability, Monte Carlo and Inverse Transform are probed. The mathematic statistical principles of each method are explored with real examples, for instance, “How to find the value of the irrational number pi”, “How to evaluate the area under any curve y = g(x) over interval [a, b], where g(x) has no anti-derivative” and “How to generate an independent random sample for a given accumulative distribution model” and so on. Also, a simulation application in Disability Income Insurance is studied for different occupations, ages, gender, duration, amount of payment, and waiting period. The simulation methods presented can be useful tools to apply to all fields within STEM. *[Acknowledgement: Louis Stokes Alliances for Minority Participation (LSAMP)]*

Faculty Advisor: Dr. Hong Dai, hdai@dillard.edu

OA #110
On a Particular Class of Tzitzeica Curves

Lewis William, Fayetteville State University, NC

Tzitzeica curves have appeared sporadically in the mathematical literature. However, at the moment, there does not exist a complete study of the nonlinear ordinary differential equation leading to this type of curves. In this talk, I am going to present the Tzitzeica curve nonlinear ordinary differential equation and, in particular, I will discuss a new class of Tzitzeica curves. In the

future, I will be interested in studying other particular solutions of Tzitzeica curve differential equation and their applications to other research areas. *[Acknowledgement: NC-LSAMP]*

Faculty Advisor: Nicoleta Bila, nbila@uncfsu.edu

NANOSCIENCE

BIOMEDICAL ENGINEERING

OA #111
Quantum Dot/Anti-claudin-4 Conjugate for Bioimaging of Human Pancreatic Cancer Cells

Melissa Cruz-Acuña, University of Puerto Rico at Mayaguez

Semiconductors Quantum Dots (QDs) are inorganic fluorophores that exhibit tunable emission, high quantum yield and exceptional chemical and photo-stability. These optical properties make QDs suitable for biological imaging and a promising tool for disease detection, such as Cancer. Envisioned applications require the QDs to be functionalized for specific targeting. Anti-Claudin-4 is an antibody specific to Claudin-4, which is present on the membrane of human pancreatic carcinoma cells.

Accordingly, the present work is focused on the microwave-assisted synthesis of water-soluble Cd-based QDs and their conjugation with Anti-claudin-4 by using a simple aqueous-phase synthesis method. Desired nanostructures were produced from starting cadmium sulphate and selenide aqueous solutions in the presence of thioglycolic acid. The reaction took place under continuous microwave irradiation at 140°C during 30 minutes. The structural, compositional and functional characteristics of the Cd-based QDs were confirmed via X-ray diffraction, HR-TEM, ICP-MS, UV-Vis and PL spectroscopy techniques. Bio-conjugated QDs were purified by using a high performance size-exclusion chromatography (HPSEC) protocol developed in our facilities.

Human pancreatic carcinoma cells (PANC-1) were incubated with 50mg/mL of Cd-based QDs or bio-conjugated QDs at 37°C during 4 hours. The cells were washed using phosphate buffer (PBS), and fixed with 4% para-formaldehyde. DAPI was used to stain the cell nuclei. Scanning confocal microscopy analyses allowed the localization of Cd-based QDs and bio-conjugated QDs in the cell samples.

Cd-based QDs of size around 4nm with high photoluminescence properties were easily ingested by PANC-1 and mainly located in the cytoplasm. We expect a specific binding of bio-conjugated QDs to the cell membrane. This QD-based platform is a promising tool for diagnostic and imaging of pancreatic cancer. *[Acknowledgement: This material is based upon work supported by the National Science Foundation under Grant HRD 0833112 (CREST Program).]*

Faculty Advisor: Oscar Perales-Perez, operalesperez@yahoo.com

CIVIL/MECHANICAL/MANUFACTURING ENGINEERING

OA #112
Characterization and Adsorption Studies of Nano-TiO2 on Porous Medium

Canisha Seymore, Howard University

The growing applications of manufactured nanomaterials in consumer products raise questions as to how such products are disposed after use, transported into natural resources, as well as their implications in the environment. As a result, it is imperative for engineers to acquire an adequate understanding to foresee the effects of such particles in natural environments by means of investigating the mobility and bioavailability of nanoparticles. It is evident from chemistry that iron-oxide can adsorb metallic compounds. Soil rich in iron-oxide is found in certain regions of the country. Hence, this research is geared at understanding and predicting how nano-TiO2 deposits and adsorbs onto iron oxide coated silica beads (model soil) as a function of pH, nature of adsorbent (beads) and concentration of adsorbate (TiO2).

A way of analyzing such adsorption can be done by investigating the relationship between the pH and the zeta potential of the nano TiO2 in relation to the three categories of silica glass beads: Unetched-Uncoated Beads (obtained from Potters Industries), Unetched-Coated Beads (Iron Oxide Coated Beads) and Etched-Coated Beads (iron oxide coated beads etched using NaOH). This observation is necessary as Zeta potential gives insight into the charge and adsorption properties of various surfaces. Zeta potential of the beads were measured using an Electronic Kinetic Analyzer (EKA), which is used to investigate the electro kinetic effects of solid and liquid interfaces of almost all shapes and sizes. 1mM of NaNO3 was used as the background electrolyte, and the pH was varied to 4.0, 5.5, and 8.3.

It was discovered that the isoelectric points (IEP), pH at which the surface charge is zero, of the etched-coated, unetched-coated, and the unetched-uncoated beads were 3.4, 2.7 and 3.0, respectively. These IEPs were expected as etched beads have a rougher surface than unetched-beads, which allows for more coating of iron oxide that has an IEP of 4.9. The IEP of the nTiO2 was measured to be 5.5. Results of the experiment proved that most adsorption of the nTiO2 onto all categories of the beads would occur in the pH range of 4.0 to 5.0, as between these values all categories of glass beads and the nTiO2 are oppositely charged. At pH values 3.4 and below, the beads and nTiO2 are

both positively charged and will produce little to no adsorption, as like charges will repel each other. Similarly, at pH values 6 and above the beads are negatively charged.
[Acknowledgement: National Science Foundation Center of Environmental Implications of Nanotechnology (CEINT)]

Faculty Advisor: Kimberly Jones, kljones@howard.edu

OA #113
Novel Size-Exclusion Chromatography Method for the Separation and Purification of Water-Soluble Zn-Based Quantum Dots

Ricardo Cruz-Acuña, University of Puerto Rico, Mayaguez
L. Alamo-Nole, S. Bailón-Ruiz, O. Perales-Pérez, and F. R. Roman, University of Puerto Rico, Mayaguez

The uses and applications of Zn-based quantum dots have been increased in the last years. Some desirable features of these nanostructures are narrow emission spectra, large quantum yield, chemical stability and high emission spectrum. These characteristics enable the use of these quantum dots in biological staining and detection of bio-macromolecules. Accordingly, any attempt to purify and obtain highly monodisperse quantum dots crystals becomes indispensable. Size exclusion chromatographic (SEC) has been typically used to separate complex samples based on their molecular sizes and size distribution. This application can be successfully extended to the characterization and separation of different types of nanomaterials, including semiconductor quantum dots.

Desired nanostructures were produced from starting zinc chloride and selenide aqueous solutions in presence of thioglycolic acid. The reaction took place under continuous microwave irradiation at 140°C during 30 minutes. The structural, compositional and functional characteristics of the Zn -based QDs were determined via X-ray diffraction, HR-TEM, UV-Vis and PL spectroscopy techniques.

The 1200 Agilent HPLC system, with Fluorescent Light Detector (FLD) and Evaporative Light Scattering Detector (ELSD), was used to separate and purify different fractions of ZnSe/ZnS quantum dots. An aqueous-compatible gel column with a pore size of 1000 Ao was used in all separations. A calibration curve was plotted using 5.0 mg/mL dextran standards in deionized water. The molecular weight of the standards ranged from 4.4 to 401.0 kD. ZnSe/ZnS quantum dots (size ~ 4nm) exhibiting strong luminescence were injected in the HPLC system. Two main peaks at retention times of 12.4 and 22.6 minutes were detected using ELSD and one peak was observed at 12.7 minutes using FLD. FLD confirmed that only one of the peaks corresponded to quantum dots, being the other (observed by ELSD) considered as an impurity by-product. Six fractions were separated and collected at different time ranges (from 11.0 to 14.0 minutes in intervals of 0.5 minutes). The optical properties of the collected fractions were analyzed by UV-Vis and PL. Our results confirmed the successful separation and purification of Zn-based quantum dots by following the developed protocol. These highly monodisperse quantum dots will find applications in disease diagnostic and biological staining.
[Acknowledgement: This material is based upon work supported by the National Science Foundation under Grant HRD 0833112 (CREST program).]

Faculty Advisor: Oscar Perales, Ph.D., operalesperez@yahoo.com

NANOSCIENCE

OA #114
Convergence of Gold Nanoparticles Nanomedicine Engineering and Nitric Oxide Cardiovascular Medicine

Atiya Te'ne' Overton, Delaware State University

Gold nanoparticles have functioned as the Gilded Hope for Medicine in biomedical engineering for many years. Gold and nitric oxide are two different faces of one coin, medicine, as both gold and nitric oxide alleviate rheumatoid arthritis and cure cancer. In this presentation gold nanoparticles will be utilized to control the release of nitric oxide from cardiovascular drugs. This presentation contributes to "NO-enhanced medicines." Despite significant therapeutic innovations, cardiovascular diseases (CVDs) remain the leading cause of death in the USA. Based on statistics provided by the National Institute of Health and the American Heart Association, approximately 80 million people in the USA suffer from cardiovascular diseases and more than 35% of deaths in North America are attributed to CVDs.

We were able to synthesize gold nanoparticles of different sizes in various concentrations by the reduction of HAuCl4 using NaBH4. The results of nitric oxide release rate on the gold nanoparticles prepared from this research will be presented. Biologically relevant S-nitrosothiols such as GSNO and SNAP can be assembled on gold nanoparticles surface due to gold-thiolate affinity. The self-assembled monolayer of thiolate on gold nanoparticles surface can be probed by electron microscopy and infrared techniques. The change in mass can be measured by a Quartz Crystal Microbalance (QCM).
The study of nanomedicine engineering of nitric oxide cardiovascular drugs presented in this proposal is an interdisciplinary research in the physical, engineering, and life sciences. The specific results in this presentation can improve the efficiency of NO drugs and enable the smart nanosensors to trigger the required release rate of the nitric oxide from cardiovascular drugs. *[Acknowledgement: This study was supported, in part, by a grant from NSF awarded to Delaware*

State University SMILE program and Dr. Ahmed A. Mohamed, Department Chemistry at Delaware State University, Dover, DE.]

Faculty Advisor: Dr. Ahmed A. Mohamed, amohamed@desu.edu

OA #115
Fabrication and Characterization of Nanoporous Alumina for Biosensor Applications

Corey Williams, Texas Southern University
Olufisayo Jejelowo, Texas Southern University
Jessica Koehne and Meya Meyyapan, NASA Ames Research Center, CA
Adam Seger, Boaz Vilozny, Paolo Actis, and Nader Pourmand, Basking School of Engineering, UC Santa Cruz

Nano-porous Alumina (Al2O3) is fabricated from sheets of aluminum, which is anodized to achieve films with ordered hexagonally packed nanoscopic pore arrays. We are interested in Al2O3 because with the desired pore length (~6 um deep) and diameter (~60 nm), the Al2O3 can be transformed into a label free biosensor to detect and convert analyte binding into a quantifiable signal by purely electrical means. This biosensor will be useful in applications that rely on detecting, measuring, and differentiating between chemical components in the environment. To improve the biosensor, we need to control pore length, diameter, and density. To fabricate the Al2O3, we control current density, time, and temperature of different electrolytic species and use Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM) to analyze and characterize the physical properties of Al2O3, such as pore size and shape. Ultimately, we want to determine the parameter best apt for fabricating the Al2O3 with desired pore diameter and length. Data obtained from the electrical detection methods will be recorded and plotted in I-V curves to highlight the relationship between the electrolyte and current density on pore size. *[Acknowledgement: This study is supported by NASA-URC at Texas Southern University.]*

Faculty Advisor: Renard Thomas, thomas_rl@tsu.edu

PHYSICS

ASTRONOMY AND ASTROPHYSICS

OA #116
Retracing the Past: Explosion Properties Uncovered by Supernova Remnant Asymmetries

Melinda Soares, University of California, Santa Cruz
Sarah Pearson, University of Copenhagen, Denmark
Laura Lopez, Massachusetts Institute of Technology
Enrico Ramirez-Ruiz, University of California, Santa Cruz

Supernova explosions are the most energetic events in the Universe, supplying nearly all the metals present in the periodic table. Supernovae come in two varieties: the thermonuclear detonation of a white dwarf (Type Ia SNe) and the explosion of a massive star (core collapse SNe). Distinguishing between these two types is difficult, and is traditionally done by observing the physical properties of the ejecta within the first few days after the explosion. How to type a supernova remnant that is thousands of years in age has been a major challenge in astrophysics. Our research involves a systematic comparison of the asymmetries of Type Ia and core-collapse supernova remnants (SNRs) using X-ray images from NASA's Chandra X-ray Observatory. Previous work by our group demonstrated that Type Ia SNRs in the Milky Way and nearby Large Magellanic Cloud galaxies are more circular and symmetric than core-collapse SNRs. We extend this analysis to SNRs in another nearby galaxy, the Small Magellanic Cloud, to test whether we can distinguish Type Ia versus core-collapse SNRs in the different conditions of the Small Magellanic Cloud. Classifying remnant types according to symmetry provides valuable information regarding explosion mechanisms, their environments, and the dynamical evolution of remnants. Such a method is an invaluable tool, providing new insight for theoretical supernova explosion modeling and serving a useful means of typing supernova remnants long after the explosion occurred. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Enrico Ramirez-Ruiz, enrico@ucolick.org

OA #117
Gravitational Field Shielding and Neutron Star Mass-Radius Relation

Bojun Zhang, Vanderbilt University
T. X. Zhang, P. Guggilla, and M. Dokhanian, Alabama A & M University

The recent measurements of neutron stars with larger mass (e.g., two-solar masses) and smaller radius (e.g., 9 km) have ruled out almost all the currently proposed models for the equation of state (EOS) of neutron stars. According to the theory of gravitational field shielding, which was recently developed from a five-dimensional fully covariant Kaluza-Klein theory with a scalar field, we obtain that a neutron star can shield up to one half of its gravity by the scalar field. Taking into account the gravitational field shielding effect in the hydrostatic equilibrium, we develop a new mass-radius relation that can explain these recent mass and radius measurements of neutron stars. With the gravitational field shielding effect, neutron stars can have larger mass and smaller radius and can also be formed from supernova explosions of more massive stars (e.g., 40 solar masses as measured recently). For an object if it is not massive or compact, the scalar field is weak and the gravitational field shielding is negligible and undetectable. But if the object is electrically charged or has a phase transition such as type II

superconductors, the scalar field is enhanced and the gravitational field shielding becomes significant. *[Acknowledgement: NSF AAMU REU]*

Faculty Advisor: T. X. Zhang, tianxi.zhang@aamu.edu, padmaja.guggilla@amu.edu

NANOSCIENCE

OA #118
Preparation of BaTiO3 Thin Films by Double-Pulse-Lasers Deposition

Simeon Wilson, Dillard University
Dr. Abdalla M Darwish and Dr. Hadi Alkahby, Dillard University, LA
Brent Koplitz , Tulane University, LA

BaTiO3 thin films made by Pulsed Laser Deposition (PLD) and other techniques have been used in capacitors, nonlinear optics, modulators, and more recently in systems for used in electric vehicles. BaTiO3 has been chosen because of its wide range of uses when doped with other materials, but the problem is there are really no techniques for doping thin films by PLD. In our research we hypothesize that by using the new and innovative Double-Pulse-Lasers Deposition technique (DPLD) it is possible to dope materials in situ with the ablation process. Inside an ultra high vacuum PLD chamber two laser beams were applied in situ to two targets and as a result two plumes were formed. The plumes then mixed and interacted with each other and then condensed on to a substrate. This method is called the DPLD technique. Epitaxial BaTiO3 films doped with Fe and Mn were made using this technique. The films were deposited at different substrate-temperatures in the range of 200°C-800°C. Different substrates were used like MgO, SrTiO3, and Si to decrease the misfit with BaTiO3.

In our results it was found that the substrate temperature and the oxygen gas pressure affected the morphology of the thin film and in turn the optical response of the thin film. AFM (Atomic Force Microscopy) results revealed a new harmonic grating structure of the thin film due to the DPLD ablation, and the roughness of the surface was measured at 50-70 nm for films of 190-270 nm thick. The thin films showed an anomalous response to the HeNe laser; a self-modulation and grating formation pattern were observed. In conclusion DPLD will add a new piece to the PLD technique to make it more attractive and versatile especially for doping of BaTiO3 and other thin films.

The technique was able to fabricate a doped thin film which has anomalous structure as observed by AFM, but given the preliminary nature of experimental results of double ablation, the new observed periodic structure of the thin film, and the new optical response of the film, new questions were raised. Future considerations are: how to catalog the conditions of the experiments, and investigation into the effect of the oxygen environment in the chamber and temperature of the substrate. *[Acknowledgement: The authors would like to acknowledge the support of: DOD-AFOSR grants FA 9550-08-1-0363, FA9550-10-1-0199, FA 9550-10-1-0198; NSF/LA BOR DUE LSAMP grants.]*

Faculty Advisor: Dr. Abdalla Darwish, adarwish@bellsouth.net

PHYSICS (NOT NANOSCIENCE)

OA #119
Algorithm for Determining U(1) Charges in Free Fermionic Heterotic String Models

William Hicks, Brown University
Dr. Gerald Cleaver, Baylor University, TX
Lesley Vestal, University of British Columbia, Okanagan, Canada

To assist in the search for phenomenologically realistic models in the string landscape, we must develop tools for investigating all gauge charges, including U(1) charges, in string models. In order to more thoroughly investigate weakly-coupled free fermionic heterotic string (WCFFHS) models, this study developed an algorithm for determining the U(1) gauge states and U(1) charges in WCFFHS models given their matter and non-Abelian gauge content. The algorithm was then implemented as a C++ module in a model-building framework under development at Baylor University and used to construct 1.4 million gauge models. While the primary purpose of this study was to develop a tool to help analyze U(1) content, analysis of these 1.4 million models confirmed the hypothesis that U(1) charge affects the uniqueness of matter states in a significant minority of models constructed.

This result demonstrates the potential usefulness of U(1) analysis in determining overall model uniqueness, which can in turn inform future searches for phenomenologically realistic models. This algorithm can also be used to identify anomalous U(1) charges in constructed models, which can help eliminate exotic particles from constructed models, and future studies should analyze how often such charges appear in models of this type. *[Acknowledgement: This research was funded by the NSF through grant PHY-1002637 as part of the CASPER/Baylor REU Fellowship.]*

Faculty Advisor: Gerald Cleaver, gerald_cleaver@baylor.edu

OA #120
Health Physics: The Effects of Radiation Exposure on Human Beings

Johne'tra Trotter, Dillard University, LA

Medical and health physics is a field of science concerned with radiation physics and radiation biology with the goal of providing technical information and proper techniques regarding the safe use of ionizing radiation. This topic was chosen and is of importance because medical and health physics is a branch, field, and study of medicine and physics with little in depth mention. All living things contain living cells, and radiation can kill living cells or change their nature when absorbed through a medium. Biological damage due to radiation stems mainly from damage to DNA. The "Sievert" is the unit of dose of most interest in radiation protection. Damage may by deterministic or stochastic. This project explains the effects of radiation as well as health risks that may occur. Further research on medical and health physics will include improvement made in ionizing radiation and recent innovations made to improve radiation therapy for cancer patients undergoing various treatments. *[Acknowledgement: This project was supported by Abdalla Darwish, Ph.D., Chair of the School of Science, Technology, Engineering, and Mathematics and Director of LS-LAMP, Dillard University, New Orleans, Louisiana.]*

Faculty Advisor: Dr. Bernard Singleton, bsingleton@dillard.edu

OA #121
Investigating U(1) Charges In Weakly Coupled Free Fermionic Heterotic String Models

Lesley Vestal, University of British Columbia / Baylor University
William Hicks, Brown University, RI

To assist in the search for phenomenologically realistic models in the string landscape, we must develop tools for investigating all gauge charges, including U(1) charges, in string models. In order to more thoroughly investigate weakly-coupled free fermionic heterotic string (WCFFHS) models, this study developed an algorithm an algorithm for determining the U(1) gauge states and U(1) charges in WCFFHS models given their matter and non-Abelian gauge content. The algorithm was then implemented as a C++ module in a model-building framework under development at Baylor University and used to construct 1.4 million gauge models. While the primary purpose of this study was to develop a tool to help analyze U(1) content, analysis of these 1.4 million models confirmed the hypothesis that U(1) charge affects the uniqueness of matter states in a significant minority of models constructed. This result demonstrates the potential usefulness of U(1) analysis in determining overall model uniqueness, which can in turn inform future searches for phenomenologically realistic models. This algorithm can also be used to identify anomalous U(1) charges in constructed models, which can help eliminate exotic particles from constructed models, and future studies should analyze how often such charges appear in models of this type. *[Acknowledgement: NSF]*

Faculty Advisor: Gerald Cleaver, gerald_cleaver@baylor.edu

SCIENCE & MATHEMATICS EDUCATION

EDUCATION

OA #122
The Mis-Education of Early Science Education

Rana Bost, Harris-Stowe State University and World Aquarium, St. Louis, MO

Based on U.S students' performance in science and mathematics being quite low, a tremendous amount of resources have been poured into the STEM initiative over the past several decades. Poor student achievement in science translates into low adult scientific literacy. A 2009 poll found that many Americans lack basic science knowledge on a variety of topics.

Recently, Gloria Mills, an undergraduate research student, established a Science Enthusiasm Quotient which allows for identification of characteristics to improve STEM learning in the middle school classroom. It is expected that a similar type of enthusiasm quotient may predict the quality of STEM education in the early childhood classroom. Using the Science Enthusiasm Quotient, students and teachers will be observed and evaluated in an urban early childhood center. The Science Enthusiasm Quotient *(Walberg and Paik, 2000)* consists of the following components:

1. Ability to understand the urban learner;
2. A healthy and effective Parent-Teacher relationship;
3. Exciting, interactive lesson plans; and
4. An expressive, dedicated and relatable educator.

These four ingredients create an effective learning environment to inspire student-teacher enthusiasm. The aim of this research project is to discover how science, when taught at an early age along with effective teaching methods, benefits children academically. Based upon the results and curriculum analysis, a new curriculum was recommended for further improvement of early STEM literacy. It is expected that this assessment application may assist other early childhood classrooms in buildingscience literacy. *[Acknowledgement: National Science Foundation World Aquarium]*

Faculty Advisor: Dr. Tommie Turner, turnert@hssu.ed

OA #123
Reaching the Science Enthusiasm Quotient: Exploring the Enthusiasm of Academics in Urban Middle Schools

Gloria Mills, Harris-Stowe State University and World Aquarium, St. Louis, MO

The quality of education in a classroom can be directly affected by the enthusiasm of the instructor and the students. The structure of the science curriculum and the disposition of the educator can positively affect students' retention rates. By identifying key factors that objectively enhance the educational environment, the enthusiasm of each student can be altered, thereby altering the retention rate and providing students with a high quality education. Through research-based observations, an enthusiasm formula has been composed. The formula highlights the determining components of the ideal urban middle school classroom. These components are: 1) the ability to understand the social climate of the environment the urban learner resides in; 2) maintaining an effective and on-going parent-teacher relationship; 3) promoting interactive, hands-on lesson plans; and 4) placing an expressive, dedicated, and relatable educator in the classroom.

The aim of this research project is to observe urban middle schools in hopes of perfecting said formula and reaching the optimum enthusiasm quotient within science classes. It is important to promote enthusiasm in science education in order to tailor analytical thinking from a young age in preparation for any career urban students may choose to venture into. Observatory research was conducted through interviews with educators and students. In addition, middle school science classes were observed. Enthusiasm and retention rates were measured by applying the enthusiasm formula and assessing the determinants based on a rubric-generated score. Correlations between the disposition of the educator and the students' likeliness to retain information were found. Classrooms that provided platforms for interactive learning held higher assessment scores, solidifying the enhanced retention rates of students due to educator enthusiasm. According to the analysis of urban middle school science classes and the interviews of urban students, the lack of enthusiasm in a classroom setting affects the progression of students' education and acquirement of scientific skills. There was a significant difference in the levels of exciting and interactive lesson plans from urban to suburban. In the analysis of cumulative factors, urban compared to suburban also yielded a significant result utilizing t-test analysis. In the future, the enthusiasm formula rubric may be used as a diagnostic tool for middle school science classes. *[Acknowledgement: National Science Foundation World Aquarium]*

Faculty Advisor: Dr. Tommie Turner, turnert@hssu.ed

PHYSICS (NOT NANOSCIENCE)

OA #124
Magnetic Pendulum-Simulating Enhanced Gravity: A STEM Education Inquiry

Melissa Bradshaw, Harris-Stowe State University
Jayashree Balakrishna, Harris-Stowe State University, MO

Gravity, a fundamental aspect of life, is part of any physical science curriculum. It is easy to calculate the gravitational acceleration on earth using a simple pendulum. The slower oscillation compared to free-fall allows for accurate time data that can be used to teach graphing and data analysis. We modified the pendulum apparatus to simulate an increased gravity (e.g. gravity on a different planet) using a magnetic ball and magnets. We hypothesized the difference between the effective acceleration and the gravitational acceleration on earth (9.8m/s^2) would fall off as 1/(distance from magnet)^2. The gravitational force falls off as 1/r^2, but this is hard to see in a typical gravity experiment. Secondary level physics students would benefit from a concrete demonstration of this abstract concept as they study gravitational effects on planet systems and satellites. A bob made of magnetized material was hung over one pole of a series of magnets lined up side by side with like poles together. Magnets were taped together to prevent realignment due to repulsion. For a given length the distance from the magnet was varied by putting the magnets on a vertical set of 2cm thick boards that were removed one board at a time. The time for 10 oscillations was measured using a stopwatch, and the period determined for each distance. The length was changed and the process repeated. We observed the 1/d^2 dependence to a reasonable level as long as the bob was not so close to the magnet that the differences in its distance from the magnet at different points on its path became significant. A non-magnetic bob was used as a control. A pendulum is an inexpensive and easy to obtain instrument to show some wonderful concepts in science. We would like to simulate lower gravity with similar methods. The use of the buoyant force or the repulsion property of like poles of a magnet are possible avenues for future research. *[Acknowledgement: This study was supported by NSF 0811219 HBCU-UP STEM Implementation Grant. Cutnell, J. D., & Johnson, K. W. (2009). Physics (8th ed.). Hoboken: Wiley. Rosenblatt, L. (December 2004). Those Puzzling Pendulums. The Science Teacher, 38-41. Sinacore, J., & Takai, H. (2010). Measuring 'g' Using a Magnetic Pendulum and Telephone Pickup. The Physics Teacher, 448.]*

Faculty Advisor: Jayashree Balakrishna, balakrij@hssu.ed

SOCIAL & BEHAVIORAL SCIENCES

PHYSIOLOGY AND HEALTH

OA #125
Attempting to Improve the Accuracy of the Screen Positive Rate (SPR) in Down Syndrome Reports of Pre-Natal Testing

Rahja' Sharp, Michigan State University / Savannah State University

Prenatal screenings are tests offered during pregnancy to determine if a mother is at an increased risk to have a baby with certain defects requiring the baby to need extra medical care. If a mother knows her baby will be born with a defect, she can make critical decisions and arrangements before birth. The purpose of this research is to improve test accuracy for detecting Down syndrome to help more mothers make decisions for their babies. The specific tests we examined are the Quadruple Test, the Serum Integrated Test and the Full Integrated Test. We increased the cut off values for these tests with the expectation of improving our Screen Positive Rates (SPRs) and accuracy rates. SPRs are calculated by dividing the number of patients with Down syndrome by the number of patients in that sample test.

This project breaks down the demographic data of two samples (2007-2010 and 2010 to present) received from the MSU Clinical Genetics Laboratory by the variables: age range, weight, ethnicity, IVF pregnancies, and diabetic status from two data sets. We compare the SPRs for each variable to see if any specific breakdown of a variable has a significant correlation to the detection of Down syndrome. Then, a comparison of the SPRs from the previous and current data sets was conducted, to display the improvement for the new cut-off value.

The Quadruple and Serum Integrated tests improved from the previous to the current cut-off values. Other than age, no other variable chosen has shown a correlation with Down syndrome. By improving the cut-off values, two of the three tests produced an enhanced SPR and accuracy rate. *[Acknowledgement: Michigan State University (MSU) Summer Research Opportunities Program, Committee on Institutional Cooperation, and National Science Foundation.]*

Faculty Advisor: Dr. Sainan Wei, Sainan.Wei@hc.msu.edu

OA #126
The Impact of Stress and Anxiety on Nicotine Addiction among Minority Females

Justin Tyner, Talladega College
Dr. Leonard Cole, Gladys Swain, and Syed Raza, Talladega College Talladega, AL

The American Heart Association reports smoking statistics that indicate that lesser educated groups of Americans are more prone to smoking. A great number of female smokers rely on nicotine for stress reduction. One hundred seventy-four thousand (174,000) females die from nicotine usage and addiction each year. A pilot study was conducted based on two hypotheses: H1. Age, income and education are the common factors contributing to stress and nicotine addiction; and H2. Does nicotine have calming effects on individuals experiencing stress?

The purpose of the study was to determine the correlation between stress and nicotine addiction among minority females at Talladega College. A survey was conducted among females, ages 18 and older, to identify the factors that contribute to stress, anxiety, nicotine addiction and non- smoking. In survey questionnaires, income, age, and education were used as correlated factors to determine the stress levels among smoking and non-smoking females at Talladega College. Survey data indicate that females, ages 18-24 with an income of $1000 to $10,000, had the highest stress levels due to smoking. Forty-five percent of female agreed that smoking gives a calming effect. The finding also indicated that seventy percent students depend on the use of tobacco with nicotine to deal with stress. The survey data indicate that females who rely primarily on nicotine usage for coping with stress have higher stress levels than non-smoking females.

Future research should focus on the recruitment of participants among minority females in all four-year colleges in Alabama. *[Acknowledgement: This study was supported by a grant from NSF/HBCU-UP awarded to Leonard Cole, Ph.D., Director of Sponsored Program, Talladega College, Talladega, AL 35160]*

Faculty Advisor: Dr. Leonard Cole, lcole@talladega.edu

SOCIAL SCIENCES/PSYCHOLOGY/ECONOMICS

OA #127
Mediating Role of Acceptance of Violence on the Relation between Male Role Norms and Intimate Partner Violence

Thomas E. Benjamin, Georgia State University / Morehouse College
Cameron A. Miller and Dominic J. Parrott, Georgia State University

It is widely accepted that intimate partner violence (IPV) is a pervasive and serious health concern that requires continued investigation. It has been shown that an accepting attitude toward partner violence is a significant risk factor for IPV (Field, Caetano, & Nelson, 2004). The present study examined the mediating role of acceptance of IPV in the relation between three different norms of hegemonic masculinity (status, toughness, and antifemininity) and IPV. Thus we hypothesized

that adherence to acceptance of IPV would mediate the relation between dimensions of the Male Role Norms Scale (Thompson & Pleck, 1986) and physical IPV per the Conflict Tactics Scale (Straus, 1999). Participants were 142, self-identified heterosexual men. Participants completed measures of hegemonic masculinity, acceptance of IPV (Acceptance of Interpersonal Violence Scale; Burt, 1980), and physical IPV during the past 12 months. Preacher and Hayes (2008) multiple mediator macro was used to test the study hypotheses.

This study study found a significant relation between the endorsement of the toughness and antifemininity norms and IPV. Analyses also revealed a significant direct effect (while controlling for acceptance of IPV) of the toughness norm ($b = .155$, $p < .001$) on minor physical aggression. Endorsement of the view that men should be tough facilitates greater acceptance of violence in intimate relationships, which in turn is a more direct predictor of physical IPV. Future research is needed to further clarify the multiple mechanisms by which traditional gender norms are associated with IPV. *[Acknowledgement: This research was supported by grant R01-AA-015445 from the National Institute on Alcohol Abuse and Alcoholism awarded to Dominic J. Parrott]*

Faculty Advisor: Dominic J. Parrott, parrott@gsu.edu

OA #128
Why Aren't You Helping Me?: Interracial Helping in Emergency Situations

Donte Bernard, Kansas State University

Two prominent theories have emerged to help better explain the shift of racism from overt to covert: the aversive racism theory (Gaertner & Dovidio, 1986) and the justification-suppression model (Crandall & Eshleman, 2003). Together, these theories clarify the contradiction between Whites' low self-reported levels of prejudice and their more covert expression of prejudice. We seek to test and apply discrimination and helping theories in a real life behavioral situation, in which participants will be placed in situations where they have the decision to help a confederate. Problem being investigated: The Five Steps model (Latane & Darley, 1969) was developed to study helping in any helping situation. According to this model, when help is needed, one must first recognize the event; second, the event must be interpreted as an emergency where help is needed; third, one must take personal responsibility for helping; fourth, one must decide how to help; and finally one must decide to provide help. Failure at any step of this process will result in no help given. We will examine the Five Steps model to determine why participants help or do not help when placed in realistic helping situations, specifically the differences in interracial helping situations.

Predictions: We expect to see differences in helping when the confederate is Black when compared to a White confederate. We expect participants to be less likely to interpret the situation as an emergency when the confederate is Black than when he is White. Furthermore, we predict that individuals high in racism will help Blacks less, and individuals low in racism to help Blacks more.

Method: Before participating, participants will complete the RAS (Saucier & Miller, 2003), an indirect measure of racial attitudes. Individuals with high racism scores have been seen to help less than individuals with low racism scores. During the study, the confederate will act as if he passed out, and the quality and speed of helping will be recorded. We will focus reactions to the situation, specifically examining helping differences based on the confederate's race and reason for passing out.

Conclusion: The findings will extend prejudice research that has used helping paradigms to study less overt forms of racism (Crosby et al., 1980; Saucier et al., 2005) by exploring the decision-making process involved in providing help to the in-groups, relative to the out-group. *[Acknowledgement: This study was supported, in part, by the Kansas State University Psychology Department.]*

Faculty Advisor: Dr. Donald Saucier, saucier@ksu.edu

OA #129
Engaging the Community in the Prevention of Childhood Obesity (ECPCO): A Model Approach

Tevon Bond, Talladega College
Dr. Leonard Cole, Gladys Swain, and Syed Raza, Talladega College, AL

Obesity is a growing epidemic in communities in the United States. Alabama has one of the highest obesity rates in the U.S. Children who live in low-socioeconomic communities have a higher rate of obesity. The purpose of this research was to identify the factors which contribute to childhood obesity and establish awareness among communities and parents. A pilot study was based on the two hypotheses. H1. Children that have healthy diets and get adequate exercise are less likely to become obese. H2. Community recreation facilities play a role in decreasing obesity among children. A pilot study was conducted to identify factors contributing to an increase in the problem of obesity among children of Talladega College faculty, staff, and students. A questionnaire was distributed to parents of children in grades K through 12. This study identified factors such as unhealthy diet, lack of exercise, community support, and sedentary behavior as contributors to childhood obesity. The finding suggested that the obesity problem is not prevalent among children (K-12 grade) of those parents who make above $40,000. Sixty-five percent of parents reported that obesity is

not a problem in the surrounding community. Thirty-Five percent of the parents were concerned that there is not enough support from the community to prevent obesity and recreation facilities are not adequate. Communities need to increase the number of recreation facilities and supporting programs for low income parents to prevent childhood obesity. Future research should focus on the recruitment of participants among Talladega County. *[Acknowledgement: This study was supported by a grant from NSF/HBCU-UP awarded to Leonard Cole, Ph.D., Director of Sponsored Program, Talladega College, Talladega, AL 35160.]*

Faculty Advisor: Dr. Leonard Cole, lcole@talladega.edu

OA #130
A Stress Reduction Study Among American Indians on the Fort Peck Indian Reservation

Angela Cole, Fort Peck Community College
Shayna Long and Christine Holler-Dinsmore, Fort Peck Community College, Wolf Point, MT

The purpose of this research is to determine whether Mindfulness-Based Stress Reduction (MBSR) education combined with exercise will significantly reduce perceived stress more than MBSR education alone. Previous research shows that MBSR can reduce depression, anxiety, and stress related conditions. Literature indicates that exercise can potentially mediate and reduce stress as well as potential negative health attributes. To date there have been few studies on Native Americans in relation to stress reduction and health. Because of the high levels of stress Native Americans endure there is a need for a long term and cost effective treatment, especially one that has shown to increase resilience to stress and stress related health concerns. Participants were solicited via flyers in local businesses, radio and newspaper advertisements. Twenty participants were randomly selected and assigned to either the MBSR education group or MBSR education and exercise group; of those groups, only eleven participants completed treatment. Both the education and exercise groups attended a two hour education class once a week; in addition the exercise group spent three hours a week exercising. Participants were tested for perceived stress, pre and post treatment using Cohen's Perceived Stress Test; for stress, Derogatis DSP, and mindfulness, and The Mindfulness Self Efficacy (Cayoun & Freestun, 2004). Participants used the Mindfulness-Based Stress Reduction Workbook (B. Stahl and E. Goldstein, 2010) that included a CD with meditation practices to use during and after the treatment. They were also given journals and asked to write down the specific formal and informal practices used along with their thoughts on them and were collected at the end of the study. Phone calls were made to record the duration and frequency that these practices were used. Results showed no difference between the exercise and education group versus the education group alone. However there was a significant difference between pre and post results for both groups. There was no significant difference between follow-up and the post test except in the mindfulness self efficacy which showed a significant increase at 0.05. In future research we will add a wait -list control group to further substantiate the efficacy of MBSR. Given our small sample size we will be increasing the number of participants as well as recruiting participants closer to the start-up date. *[Acknowledgement: This research was supported by NIH Sub-award G113-12-W3547, Prime award 5P20RR016455-11.]*

Faculty Advisor: Christine Holler-Dinsmore, choller-dinsmore@fpcc.ed

OA #131
Embracing the Darkness

Anthony Culp, Morehouse College
Thameena Azziz, Clark Atlanta University, GA

The area of study that focuses on the behavioral responses to light in blind worker subterranean termites (Reticulitermes sp) has not been extensively explored. Previous tests in our lab demonstrate that subterranean termites show a negative phototactic response to white fluorescent light. Our current study looks at termites reaction to light across a spectrum between 450nm (blue light) to 650nm (red light). Our original hypothesis was that termites reaction to light would vary across the different wavelengths, where termites would find long wavelength light (650nm) less aversive. The reasoning behind this notion is the fact that most insects cannot detect light with a wavelength greater than 650nm. To test our hypothesis, 10 termites were placed in a 35mm petri dish in which one side was painted black and the other side remained clear (Experimental group). A second group of 10 termites were placed in another 35mm petri dish with a black line drawn down the middle, in which one side was arbitrarily designated as the dark side and the other the light side (Control group). The Experimental and Control group were place in a black painted fish tank in an environmental chamber at 26 °C ± 2 °C and at 80% ± 2 relative humidity. Light of different wavelengths was presented using a Fiber-Lite Metal Halide Machine Vision Illuminator in conjunction with wavelengths filters ranging from 450nm to 650nm in increments of 50nm. A video camera was used to record each experiment. For a previous experiment in our lab, to rule out heat as a confounding variable, two P300 thermocouples were used to monitor the temperature inside each petri dish under these experimental conditions, and there was no significant difference in temperature between the experiment and control petri dishes. Preliminary results showed that termites spent significantly more time in the dark then in the light in the Experimental group. For the Control group there was no difference, in regards to time spent on the arbitrarily designated dark and light side. Also there was no difference in the Experimental group in regards to avoiding light at different wavelengths. Based on these preliminary results, termites will

avoid light equally between 450nm and 650nm. This suggests that blind termites may be able to detect the entire visible spectrum. This suggests a broad range of light at different wavelengths could be used as a biological control for termites. *[Acknowledgement: This study was supported by the Morehouse Wide Initiative for Sustainable Energy (M-WISE), National Science Foundation awarded to Lycurgus Muldrow Ph.D., Director of Integrated Programs, Morehouse College, Atlanta, Georgia, 2010, with additional funding from the Howard Hughes Medical Institute.]*

Faculty Advisor: Dr. Duane Jackson, djackson@morehouse.edu

OA #132
Heavy Particle Effects on Spatial and Object Recognition Memory in Rats

Daniel Martins, University of Maryland Baltimore County

The present study is an investigation of biological and behavioral correlates of astronaut exposure to cosmic particles on exploratory class missions. Heavy particles (HZE particles) and irradiation have a documented effect on neurocognitive function (Hodges et al., 1998). Previous studies have also shown that age may influence the amount of exposure necessary to produce neurocognitive effect. Through the use of heavy particles (a ground-based model for cosmic particles) it is possible to examine the extent of this neurocognitive impact. The subjects in the present study are both male and female Sprague-Dawley (S-D) rats. The controls in the study are rats exposed only to oxygen and unexposed to irradiation with the investigated HZE particles. Spatial memory and novel item testing are used to investigate heavy particle effects on orientation, awareness, and object recognition memory. Elevated plus maze testing is used to measure anxiety and caution in exploration. It is expected that irradiated rats will show higher levels of neurocognitive and memory-related deficiency. The results of this study may provide direction for future studies and ultimately may provide NASA with necessary information for long term astronaut protection. *[Acknowledgement: NASA]*

Faculty Advisor: Dr. Bernard Rabin, rabin@umbc.ed

TECHNOLOGY & ENGINEERING

CIVIL/MECHANICAL/MANUFACTURING ENGINEERING

OA #133
Regional Climate Change Analysis Based on Long-term Precipitation Data

Mekonnen Hailegiorgis, University of District of Columbia

It has been recognized that there will more extreme weather related events due to climate change which can have severe impacts on our water resources and water infrastructures. For example, extreme precipitation events can have severe impact on the society, particularly urban areas and most of urban infrastructure systems (i.e., transportation system, drainage systems, building systems and electric systems etc.). Therefore, there is need to analyze the long-term precipitation at specific locations to understand the possibility of extreme events and their magnitudes related to possible climate change.
To understand the climate change at a specific location based on the precipitation data, this project is designed to conduct an analysis of long-term precipitation data. The random rainfall events are analyzed based on defined statistical events which are based on the inter-event time definition. The methodology includes the collection of long-term data from NOAA and NCDC web sites and conducts a storm event analysis. The long-term precipitation record of Washington DC Metropolitan area is divided into small chronological records of each decade. The storm event characteristics such as event volume, event duration and event intensity are analyzed to see the trend over the last half century. The results are presented to understand the climate change scenarios of the DC area. Such analysis has a strong practical application for civil engineers who are responsible for analyzing, designing, and maintaining the civil systems. *[Acknowledgement: My special thanks goes to the STEM Center.]*

Faculty Advisor: Pradeep k.Behera, Ph.D, pbehera@udc.edu

OA #134
Renewable Energy-Powered Bulk Milk Cooling for Smallholder Dairy Farmers

Jonathan M. E. Jones, University of Georgia

Uganda's population of 30.7 million is predominantly found in rural agricultural areas. Agriculture makes up 15.1 percent of the country's total GDP and 90 percent of its exports, with dairy production commanding a large portion. Due to poor road networks and lack of electricity, many smallholder dairy farmers lack the means to preserve the evening milk, which results in large economic losses. In previous studies, a 15.5-liter renewable energy-powered zeolite absorption evaporative cooler that lowers the temperature of milk 18 degrees Centigrade was developed. One hundred percent of the milk entered the cold chain and milk received a 5 out of 6 on the Resazulin test for bacteriological content. This device allows farmers to preserve their evening milk using basic evaporative cooling and vacuum pressure. However, the 15.5-liter capacity has been limiting. The objective in the current study is to scale-up the cooler to 100 liters. Our hypothesis is that with a larger capacity, the system can be easily diffused among the more educated farmers with more milk, which will increase the adoption of the technology. This current study involves the

testing of wicking material, zeolite saturation, zeolite regeneration, and biogas regeneration. Results show that the system can be optimized for larger capacity utilizing the CoolMax wicking material and regenerating zeolite after 55 percent saturation at 250-300 degrees Centigrade using a biogas digester. Future work will include the production and testing of the new prototype in Uganda as well as the establishment of a training facility for local farmers in country. The use of these innovations will permit more milk from the farmers to enter the cold chain, facilitating an increase in incomes and GDP of Uganda. The device will also allow farmers to use excess biogas for cooking and lighting, decreasing the demand for woody biomass, which will reduce the deforestation rate and methane gas release. Special thanks to Khushboo Bhambhatt at the University of Georgia and Kenneth Ndyabawe from Makere University for their assistance on this project. *[Acknowledgement: The funding sources of this study: World Bank Development Marketplace Program Award DM08 5681; Engineering International Foundation; National Science Foundation Award 0528062; and U.S. Environmental Protection Agency Grant Number SU834725.]*

Faculty Advisor: William Kisaalita, PhD, williamk@engr.uga.edu

OA #135
A Study on Friction Stir Welding of Mixed Joints (Copper and Aluminum)

Kenneth Williams, Virginia State University
Jahangir Ansari, PhD, Virginia State University

Friction stir welding (FSW) is a solid-state welding process used to join two materials together while maintaining the original material characteristics. In FSW, a cylindrical shouldered tool having a pin is rotated and plunged into the joining area between the two pieces of plate material. The heat generated by friction at the tool causes stirred material to soften without melting. The material is then conjoined around the tool and forms a weld. The focus of this study is to examine the joint ability of Copper and Aluminum by controlling the parameters such as force, welding speed, and rotational speed of the tool. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Jahangir Ansari, PhD, jansari@vsu.edu

Computer Engineering

OA #136
PR2 Head and Hand Manipulation through Teleoperation Using an Attitude and Heading Reference System

Jason Allen, University of the District of Columbia

Previous research using Vicon, a motion capture system, has been used to tele-operate the PR2 robot's head using tracking markers attached to the user's head mounted display (HMD). However, the Vicon system requires special cameras, rigging, and an extra software suite to perform this task. Our current goal is to find a smaller, mobile alternative that is at least as accurate as the Vicon system in order to manipulate the PR2 robot from Willow Garage. The CHR-6dm Attitude and Heading Reference System (AHRS) from CH Robotics meets our goal. The CHR-6dm is the size of a quarter, can be easily attached to the user's HMD, and its driver and programs can be added to the existing robot's operating system. Shown to be an acceptable replacement to the Vicon system, the AHRS, in conjunction with actuators and tactile sensors, is being considered for controlling the PR2's grippers and contributing to a more complete tele-immersion experience. *[Acknowledgement: NSF ARTSI SUNFEST LSAMP]*

Faculty Advisor: LaVonne Manning, manningudc@verizon.net

OA #137
Assessing Software and Protocol Vulnerabilities in Routers for Secure Cloud Computing

Nicholas Luna, Tennessee State University
Dr. Sachin Shetty and Hellen Maziku, Tennessee State University

With the rapid increase of interest in cloud technologies, there exists an ever growing need to examine the network security aspects of the cloud. Servers and routers represent two targets for network vulnerabilities in the cloud. A large focus has been placed on the security of cloud servers. However, there is a strong likelihood cloud routers have not received the same level of security focus. This leaves a half realized picture of the security levels of cloud networks. A company interested in moving their data to the cloud should have a complete knowledge of the potential security risks a cloud network proposes. This research will help companies better understand the aspects of cloud security and allow them to better evaluate if moving to the cloud is right for them. As such, we present the methodologies and results of a vulnerability assessment of cloud routers. Several tools were used during the assessment of the router security levels including PlanetLab, Network Mapper (nmap), and MySQL. PlanetLab is a worldwide network intended for global scale networking and distributed computing research. PlanetLab was used to perform a full mesh trace route to discover router IP addresses within the U.S. The vulnerabilities of the router IP addresses were assessed by using port scanning. Port scanning was the technique chosen to discover vulnerabilities as ports represent the backbone of internet services. Specifically, the TCP connect technique was used as it is a reliable non-stealth port scanning technique. Nmap was chosen to implement the TCP connect scanning technique as it is an industry standard port scanning software system. The TCP connect scans results were inserted into a MySQL database for easy parsing. The data shows that of the 56,287 routers

scanned 38,914 (69%) had trivially exploitable ports open. 11,063 (20%) routers were found to be secure having all scanned ports closed. 1136 (2%) were found to have trivially exploitable ports closed with non-trivially exploitable ports open. This overwhelmingly proves that cloud routers are ignored in security practices. Future work should focus on widening the scope of ports scanned, expanding the target routers to a world scale, and to find information on router owners. *[Acknowledgement: This study was funded by the NSF Research Initiation Grant awarded to Sachin Shetty Ph.D., Director of the Cyberviz Research Lab, Tennessee State University, Nashville, TN.]*

Faculty Advisor: Dr. Sachin Shetty, sshetty@tnstate.edu

OA #138
A Computational Study of Transient Couette Flow Over an Embedded Cavity Surface

Michael Thompson, Arizona State University

Insect flight has become a topic of increased study due to bio-inspired applications for Micro-Air-Vehicles (MAVs). The complex yet efficient flight mechanism of butterflies relies upon flexible, micro-geometrically surface patterned, scaled wings. Effective vortex control, when flapping as well as low-drag gliding, may result from the wing's texture. This hypothesis was tested by focusing on the formation of embedded vortices between the rows of scales on butterfly wings. To calculate the total surface drag induced on the moving cavity surface a computational fluid dynamics study using FLUENT simulated the flow inside and above the embedded cavities under transient Couette flow conditions with Reynolds numbers varied from 0.01 to 100. The computational model consisted of a single embedded cavity with a periodic boundary condition. Based on SEM pictures of Monarch (Danaus plexippus) butterfly scales, various cavity geometries were tested to deduce drag eduction. Results showed that the embedded vortex size and shape generated within the cavity depended on which surface moved (top, flat wall or bottom, cavity wall) as well as aspect ratio. Surface drag reduction was confirmed over the cavity surfaces when compared to that of a flat plate, and increased with aspect ratio. *[Acknowledgement: Funded by REU SITE EEC – 1062611]*

Faculty Advisor: Armando Rodriguez, aar@asu.edu

Computer Science & Information Systems

OA #139
Evaluating Data Visualization: An Information Dashboard in the College of Veterinary Medicine

Sharrod Hines, Iowa State University / Norfolk State University

The faculty and staff in the Iowa State University College of Veterinary Medicine are routinely presented with complex decisions relating to the development and implementation of their curriculum. For that reason we created a prototype that will enable the faculty of the College of Veterinary Medicine to make quick and accurate decisions regarding the curriculum. We tested the prototype using several students from a local summer research opportunity internship. The goal of testing was to determine if the prototype was reported as easy to use as well as to identify changes that could be made to improve the usability and efficiency of the dashboard. We paid particular attention to the topic of which graphs were rated most helpful by the participants and how difficult the participants felt that the tasks were to complete. After completing usability tests, we made changes to the most confusing and unhelpful parts of the dashboard. Based on the changes, we put together a well thought out dashboard. Future work includes seeing if this dashboard is actually efficient for time and accuracy for making decisions for the veterinary faculty at Iowa State to use. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Jared Danielson, jadaniel@iastate.edu

Electrical Engineering

OA #140
Asymmetrical Capacitor Thrusters in Microgravity

James Bynes III, Kapi'olani Community College
Hiroshi Park, Kapi'olani Community College

NASA has developed a method called "Microgravity" whose aim is to simulate both reduced and increased gravitational fields ranging from 0g to 1.8g using a Boeing 727 aircraft maneuvering in a parabolic flight pattern. This opportunity has been opened to researchers interested in conducting experiments where systems may be observed in controlled gravitational fields. A lifter, an asymmetrical capacitor able to produce a vertical thrust under high voltage, is an experimental system for which no theoretical model (i.e. Biefeld-Brown, anti-gravitational force, etc.) has been successfully applied to accurately predict its thrust. If the effect of the anti-gravitational force can be experimentally ruled out, such results would shine new light on the possible sources of the thrust. By conducting this experiment in variable gravitational fields, the purpose of this project is to verify the null effect of the gravitational force on the thrust of the lifter. Following strict guidelines and procedures from NASA, the method implemented will be as follows: a high voltage (>30kV) is applied to a lifter, equipped with a string at the center of its base, which is connected to a calibrated spring and situated longitudinally as respect to its direction of motion. The resultant vertical motion of the lifter exerts a tensile force to the anchored spring, causing it to elongate. An optical camera is used to measure the elongation of the spring. The elongation of the spring will be monitored

continuously throughout the parabolic flight, collecting data throughout the controlled gravitational fields. The aircraft accelerometer will be interfaced with the experiment control module in order to correlate the thrust generated by the lifter with respect to each gravitational field. It is expected that gravity will have no effect on the thrust of the lifter, which suggests that the effect of anti-gravity will not be needed in future theoretical development of models whose aims are to predict with better accuracy the magnitude of the thrust. If this proposal is accepted by NASA and this experiment is carried out, more experiments should be conducted to further understand the forces where the sources of the thrust may then be narrowed down. *[Acknowledgement: We would like to recognize and thank the support of the National Science Foundation, as well as the Kapi'olani Community College STEM program for allowing us to design this project and support the implementation of this experiment.]*

Faculty Advisor: Herve Collin, herve@hawaii.edu

OA #141
The "Reconfigurable" Energy Management System Project

Tina Hoots, J. F. Drake State Technical College
Amber Davis and Kenneth Kennedy, J. F. Drake State Technical College, AL

This project investigates enhancing the energy efficiency of residential homes using FPGA and microcontroller technology. In the typical pre-existing home, there is currently no user friendly product that can manage power consumption without great expense. The systems that we investigated were also quite complicated in design and they were not flexible or scalable. Each device performs one task only and typically did not have the ability to be improved without a new installation. Our project will be a low cost user friendly integrated control system that will allow the consumer in real-time to monitor, manage and forecast energy consumption. This system will also help eliminate "phantom power." This is power consumed by devices that are not "on," but still plugged into an active power outlet.

The system incorporates two main components: an electronic monitoring system and a "smart control system." The monitoring system is responsible for providing the "consumption/usage" data and the control system manages "smart" breakers and outlets. Based on the data from the monitoring system, the user will be able to manage power consumption by modifying the behavior at the outlet source or the circuit breaker in the panel. The energy usage data is wirelessly transmitted to a microcontroller input that will perform analog to digital conversion on the signal. This information will be further conditioned in a FPGA logic device. The information will then be displayed to the user via a "control" software program. The user can then elect to enable or disable an entire circuit or a particular outlet via wireless commands from a FPGA logic device to the particular "smart" breaker or outlet. Our system derives its ability to be reconfigurable from the usage of FPGA and microcontroller technology. These devices can simply be reprogrammed to add more features and input devices.

At the time of this writing, we have a design completed for the monitoring system, and it is currently being tested in hardware. The control system is still in the design phase. The control system presents unique challenges in that most of the commercially available "smart" breakers are not generic. They are typically manufactured for a specifically designed system, and these systems are quite expensive. The ability to build a system that opens and closes high current circuits is significantly more difficult than low current circuitry. We are continuing to make progress and overcome obstacles. *[Acknowledgement: This activity is funded in part by a Historically Black Colleges and Universities Undergraduate Programs (HBCU-UP) grant Project 0625155. John Reutter is the Principal Investigator and Karl W. Henry is a Co-Investigator.]*

Faculty Advisor: Karl W. Henry and James Pleasure, karl.henry@drakestate.edu

OA #142
A Wireless Sensor Network Based System for Detecting Falls in Elderly Patients

Aime V. Mbakop, University of the District of Columbia

Falling inadvertently in nursing homes constitutes the major cause of admission of elderly in hospitals. Failing to respond to such falls in a timely fashion may cause serious injuries or even death. Thus, the development of a fall detection system that can instantaneously alert the caregivers is of important need. In this project, a system using wireless sensor networks was created to immediately alert the caregivers when a fall is detected. The system is designed to detect falls based on the body position and the bed occupancy. By tracking patients' activities, the system determines whether a patient is in his or her bed, or has fallen off. Using Labview, a graphic user interface was created to alert caregivers of the patients' condition. The Memsic's Wireless Sensor Network Developmental Kit including MICAz and MIB520 base station were used and data was collected from people simulating falls to optimize the fall detection algorithm. *[Acknowledgement: This study is supported, in part, by a grant from NSF/AAAS awarded to Freddie M. Dixon, Professor, Department of Biology, Director for the Center of Biotechnology and Biomedical Sciences, and by a grant W911NF-11-1-0144 awarded to Paul Cotae from the Department of Defense Research and Educational Program for Historically Black Colleges, Universities, and Minority Serving Institutions at the District of Columbia, Washington, DC.]*

Faculty Advisor: Dr. Haghani, shagani@udc.edu

OA #143
Smart Grid System Simulation and Power Measurement Systems

Babatunde Taiwo, University of the District of Columbia

The existing electricity grid across the nation is old and outdated, causing a growing number of outages due to limited transmission and growing demand, and it is the difficulty to monitor the vast distributed and various utility grid power equipments. There is a growing need for modernization of the electric grid system to improve power transmission throughput, power systems reliability, and to allow the grid to utilize energy from renewable sources. This research utilizes current technological advances to exploit means of making the grid system more intelligent whereby the utility power company can monitor in real-time the operations and performance of field equipment including residential homes electric meters.

The aim of the research is to design domestic smart meters that continuously monitor power consumption of home appliances, interfacing the smart meters to utility residential meters and wirelessly mapping the utility power meters as cloud dots which can be networked and programmed to provide utility companies with more accurate and up-to-date data on electricity demand and capacity in a given area. In this phase of the study, a plug-in wireless network is configured with sensors that measure the power consumed in normal home appliances. The sensor outputs are hard-wired into a power meter (PM-3310), which is connected to a ZigBee (ZB-2551). The ZigBee transmits the measured data to a central hub in the house, for monitoring and control. The essence of the smart meters inside the homes is to require consumers to change their behavior around variable electric rates, and to be conscious at all times of the electricity bills accumulated on a daily basis. *[Acknowledgement: STEM Center University of the District of Columbia]*

Faculty Advisor: Dr. Esther T. Ososanya, eososanya@udc.edu

OA #144
Anomaly-based Intrusion Detection System

Corie Wilson, Tennessee State University
Grantland Gray, Tennessee State University

Intrusion detection is a critical requirement for enterprise network protection, since one of its necessary tasks is to protect the computers responsible for the infrastructures operational control, and an effective intrusion detection system (IDS) is essential for ensuring network security. Network-based attacks make it difficult for legitimate users to access various network services by sabotaging network resources and services. This is achieved by sending large amounts of network traffic, exploiting flaws in networking services, and by overwhelming network hosts. Intrusion Detection attempts to detect computer attacks by examining various data records observed in processes on the network and splits them into two groups, anomaly detection systems and misuse detection systems. Anomaly detection is an attempt to search for malicious behavior that deviates from established normal patterns. Misuse detection is used to identify intrusions that match known attack scenarios. In this research effort, focus is given to anomaly detection, and our proposed strategy is to detect network based anomalies. We employ a supervised machine learning method, Support Vector Machines (SVM) for classification of abnormal traffic and normal traffic and LiBSVM and LibLinear, as support vector machine tools. The tools provide an effective mechanism to perform cross-validation, parameter selection and training large datasets. *[Acknowledgement: I would like to acknowledge NSF as our funder.]*

Faculty Advisor: Dr. Sachin Shetty, sshetty@Tnstate.edu

Environmental Engineering

OA #145
In Situ Remediation Technique for Mercury Contaminated Soils

Janique Cheesman, Syracuse University

Historically, metal mercury (Hg) was widely used for multiple industrial applications such as the mining of gold and silver and the production of chlorine; however, the negative health effects that result from exposure have caused the use of mercury in industry to be sharply reduced. The health problems associated with mercury range from chest pain and shortness of breath to impaired pulmonary and central nervous system functions and these have propagated a need for clean up of mercury waste in soil. Mercury is unique for two reasons: 1.) it is a liquid at room temperature; and 2.) it has a low vapor pressure. It reacts readily with sulfur to form mercuric sulfide which is a more stable form.

These properties were used to adapt a potential treatment method for mercury contaminated soils. An energy dispersive XRF was used to analyze Hg sand samples that were taken from a closed system that initially contained a sodium sulfide treatment rod in the middle of a homogenous mixture of Hg and sand. This system was contained in a 24.5 cm diameter x 24.5 cm length glass bell jar. The extracted samples were taken at the surface of the system and at different depths. After a few months, the sand closer to the treatment was higher in Hg than the outer region which suggests that the Hg was being drawn inward by the sulfide treatment rod. However, after several months when equilibrium was apparently reached, the concentration gradient that was originally present to draw mercury towards the treatment rod became less steep which caused the sand closer to the treatment rod to have the lowest Hg concentration and the sand furthest from the treatment rod to have the highest. This suggests that sand further away from

the treatment rod will not be affected as greatly as sand closer to the treatment rod. This project is part of an ongoing process to develop an in-situ treatment technique for mercury in soil. Further work will be done to see what conditions such as temperature and distance would optimize uptake of mercury. *[Acknowledgement: NSF Syracuse Universit, DOE, Brookhaven National Laboratory]*

Faculty Advisor: Charles Driscoll, ctdrisco@syr.edu

Materials Science

OA #146
Intrinsic Viscosity of Actively Swimming Microalgae Suspensions

Lucas M. Caretta, University of Minnesota
Randy H. Ewoldt, University of Illinois at Urbana-Champaign
Anwar Chengala, St. Anthony Falls Laboratory and Dept. of Civil Engineering, University of Minnesota
Jian Sheng, Dept. of Aerospace Engineering & Mechanics, University of Minnesota

The photosynthetic cells of algae produce an oily goo that can be converted to biofuels. Microalgae are considered one of the most promising feedstocks for biofuels, but challenges remain in economical scale-up, including cost-effective growth chambers and efficient harvesting of oil from the cells. The flow properties of these active microorganism suspensions (and their complex fluid byproducts) will be relevant for processing and production scale-up challenges. Suspensions of actively swimming microorganisms exhibit an effective viscosity which may depend on volume fraction, cell shape, and the nature of locomotion, (pushers vs. pullers). Theories have recently been developed to predict the effective viscosity of actively swimming suspensions; such theories typically neglect hydrodynamic interactions and strictly apply only to the dilute concentration limit.

To date, none of the dilute theories have been supported by experimental observation, as no experiments have resolved the dilute limit intrinsic viscosity of active suspensions. Here we use a cone-and-plate rheometer to measure the dynamic shear viscosity for both motile and non-motile suspensions of D. Primolecta at concentrations ranging from 0.01% to 1% of volume fraction. With measurement precision within 0.5%, we are able to resolve the intrinsic viscosity and compare to current theory. Relative intrinsic viscosity of motile D. Primolecta to non -motile D. Primolecta was calculated to be 3.3. Future work will extend measurements to include higher concentrations, different swimmers, and enhanced visualization. The connection of rheology and flow to biofuel pre-cursors extends beyond microalgae, including cellulosic biomass which exhibits complex non-Newtonian rheology and a yield stress. Beyond microalgae for biofuels, other active-particle suspensions of interest include bacteria suspensions (which are pushers, rather than pullers), self-propelled particles, and medical microrobots in fluid environments. *[Acknowledgement: This research is funded in part by the National Science Foundation through the Institute for Mathematics and its Applications, and through an undergraduate research program sponsored by the North Star STEM Alliance, an LSAMP Program]*

Faculty Advisor: Randy Ewoldt, ewoldt@illinois.edu

Mathematics and Statistics

OA #147
Jet Engine Heat Transfer

James Houston II, University of Arkansas at Little Rock

Heat transfer is the process of heat moving along a gradient from hot to cold. This process is one-way (hot to cold) and cannot be reversed. Many commercial and domestic processes involve heat transfer, sometimes necessitating cooling a fluid and sometimes necessitating heating a fluid. Because energy costs can be high, coupling cooling and heating processes makes sense both in terms of energy and monetary conservation. I developed equations to allow calculations of waste heat and its capacity to warm a fluid. Variables in these equations included the amount of excess heat generated and the volume of fluid to be warmed, the specific heat of the fluid, and the desired temperature increase.

Then, using materials and equipment furnished by the university, I constructed a prototype to measure the increase in temperature of a specific volume of water when warmed by a propane heater. My project produced an equation allowing calculation of heating ability of a given amount of waste heat and demonstrated that waste heat generated from one process has the potential to be used to heat another fluid. Engineers and designers should look for opportunities to couple heat-generating and heat-requiring processes. *[Acknowledgement: This study was supported in part by grants from the National Science Foundation, Arkansas Louis Stokes Alliance for Minority Participation, and the Arkansas Space Grant Consortium.]*

Faculty Advisor: Dr. Janet Lanza, jxlanza@ualr.edu

Water

OA #148
Sustainable Engineering in Research, Education and Practice

Christina M. Abate, Binghamton University

A case study based on an engineering senior design project for the community of Rio Hondo in Ocotepeque, Honduras will be

presented to illustrate the incorporation of sustainability in engineering research, education and practice. Components of sustainability can progress and enhance conventional engineering design goals, methods and practice by considering global perspectives and implications, societal needs, and all of the people involved/affected. Engineering students interacted with the community to identify their constraints and project requirements. Community members constructed the system and understood the concept of water sanitation using the system's components. The system consisted of a 5,000 gallon water tank with a hypo chlorinator and a distribution network. The project aided in water conservation and sanitation for the local area. All of the students on the design team developed engineering problem solving skills using sustainability to enhance their design. Future research is currently being conducted on cleansing the grey water leaving the homes in the community so that it may reduce pollution of the surrounding environment, using sustainable engineering practices. *[Acknowledgement: This research project was funded by Louis Stokes Alliance for Minority Participation at Binghamton University; Advent Lutheran Mission Fund; The Society of Hispanic Professional Engineers at Binghamton University; Engineers Without Borders at Binghamton University; Binghamton University; IBM Corporation and individual donors.]*

Faculty Advisor: Dr. Raymond Barnes, rbarnes60@aol.com

Undergraduate Abstracts for Poster Presentation

BIOLOGICAL SCIENCES

BIOCHEMISTRY (NOT CELL AND MOLECULAR BIOLOGY AND GENETICS)

1

Alpha-1A Adrenergic Receptor Stimulation Improves Mood in Mice

Bethany Davis, University of North Dakota

The role of α(1)-adrenergic receptors (α(1)ARs) in cognition and mood is controversial, likely due to past use of non-selective agents. α(1A)AR activation was recently shown to increase neurogenesis, which is linked to cognition and mood. We studied the effects of chronic α(1A)AR stimulation using transgenic mice engineered to express a constitutively active mutant (CAM). CAM-α(1A)AR mice showed enhancements in several behavioral models of learning and memory. In contrast, mice that have the α(1A)AR gene knocked-out (KO) displayed poor cognitive function. Hippocampal brain slices from CAM-α(1A)AR mice showed displayed basal synaptic transmission, paired-pulse facilitation and long-term potentiation compared to wild type (WT) mice. WT mice treated with the α(1A)AR-selective agonist, cirazoline, also showed enhanced cognitive functions. In addition, CAM-α(1A)AR mice exhibited antidepressant and less anxious phenotypes in several behavioral tests when compared to WT. Furthermore, the lifespan of CAM-α(1A)AR mice was 10 percent longer than that of WT mice. Our results suggest that chronic α(1A)AR stimulation improves synaptic plasticity, cognitive function, mood, and longevity. This may afford a potential therapeutic target for counteracting the decline in cognitive function and mood associated with aging and neurological disorders. *[Acknowledgement: This investigation was supported in part by NSF Faculty Early Career Development (CAREER) Award Grant 0347259 (VAD), NSF Research Experience for Undergraduates (REU) Site Grant 0851869, the Research Experience for University of North Dakota Undergraduates (REFUNDU) program, the University of North Dakota School of Medicine and Health Sciences, a component of the National Institutes of Health (NIH), and NIH Grant RO1HL61438.]*

Faculty Advisor: Dr. Van Doze, van.doze@med.und.edu

2

How Does a High Lipid Diet Affect Larval Growth and Metabolic Rate of Manduca sexta, Tobacco Hornworm?

Zekedra McMorris, Mississippi Valley State University
Gita Thapa and Kendra Greenlee, Department of Biological Sciences, North Dakota State University

Obesity in the United States has skyrocketed, with 66% of the population considered overweight. This trend makes it important to understand mechanisms which underlie metabolic control (Baker, 2007). Currently, researchers lack a simple genetic model system that coordinates metabolic responses with high-fat diet induced obesity. *Manduca sexta,* the tobacco hornworm, is an ideal model organism, because they are easy to rear in the labs, have quick life cycles, and large body size. Our goal is to determine the effects of a high lipid diet on *M. sexta* growth and metabolic rate in comparison to a medium and regular lipid diet.

Our hypothesis is that the high fat diets will alter growth and metabolism in these caterpillars. We predict that the high fat group will be larger due to higher fat intake and will have lower mass-specific metabolic rate because it takes more oxygen to oxidize fat. To go about this we collected 60 *M. sexta* eggs and waited for them to hatch. Once hatched we placed each in their own 1 oz. clear plastic cup for their living environment, the cup size increased to 10 oz. once they reached their third instar. Daily, until they began wandering, they were weighed with the help of the digital scale, length and head size measured with the help of calipers and fed fresh food with the old food being weighed to record consumption. For the first two instars they

were fed 2 grams daily, for the third and fourth instar, 4 grams were given daily and in the fifth instar 5 grams. The first day of the fifth instar we broke the animals up into three groups and placed them on separate diets. There was the regular (control) which were fed all along, medium fat, and high fat.

This data was collected daily and then statistically analyzed for results. Once in the fifth instar we took each of the *M. sexta* and collected their metabolic rate. Using a CO_2 analyzer we used syringes as a chamber to avoid leakage of CO_2. Chambers were flushed with purge gas (CO_2 free) to collect a baseline which was recorded for one minute. Then an animal was placed in the chamber and recorded for five minutes to look at the CO_2 in the chamber, followed by a baseline reading.

This was done for each animal under the same conditions so that we may analyze their metabolic rate. In contrast to our prediction, the high fat group had a slightly lower body mass which may be attributed to eating less once placed on the diet or secreting the fat in some other way. However the high fat group did have the lowest mass-specific CO_2 emission which was expected. Further studies are in progress looking at lipid extractions of fecal pellets and fat body from samples on each diet. Also studies are being conducted to see if there is a diet preference. *[Acknowledgement: Support for this project was provided by the National Science Foundation IOS-0953297 (KJG), and National Institutes of Health 2P20RR0l5566 from the National Center for Research Resources (KJG). The contents of this study are solely the responsibility of the authors and do not necessarily reflect the views of the NIH.]*

Faculty Advisor: Rachel Beecham, rvbeecham@yahoo.com

3

Enzymatic Activity Of A Fungal Lignin Peroxidase Expressed In E. Coli

Etienette Oatis, Clark Atlanta University
Tara Hines, Filmon Kiros, and John Melnyczuk, Clark Atlanta University

In the United States, billions of dollars each year go to fuel production and consumption. Tradition fuels are produced from petroleum, which is both becoming increasingly expensive and generating environmental hazards. In automobiles, gasoline can be replaced by bioethanol, which can in principle be made from woody residues, or lignocelluose. A barrier to use of lignocellulose for ethanol production is the complexation of cellulose with lignin in the plant secondary cell wall. Our group hypothesizes that the enzymatic degradation of lignin will retrieve adequate cellulose to make bioethanol production from wood waste efficient. We will design and synthesize a gene for a lignolytic enzyme, lignin peroxidase (LiP), based on a fungal source (Phanerocheate chyrsosporium), and produce recombinant enzyme in Escherichia coli. LiP Enzyme activity will be measured using a model lignin compound, veratryl alcohol, which can be oxidized to veratraldehyde and measured by absorbance at 310 nm. In order to successfully complete the assay, we have to test many variables to make sure that he enzyme is working. To model the efficiency of sequential or simultaneous treatment with LiP and cellulases, we will compare the catalytic parameters of fungal and bacterially produced enzyme, as well as determine pH and temperature optima. In preliminary experiments we detect activity of the fungal LiP and horseradish peroxidase using a general peroxidase substrate, 3,3' diaminobenzidine (DAB). Ultimately we will test the ability of a mixture of LiP and cellulase to enhance release of glucose from sawdust. *[Acknowledgement: This study was supported in part by NSF (HBCU-Up grant) and EPA SU-83508301.]*

Faculty Advisor: Dr. Myron Williams, mnwill@cau.edu

4

Probing the Properties of KCNE1 Using Site-Directed Spin Labeling EPR Spectroscopy

Ro-Jay Reid, Oakwood University

KCNE1, a membrane protein is found in the ears and the heart. Mutations of human KCNE1 cause deafness and long QT syndrome (LQTS) - an inherited life-threatening cardiac arrhythmia. Even though extensive research has been conducted on KCNE1 and valuable information has been obtained about its transmembrane domain in micelles, there are few notable questions regarding KCNE1's structure and location in a lipid bilayer, hence the significance of this research. A lipid bilayer provides a more native environment for KCNE1, which ensures precise data regarding the structure of the protein. Circular dichroism (CD) spectroscopy shows that KCNE1 is more alpha helical in shape in a lipid bilayer than a micelle. In this review, electron paramagnetic resonance (EPR) spectroscopy was used to determine the structural and dynamic properties of three amino acid residues of KCNE1: G29C, L30C, and I66C. Further research will be to conduct EPR spectroscopy on the entire KNCE1 amino acid residues. *[Acknowledgement: This work was supported by the National Institute of Health Grant GM60259-01 and the National Science Foundation Award CHE-1011909 via the Lorigan's Lab at Miami University, Oxford, Ohio.]*

Faculty Advisor: Dr. Kenneth LaiHing, laihing@oakwood.edu

5

Exploring Relationships between DNA Satellite Activity and ACMV

Courun Williams, North Carolina State University

Cassava (Manihot esculenta) is a major staple crop for Africa and Asia that is capable of withstanding drought and poor soil conditions. The cassava tuber is a vital source for calories for

millions in the developing world. African cassava mosaic virus (ACMV) infection constitutes a major proportion of annual losses in cassava cultivation. In 2005, almost half of the cassava crop loss was attributed to a complex of begomoviruses that includes ACMV. Though farmers have constantly developed cultivars with virus-resistant properties, the presence of two small DNA satellites has been found to greatly enhance the virulence of ACMV, even breaking resistance of specially bred cassava lines. We seek to understand the mechanism by which these satellites augment ACMV virulence as part of an effort to devise a broad solution against all begomovirus infections in cassava. The ACMV genome is composed of two distinct segments, the A and B components. Sequences corresponding to the A and B DNA components were released from plasmids by restriction endonuclease digestion and ligated into the Agrobacterium vector pMON721.

To facilitate cloning of the satellites, site-directed mutagenesis was performed to create Not 1 restriction sites flanking their sequences. Once the orientations of the viral genome components and satellite sequences have been verified in the Agrobacterium vectors, they will be transformed into Agrobacteria and used in leaf disc assays and for infection studies in plants. These experiments will be performed in two model plant species, Arabidopsis and Nicotiana benthamiana.
[Acknowledgement: National Science Foundation]

Faculty Advisor: Linda Hanley-Bowdoin, linda_hanley-bowdoin@ncsu.edu

Biomedical Engineering

6
Regulation of Transcription Factor SOX9 and 6 During in Vitro Cartilage Formation is Mediated by Insulin Receptor

Chelsea Brown, University of Arizona

Cartilage does not regenerate after a sudden impact or degeneration from overuse. Tissue engineering is a possible solution to this problem, however; it requires a high cell seeding density when used in three-dimensional cultures. Cell expansion is a routine practice, but the expansion of chondrocytes causes dedifferentiation during the culture process. A serum free (SF) culture system to re-differentiate cultured bovine chondrocytes (bP2) was developed, and initial observations indicate regulation by Insulin Receptor (IR). IR activates the Insulin/IGF pathway, which results in downstream regulation of SOX 6 and 9, two transcription factors involved in chondrogenesis. The effects of IR inhibition are hypothesized to determine the role of the Insulin/Insulin-Like Growth Factor (IGF) pathway in redifferentiation of bP2.

Primary bovine chondrocytes were passaged twice with a density of 2,000/cm2. Cells were cultured in SF on Collagen Type II coated inserts for 24 hrs, starved for 24 hrs and treated for 2 hrs with 50 uM and 100 uM of the inhibitor HNMPA-(AM3). During the last 18 hrs either Insulin or IGFI were added. The effects on pShc, pERK, Sox6 and Sox9 were detected via immunoblotting and quantified by densitometry. Additionally, cultures were incubated for 3 weeks and tissue deposition was monitored by toluidine blue staining.

Immunoblotting showed inhibition of IR caused down-regulation of pSHC and pERK in both Insulin and IGFI. Inhibition of IR resulted in down-regulation of SOX9 in Insulin and IGFI only at 50 uM HNMPA. Interestingly, down-regulation of SOX6 was only observed under Insulin stimulation. After 3 weeks of culture tissue formation was only seen under Insulin.
Discussion: This data suggests that in the SF culture system cartilaginous matrix deposition is mainly regulated by SOX6, which appears to be controlled by the signaling cascades activated only by insulin. Further studies will be done to test the involvement of IGFI and II as well as the specific roles of SOX 9 and 6 in redifferentiation of passaged chondrocytes.
[Acknowledgement: I would like to thank the BRAVO! Program, the National Institutes of Health (Grant MD 001427), CEB, and CIHR for their generous support.]

Faculty Advisor: John A. Szivek, PhD, szivek@email.arizona.edu

7
The Effects of Feeding on the Blood Chemistry of Hybrid (blue x channel) Catfish Fingerlings

Jermelody Brown, Mississippi Valley State University

It has been suggested that restricting feed during an outbreak of disease will decrease oxygen demand in the fish, which in turn will reduce the likelihood of hypoxia related mortalities. However, for reasons that are not clearly understood, within pond populations there is often a subset of the population that shows no signs of disease and appears perfectly healthy. Consequently, restricting feed during these periods is restricting feed to these populations that are unaffected by the disease, reducing the overall production of the pond. The blood physiology of fish was tested and comparisons were made between two groups of fish (one group fed daily and the other not fed). No statistical differences were found between the fed and not fed groups of fish for any of the variables tested (pH, pO2, pCO2, hematocrit, hemoglobin, SO2, Glucose, and osmolarity). This project demonstrated that restricting feed to catfish has no appreciable effect on the physiology and oxygen demand of these fish. This study provides producers with more information from which to base management decisions in the case of a severe outbreak, and provides the first scientific data to support the decision to feed during outbreaks of this disease.

Specific-pathogen-free blue x channel backcross hybrid fingerlings were placed in tanks at the Thad Cochran National

Warmwater Aquaculture Center (TCNWAC) Fish Diagnostic Laboratory, Stoneville, MS. In each tank, methods consisted of confining fish (n=10) in 8 replicate tanks. During the experiment, all fish were fed daily to satiation. Then on the day when fish were bled for data collection, four tanks of fish were fed to satiation, and four tanks were not fed. Fish (n=3) were sampled from each tank at 30 min, 2 hours, 4 hours after feeding. Upon sampling, fish were weighed and blood collected.

The results from this study provide insight into whether catfish should be fed during PGD outbreaks. The decision to feed or not to feed weighs heavily during periods of disease, as producers are wary of production loss associated with restricted feeding regimes, but do not want to incur more significant losses from mortalities which may be induced by feeding during disease outbreaks.

Since farm raised catfish is such an important economic industry in Mississippi and PGD cases make up twenty percent of the cases in Mississippi, understanding the physiology of the disease and determining methods to cont *[Acknowledgement: Matt Griffin and Rachel Beecham, Stoneville Research Center]*

Faculty Advisor: Rachel Beecham, rvbeecham@yahoo.com

8

Collagen Network Architecture of Pure Collagen and Collagen-Fibrin Co-gels

Allan Kerandi, University of Minnesota: Twin Cities

Tissues, both natural and bio-engineered, are often composed of multiple fiber networks (elastin, collagen, fibrin, etc.). The extracellular matrix (ECM) proteins provide a biochemical environment for modulation of cellular responses such as growth and migration and mechanical strength to the tissue. In addition, tissue engineers use fibrin as a scaffold to seed cells for tissue growth; over time, networks of collagen and fibrin coexist as the fibrin is degraded and replaced with cell-synthesized collagen. Fibrin and collagen networks also exist in the thrombus while wounds are healing. While many studies have been done on collagen 1 and fibrin matrices separately, the structure and mechanics of collagen and fibrin in coexistence with each other remains poorly understood. Our group had previously studied the mechanics of pure collagen gels cast at 1.65 mg/ml (0.5 C), compared with collagen gels obtained from plasmin digestion of 50:50 collagen-fibrin co-gels (1.65 mg/ml each of collagen and fibrin) (d-CG). Results showed slight mechanical differences between these collagen gels even though they had the same protein concentration.

This study aims to elucidate these differences by studying the collagen network architecture in these gels. Analysis of the network morphology was performed via 3D reconstruction of these collagen networks, using Z stack images obtained from confocal microscopy. The following gels were cast: Pure Collagen gels at 1.65 mg/ml (0.5 C), 50:50 collagen-fibrin co-gels (CG) at 1.65 mg/ml each collagen and fibrin (undigested). To fluorescently label the networks, the gels were fixed in 4% paraformaldehyde, blocked with 5% normal donkey serum, and were labeled with collagen primary antibody followed by a secondary antibody conjugated with a green dye. 3D reconstruction of each collagen network was created from 51 confocal Z stack images using an in-house Matlab code. Comparison between the reconstructed networks of 0.5 C and CG gels show no significant differences in collagen network architecture (fibril density, length, and tortuosity). Collectively, results from previous and current studies suggest that the mechanical differences observed cannot be explained by differences in microstructure (i.e. network architecture); however, whether further microstructure changes occurred with the digestion of fibrin remains unclear. Work is in progress to compare collagen networks in undigested and digested co-gels. *[Acknowledgement: National Institutes of Health (R01 EB005813).]*

Faculty Advisor: Victor Barocas, baroc001@umn.edu

9

Using Anesthetics to Minimize the Stress Response of Immobilized Zebrafish

Curvelle Lewis, Dillard University
Bernard Singleton, Dillard University, New Orleans
Stephen C. Ekker, Karl Clark, and Chris Pierret, Mayo Clinic Graduate School, Rochester, MN

In humans, stress response systems that are overwhelmed can cause increased incidences of disorders such as immunosuppression, cardiovascular disease and dementia. The zebrafish (Danio rerio) is an invaluable model for scientific researchers trying to understand the genetic and epigenetic basis for stress responses in vertebrates. Capturing quality visual data from these organisms however, generally requires immobilization, which may cause stress to fish. Specimen in a Corrected Optical Rotational Enclosure (SCORE) imaging is a method used to immobilize and photograph embryonic and larval zebrafish by placing them in a capillary tube containing methylcellulose. In recent research, anesthetics have been found to minimize stress in adult fish during handling. We hypothesized that anesthetics can be used to minimize the stress response of zebrafish used in the SCORE imaging technique.

The purpose of this study is to determine if anesthetics will reduce the stress response of zebrafish that are immobilized during SCORE imaging. The zebrafish releases cortisol in response to stress. In this experiment, zebrafish with a genetic sensor that respond to cortisol by producing a short half-life green fluorescent protein (GFP) were used. These fish were

immobilized in methylcellulose only and later in methylcellulose combined with anesthetics. The fish immobilized in methylcellulose only were used as the controls. It is expected that the fish that were immobilized with anesthetics would have a delayed or minimized expression of GFP compared to fish that were immobilized in methylcellulose only. If so, the use of anesthetics during SCORE imaging will help scientists to produce more quality data from stress response experiments. In the future, we intend to determine if the potential survival time of zebrafish in the capillary tubes used in SCORE imaging is dependent on the age of the fish. *[Acknowledgement: This study was supported by the NSF/LSAMP Program Awarded to Abdalla Darwish, Ph.D., Coordinator/Campus Director at Dillard University, New Orleans, LA 70122.]*

Faculty Advisor: Dr. Bernard Singleton, bsingleton@dillard.edu

10
Analysis of SK3, IK1, and TRPC1 Protein Expression in Salt-Sensitive Hypertensive Rats

Caterina Pette, Florida International University

The objective of this research is the analysis of calcium dynamics and homeostasis. Research shows that calcium homeostasis is closely related to potassium channel expression. A vessel is lined with endothelial cells (ECs) and surrounded by smooth muscle cells (SMCs) which act as the diameter regulators. High concentrations of calcium, a paracrine that causes vasodilation, also leads to the activation of the potassium channels which allow an efflux of potassium out of the cell and hyperpolarize the endothelial cell (EC). This proves significant because it is found to be the body's natural reaction to hypertension. Especially during hypertension, vessels are more constricted and potassium channels such as IK1, and SK3 will try to alleviate it by hyperpolarizing smooth muscle cells and decreasing contraction, or dilate. IK1 and SK3 are calcium-activated potassium channels.

In order to test for the overexpression of certain genes into specific membrane protein and channels, we use salt sensitive hypertension-induced rats which have a tendency genetically towards hypertension, and are also given high salt diets. Moreover, tests are conducted on isolated mesenteric artery tissue measuring the expression of these genes into proteins. The expression of proteins in endothelial cells is analyzed through the Western Blot. The Western Blot measures the intensity of specific protein expressions through antibody tagging. The proteins analyzed are SK3, IK1 and TRPC1 which are potassium channels and a non-specific cation channel, respectively. The results showed that these proteins, IK1, SK3 and TRPC1 were overexpressed in hypertensive rats, due to the attempt to alleviate constriction of vessels. *[Acknowledgement: Nikolaos Tsoukias]*

Faculty Advisor: Dr. Mahesh Joshi, mjoshi@fiu.edu

11
The Incorporation of Cardiac Stem Cell Therapy to Induce Angiogenesis at Infarct Regions of the Heart

Pamela Tiet, University of California, Berkeley

Congestive heart failure is prevalent in the US, affecting 64.4 million Americans each year. In order to address this need, a novel method, involving regenerative medicine and biomaterials, is being researched in order to alleviate and restore the infarct region of the heart. Cardiac progenitor stem cells, which are integrated within a synthetic thermo-responsive hydrogel polymer network, can be transplanted into the infarcted myocardium for therapeutic cardiac tissue regeneration. The polymer network acts as a substitute extracellular matrix (ECM), allowing cells to adhere to the surface. Due to its source of specific growth factors and mechanical properties, the synthetic polymer allows the cardiac progenitor stem cells to proliferate and differentiate into cardiac tissue. Ultimately, these growth factors and the mechanical properties of the polymer network help to induce angiogenesis (formation of blood vessels). With the incorporation of growth factors and peptides within the polymer network, this will increase cell proliferation and adhesion, leading to robust vessel formation. Before testing on the hydrogel proceeds, the cardiac progenitor cells are initially grown on Matrigel, ECM derived from a mouse sarcoma. EBM-2 media and appropriate growth factors are then used to culture the cells. They are then allowed to proliferate for a period of four hours. After four hours, vessel formation is observed and imaged. Moreover, specific endothelial progenitor cells will be studied in a similar manner to use as an appropriate comparison and control. The formation of vessels from these studies shows that the cardiac progenitor cells used are viable cells and have the potential to be used in tissue regeneration. Angiogenesis is pertinent in cardiac wound-healing. Therefore, the ability of the cardiac progenitor cells to proliferate and form vessels within both the Matrigel and synthetic polymer needs to be assessed. The direction of this research will be aimed at assessing and quantifying the appropriate amount of growth factors for robust proliferation and vascular tube formation of cardiac progenitor stem cells in order to achieve tissue regeneration. In addition, future research includes conducting 3-D vessel formation assays on the polymer network and in-vivo mouse studies using the cardiac progenitor cells housed in the synthetic ECM.
[Acknowledgement: CAL NERDS-WISE Stars Program NIH-IMSD]

Faculty Advisor: Kevin Healy, pamtiet@gmail.com

12
Enhancing the Expression of Soluble MKK6 Protein

LaManuel White, North Carolina Central University
Sam Witherspoon, Dorothy Tolo, and Dr. John E. Scott, Biomanufacturing Research Institute and Technology Enterprise, North Carolina Central University

Recent literature has provided evidence that the MEKK2-Erk5 MAPK signaling pathway may be important for tumor growth and metastasis. An MEKK2 activity assay is being developed using the protein MKK6 as a substrate. When expressed in bacteria, MKK6 protein is insoluble and cannot be used. The proposed project was to clone the MKK6 gene into a Glutathione S-Transferase expression plasmid (pGEX-5X-1) to express a GST-MKK6 fusion protein because GST generally increases solubility. A Polymerase Chain Reaction (PCR) was done to produce MKK6 cDNA. Sequential double digests were performed using SmaI and SalI restriction endonucleases at 25º and 37ºC, respectively. Gel electrophoresis was done to allow for quantitation of prepared insert and vector fragments by densitometry. Then a ligation reaction was conducted with varied concentrations of MKK6, and then products were transformed into competent E. coli cells. It was hypothesized that either plasmid concentration or restriction site incompatibility were the reason for an unsuccessful transformation. Therefore, an alternative blunt-end cloning scheme is in process which uses only SmaI to digest vector and insert. In conclusion, the MKK6 gene was successfully amplified as a PCR product, purified and sub-cloning is under way to generate the desired GST-MKK6 fusion product.
[Acknowledgement: Howard Hughes Medical Institute Science-Education Alliance; NCCU FUTURES Program, National Cancer Institute 5U54CA156735]

Faculty Advisor: Dr. John E. Scott, jscott@nccu.edu

CANCER RESEARCH

13
Functionalized Gold Nanoparticles as Novel Non-Viral Vectors for Gene Therapy Treatment of Cancer

Alex Avendano, Iowa State University
Elizabeth Figueroa and Rebekah Drezek, Department of Bioengineering, Rice University

Today, cancer remains one of the leading causes of deaths worldwide. Many efforts have been made towards gaining a comprehensive scientific understanding of cancer and to develop treatments. One approach, known as gene therapy, is based on delivering targeted DNA to destroy cancerous cells. Gene therapy hinges on condensing and delivering DNA into the cell with the use of delivery vectors which can be viral or non-viral. The role of these vectors is to protect the DNA from enzymatic degradation and ensure its delivery into the cell's cytoplasm and nucleus. Viral vectors provide a more effective transfection than non-viral vectors. However, side effects such as immunogenicity, carcinogenicity, and inflammation have limited their use in clinical applications. Therefore, efforts are being made to design safe and efficient non-viral vectors. Gold nanoparticles are bioinert, nontoxic, and readily synthesized. They can be functionalized to condense DNA into compact nanoparticles that can be endocytosed by cells. In this work, two classes of functionalized gold nanoparticles (Au NPs) vectors were compared, and a third class of Au NP vector was synthesized. The first two vectors were functionalized with either G0 polyamidoamine (PAMAM) dendrimers or triethylenetetramine (TETA), and comparison was made on the basis of degree of DNA condensation, transfection efficiency and cytotoxicity.

First, studies were performed to observe the degree of DNA condensation. In this study, fluorescence spectroscopy was used to quantify displacement of intercalated ethidium bromide (EtBr) by the vectors. EtBr molecules are known to intercalate into DNA strands and can be observed from their fluorescence. The displacement of the EtBr is a result of DNA condensation, where the vectors wrap the DNA into a compact nanoparticle and prevent the EtBr from intercalating between the strands. Solutions of DNA with EtBr were prepared, followed by the addition of the Au NPs vectors at different molar ratios to the DNA. The displacement of EtBr molecules was quantified by a decrease in the fluorescence signal. Cell studies will be performed to observe if these vectors can deliver DNA into the cytoplasm and nucleus of cells in vitro. In this procedure, solutions of vectors and DNA containing instructions for the production of Plasmid Green Fluorescence Protein (pGFP), will be added to samples of cells which will then be incubated at 37 ˚C for 48-72 hours. Fluorescence microscopy will then be used to quantify the amount of cells that were transfected with DNA after the incubation period. This will be determined by observing cellular fluorescence, which will originate from the pGFP protein the cell will produce if the DNA is successfully delivered. The synthesis of the third Au NP vector, functionalized with G0 PAMAM dendrons, was also investigated.

This synthesis consists of binding mercaptoundecylamine (MUAM) to the Au NPs by gold-thiol chemistry followed by alkylation and amidation of the terminal ends. This new vector, termed Au-Umbrella due to the shape of its functionalized molecules, will also be subjected to EtBr displacement assays and cell studies to compare with the Au-PAMAM and Au-TETA vectors. A reaction scheme consisting of three steps have been designed for the synthesis of this vector. These steps involve reaction of the gold nanoparticle with MUAM, methyl acrylate, and ethyldiamine respectively. Each of these steps must be optimized and validated to ensure a complete formation of Au-Umbrella vector. It was found that Au-PAMAM and Au-TETA vectors are capable of condensing DNA with an optimal molar ratio DNA:Vector of 1:100 being the best option. However, in vitro studies are necessary to determine if this ratio will work well in cells. In addition, step 1 of the Au-Umbrella Synthesis has been completed and validated. An optimal ratio of 1:150 (mL:µL) for Au:MUAM has been observed to give the best result for this step. In vitro studies will determine the ability of the vectors to protect and deliver the DNA into the nucleus of cells

as well as their potential cytotoxicity. These will be performed in the near future. The results of this work aim at providing novel non-viral vectors for gene therapy treatment of cancer. *[Acknowledgement: The studies described are preliminary work for a joint NSF SBIR/ERC project MIRTHE CENTER- Center for Mid -Infrared Technologies for Health and the Environment National Science Foundation Grant EEC-0540832.]*

Faculty Advisor: Rebekah Drezek, drezek@rice.edu

14
The Effects of Molecular Crowding on Protein Structure and Function

Nickolas Bradley, Fort Valley State University

Fibroblast Growth Factors (FGFs) are heparin binding growth factors that possess broad mitogenic and angiogenic activities. FGFs are involved in diverse biological processes, such as wound healing, tumor growth and development of nervous system. The improper functioning of FGFs has been linked to many life threatening diseases such as cancer. In order to retain the proper functioning of FGF, a more stable environment is needed. Various researches have been conducted on the in vitro stability studies of pure FGF, but in order to mimic the exact intracellular environment as that of in vivo studies, similar environments should be provided.

In this study, the in vivo environment is simulated with macromolecular crowding agent such as ficoll. Ficoll is a neutral, highly branched, high-mass, hydrophilic polysaccharide having radii ranging from 2-7 nm and readily soluble in aqueous solutions. It is prepared by reaction of a polysaccharide with epichlorohydrin. In this project the effects of molecular crowding on protein (FGF) stability was tested in two ways; by testing the enzymatic activity of the trypsin on FGF by using SDS gel electrophoresis, and by testing FGF's thermal stability using steady state fluorescence.

Research outcomes of the present study includes: FGF has been successfully expressed and purified using different affinity chromatography techniques; proteolytic digestion experiment clearly shows that the solvent accessibility of FGF increases upon the increase in concentration of the crowding agent; and thermal stability of FGF decreased significantly upon increase in concentration of crowding agent. A more detailed analysis including Molecular Dynamic Simulation is currently in progress. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

15
Impact of Bisphenol-A Exposure on HOX Gene Expression in Human Cells

Rebecca Denney, University of Texas at Arlington

Technological advances have brought a considerably amount of change to daily living with the introduction of new plastics, pesticides, and lubricants. However, many of these consumer products contain compounds later found to cause changes in gene expression and regulation. These compounds are categorized as endocrine disruptors, which are absorbed into normal human cells after exposure or use. Bisphenol-A or BPA is a well known endocrine disruptor found in many of the plastics used today including baby bottles, water bottles and kitchen storage containers. Because of this, BPA is heavily observed in processed foods and drinking water. When this specific endocrine disruptor is introduced into our bodies it mimics estrogen, a common human hormone.

These effects and BPA are well known, however the genes involved have yet to be fully analyzed. In this work, we investigate the impact of BPA exposure on HOX gene expression in human cells. HOX genes are homeobox containing genes that play critical roles in cell differentiation and development. Studies from our laboratory and others have demonstrated that several HOX genes such as HOXC6, HOXC13 and HOXB9 are transcriptionally induced upon exposure to steroid hormone estrogen. Herein, our preliminary studies demonstrated that HOXC6 is transcriptionally upregulated upon exposure to BPA in human breast cancer cells. HOXC6 is a critical player in mammary gland development and is also over-expressed in breast and prostate cancer. Thus, misregulation of HOXC6 gene expression upon exposure to BPA indicates a potential link between BPA and human disease. *[Acknowledgement: NIH, National Institute of Health; Rebecca Denney, Jonathan Michael Comer, Sahba Kasiri, Imran Hussain, Subhrangsu S. Manda, Gene Regulation and Disease Research Laboratory, Department of Chemistry and Biochemistry, University of Texas at Arlington, Arlington, Texas 76019.]*

Faculty Advisor: Subhrangsu S. Mandal, smandal@uta.Mandal

16
The Characterization of Autophagy in an Inflamed Mouse Prostate

Marshe Edwards, Bennett College
Travis J. Jerde, Ph.D. and Jason Myers, Department of Pharmacology and Toxicology, Indiana University School of Medicine

There are many possible triggers to prostate cancer development and progression. Inflammation is a very common histopathological feature in the microenvironment of

adenocarcinomas. This has led to the hypothesis that inflammatory processes induce tumor growth or tumor formation and may in fact be the precursors for cancer. However, the hypothesis about the mechanism of inflammation induced tumor growth is unclear. In this project we observed autophagy in prostate cancer. Autophagy is the mechanism of cell death and survival. Our goal was to characterize the induction of autophagy in a mouse model of induced prostatic inflammation. We used a LC3 rabbit antibody to characterize autophagy. We found that LC3 is induced in prostate inflammation on day three of inflammation. This means that there is a relationship with autophagy and prostatic inflammation, and this affects tumor growth that can lead to cancer. Future studies need to be done to verify the induction and determine the quantity and subtypes of the responding epithelial cells. Future studies also include analyzing the role of LC3 in inflamed HUMAN prostates harboring cancer. *[Acknowledgement: This project is funded by the Indiana University Simon Cancer Center (IUSCC).]*

Faculty Advisor: Margaret W. Curtis, Ph.D., mcurtis@bennett.edu

17

Investigating the Effect of Diallyl Disulfide on Apoptosis in a Mouse Basal-Like Breast Cancer Cell Line

Ebone Evans, Winston Salem State University
Stephanie Dance-Barnes, Winston Salem State University

Many chemotherapeutic agents have been used to treat breast cancer, with varied outcomes depending on the specific subtype of breast cancer. To date, various laboratories have identified five distinctive subtypes of breast tumors, with one being particularly aggressive, basal-like breast tumors (BBT). The focus of this work is to characterize mouse mammary tumors that mimic human BBT in order to develop improved therapies that are specific for this tumor subtype. We have utilized a mouse mammary tumor cell line (K14TRT) that our lab cultured from a "humanized" mouse model that has been shown to better mimic in mice the genetic alterations seen with BBT formation by using gene knock-out technology. In this study we investigate the effects of Diallyl disulfide (DADS), a component of garlic, on apoptosis in the K14TRT cell line.

It is our hypothesis that DADS, which has been previously shown to induce apoptosis and inhibit proliferation in MCF-7 breast cancer cells, would have a comparable affect in the K14TRT cells. K14TRT cells were treated for 24 h with doses of DADS ranging from 25-75mM. DADS appeared to induce apoptosis when viewed microscopically for morphological variations, which included condensed nuclear chromatin.

This apoptotic event appeared to be dose dependent as demonstrated by trypan blue exclusion, when comparing the DADS treated to the untreated K14TRT cells. We also further validated apoptosis being due to DADS treatment by confirming DNA fragmentation in the K14TRT harvested cells. This study provides evidence that DADS does induce apoptosis in basal-like mammary tumor cells, and could possibly be used as a chemotherapeutic in targeting this specific subtype of breast cancer. *[Acknowledgement: The National Science Foundation HBCU-UP Program at Winston Salem State University]*

Faculty Advisor: Dr. Stephanie Dance-Barnes, dancest@wssu.edu

18

Predicting Ten-Year Survival of Breast Cancer Patients

Tasha Hester, Bennett College
Chiquita Thomas, Alcorn State University
Nyesha Warren, Dillard University
Raven Mobley, Claflin University
Charles Bland, Ph.D., Bioinformatics, Mississippi Valley State University

Cancer patients have many factors that affect their survival including, but not limited, to treatment types, tumor size, growth rate of the cells, and tumor location. This data was then placed into association rules, which could be used to arrange a variety of combinations to predict ten-year survival. In Association rules, the factor that could affect breast cancer was added in the left column and compared against the values in the right, which were ten-year survival rates. The data was gathered from research on gene expression. The computer was programmed to understand the information that was most important versus the information that was not vital in determining survival. Doing so allowed for the most important attributes to be analyzed and grouped, determining the output of whether the patient would survive.

After using association rules, confidence and support were expressed for each individual data set. Confidence is defined as the chance in a specific result occurring, while support is the number of data sets in results. It was concluded that after analyzing 51 genes that had a chance in determining the clinical outcome, 30 of the 46 patients could have possibly benefited from different treatment in reference to what they received. It was also found that those patients who had larger tumors had a higher percentage of survival versus those with smaller tumors, who had a higher level of death. In future studies a larger database could aid in the determining factors of those individuals who have a great chance of survival. *[Acknowledgement: This project is funded by the United States Department of Education.]*

Faculty Advisor: Margaret W. Curtis, Ph.D., curtis@bennett.edu

19

Tip30 Regulates EGFR Nuclear Localization in Estrogen Receptor Negative/ Progesterone Receptor Negative MDA-231

Lishann Ingram, Michigan State University
Hua Xiao, Fengsheng Chen, Shenglan Gao, and Aimin Li, Michigan State University

There are approximately 70,000 new cases of (ER/PR-/HER2+) cancer that are diagnosed annually. About 25 % of all breast cancers are both ER-negative and PR-negative. In a population-based study from the Tuscan Cancer Registry all the invasive breast cancer cases diagnosed in the provinces of Florence and Prato, central Italy during the period 2004-2005, were retrieved. Out of 1487 patients 70.3% were luminal A subtype (ER/PR + HER2-), 15.6% luminal B (ER/PR + HER2+), 8.1% triple negative (ER/PR-HER2), but 6.0% HER2+ (ER/PR-HER2+). Although the double negative subtype had the lowest percentage, it is often highly invasive, has a lower amount of successful treatments, and also has a lower survival rate. There are various hypotheses trying to explain the development of ER-/PR-breast cancers such as inhibition of PR transcription by aberrant ER cofactors or nonfunctional ER, reduced ER activity due to circulating estrogen levels. Of particular interest are growth factor signaling pathways in which distortion are common in many human cancers. Tip30 (Tat Interacting Protein), also known as CC3, is a human cellular protein that is abnormally expressed in human liver, lung and breast cancers.

Previous studies suggested that this protein acts as a tumor suppressor which is probably due to multiple mechanisms. Emerging evidence suggest that Tip30 acts as a tumor suppressor to control the cell proliferation and development of the mammary gland partly through the regulation of EGFR intracellular trafficking and loss of Tip30 promotes breast cancer development and progression. Thus, we hypothesize that TIP30 regulates the nuclear localization of EGFR in estrogen receptor negative and progesterone receptor negative (ER-/PR-) namely in MDA-231 model cell line.

The aim of this project was to determine whether the inhibition of Tip30 increases the protein levels of nuclear EGFR in MDA-231 cell line, using three assays; cell culture, western blot and immunostaining. Epidermal growth factor receptor (EGFR), implicated in the pathogenesis of many human cancers including breast cancer, is expressed in the nucleus of many cells and might therefore function to increase expression of genes required for highly proliferating activities. Our results revealed that Tip30 knockdown regulates EGFR nuclear localization of estrogen receptor-/ progesterone receptor- in MDA-231. *[Acknowledgement: This study was supported, in part, by a grant from NIH/NCI awarded to Hua Xiao MD,Ph.D., Department of Physiology, Michigan State University, East Lansing MI 48223.]*

Faculty Advisor: Dr. Hua Xiao, xiaoh@msu.edu

20

Assessing Compound Effects on Breast Cancer Cell Migration Using a Wound Healing Assay

Preston Newby, North Carolina Central University
Zainab I. Thomas, Jennai Pettis, and Kevin P. Williams, North Carolina Central University

Inflammatory breast cancer (IBC) is an aggressive, highly invasive tumor with one of the worst clinical outcome among breast cancers with rapid clinical progression and resistance to chemotherapy and radiotherapy. Epidemiologic data show that IBC affects women at a younger age (58.8 years vs. 66.2 years for locally advanced breast cancer) and minorities (African Americans, Hispanics, and Native Americans) are disproportionately affected. Therefore, there is a critical need to elucidate the unique molecular characteristics of IBC that will allow for targeted treatment regimens. SUM149 cells were generated from an aggressive IBC tumor and have been characterized as a triple negative (ErbB2-, ER- and PR-) subtype of breast cancer cell, which is frequently more invasive than other breast cancer cell types.

Hence, we want to investigate the unique migratory phenotype of SUM149. In our study, we have used a conventional in vitro wound healing “scratch” assay (Liang et al. Nat Protoc, 2: 329-333, 2007.) as a measure of cell motility with the objective to identify novel small molecule inhibitors of IBC cell migration. We have previously used this assay to assess the effects of siRNA mediated gene knock downs on SUM149 migration (Thomas et al., Br J Cancer, 104: 1575-1586, 2011). In this current study, we have optimized and validated the scratch assay using a panel of compounds with reported effects on cell motility including wortmannin, nocodazole and colcemid. MCF-7 breast cancer cells were used as a non-motility control cell line. The effects of compounds on cell migration into the scratch were quantified by image analysis as we have previously described. Briefly, cells were visualized using an Olympus IX51 inverted microscope and brightfield images taken at 4x and 10x magnification over 24 h were analyzed using the open-source CellProfiler software to calculate the area occupied by cells at 0 and 24 h. The percentage of wound occupied was calculated by dividing the non-recovered area at 24 h by the initial wound area at 0 h and subtracting this value as a percentage from 100%. Data will be presented showing that a subset of these compounds affect cell motility but not cell viability. *[Acknowledgement: The authors gratefully acknowledge the generous support provided through the Louis Stokes Alliance for Minority Participation Program (NCLSAMP) funded through the National Science Foundation: Grant HRD 0217571, NIH grant CA137844 (K. P. Williams) and additional funding from the Golden LEAF Foundation and the BIOIMPACT Initiative of the State of North Carolina.]*

Faculty Advisor: Dr. Kevin P. Williams, kpwilliams@nccu.edu

21

Effects of an Anticancer Agent on Brain Development of Mice on Regular and High Fat Diets.

Moriamo O. Sulaiman-Ifelodun, Minnesota State University-Mankato
Steven D. Mercurio Faculty Mentor, Minnesota State University- Mankato, Department of Biological Sciences

Obesity may lead to cancer as well as heart disease in young people. Mice were used to test the effect of an anticancer agent to stem the obesity caused by a high fat diet (11% fat) compared with control (4% fat) mice. This anticancer medication, Avastin®, works by preventing new blood vessel formation (antibody to vascular endothelial growth factor). The concern in developing animals and humans is that brain development may be compromised. Mice were injected i.p. for 10 days at 0.1 mg/ mouse/day with Avastin® at the beginning of the 15 week feeding study to evaluate these concerns. Brain weight and brain region measurements were taken to evaluate the hypothesis that decreasing blood vessel formation would retard brain growth and development in the process of preventing new blood vessel development. Results supported this hypothesis indicating that Avastin® decreased brain weights more than it decreased weight gain in either low or high fat diet. Other brain region development also appeared affected similarly. A brain molecular marker for blood vessel development will also be brought to bear on this study. It appears that care must be taken in using this medication in children as indicated by the manufacturer to prevent the worst problems of obesity due to possible brain development deficits unless they have a life-threatening cancer. *[Acknowledgement: This study was supported fully by the Minnesota State University- Mankato North Star STEM Program to Moriamo Sulaiman-Ifelodun, Undergraduate Student at Minnesota State University-Mankato, Department of Biological Sciences, Mankato, MN.]*

Faculty Advisor: Dr. Steven D. Mercurio, steven.mercurio@mnsu.edu

22

Radiation Targeted Apoptosis in Breast Cancer Cells

Shalitha Swain, Talladega College
Dr. Alison Brown, Talladega College

Breast cancer is a disease in which malignant cells form in the tissues of the breast. Breast cancer is an uncontrolled growth of breast cells that affects both women and men. Breast cancer is the second leading cause of cancer death in women. It is considered a heterogeneous disease—differing by individual, age group and even the kinds of cells within the tumors themselves. Apoptosis or programmed cell death is a natural process in the development and maintenance of multicellular organisms. Tumor cells evade apoptotic pathways. Radiation therapy is commonly used in breast cancer treatment. Apoptosis as a cellular response to radiation treatment was examined in 2LMP breast cancer cells. An apoptotic cell undergoes multiple changes that include chromosomal condensation and DNA fragmentation. DNA fragmentation of radiation treated 2LMP cells was analyzed by gel electrophoresis. DNA fragmentation was observed in 4 Gy treated cells when compared to 0 and 2 GY treatments. ATP levels have been observed in different modes of cell death and viability. An assay of ATP in 2LMP breast cancer cells remained constant for 2 and 4 Gy treatments as compared to control. Radiation induced apoptosis may be important in applications of molecularly targeted agents in cancer treatment when combined with radiation. *[Acknowledgement: This study was supported by a grant from NSF/HBCU-UP awarded to Leonard Cole, Ph.D., Director of Sponsored Program, Talladega College, Talladega, AL 35160.]*

Faculty Advisor: Dr. Alison Brown, AKBrown@talladega.edu

23

Antibodies Characterization for New CCDC130 Protein Related to Cancer Progression

Tseday Tegegn, University of the District of Columbia
Juliet Chijioke, Evgeny Makarev, and Deepak Kumar, University of the District of Columbia Cancer Research Laboratory

Understanding the pathways of newly discovered anti-cancer proteins can be useful to learn more about the development and prevention of cancer. It can thus help to find a better diagnosis and prognosis tool for cancer. CCDC130 was identified by Digital Differential Display in cancer Expressed Sequence Tags (EST) libraries from pancreatic cancer and normal tissues. It had been shown CCDC130 differentially represented ($P<0.007$) in pancreatic tumor libraries when compared to libraries from normal pancreatic tissues. Thus, CCDC 130 can be considered as a new cancer-related protein which has coiled coil domain, a protein-protein interaction domain. We suppose this protein is involved in apoptosis pathway to kill cancerous cells or control their growth.

Hence, studies are being conducted to measure endogenous expression levels of this protein in many cancer cell lines. In order to better understand this protein, we need to develop essential tools for its further characterization. Study of CCDC 130 function would not be possible without characterization of its antibody. Finding the correct antibody and application of the correct concentration of the antibody is essential. We tested antibody congaing serum developed with two peptides from C- and N- terminus of CCDC130. Totally we tested 4 different antiserum obtained from 4 rabbits. Different concentrations of antiserum were used to determinate the best working concentration of the antibody which is able to detect CCDC130. As a positive control we use cell lysates from cells transfected with CCDC130. As a negative control we used cell lysates from

untransfected cells. We found that only one antiserum can recognize CCDC130 protein in Western Blot assay. Antibody titration assay helped us to find optimal concentration (1:4000 with overnight incubation at +4C) of selected antibodies to produce the best signal-noise ratio. Protein to protein interaction has to be further explored to understand the mechanism of CCDC 130 and its anti-cancer role. *[Acknowledgement: University of the District of Columbia]*

Faculty Advisor: Deepak Kumar, dkumar@udc.edu

Cell and Molecular Biology

24
The Creation and Characterization of Transgenic Tools in Drosophila

Ashani Andrews, Virginia Commonwealth University / Norfolk State University
Divya Padmanabha, and Keith Baker, Department of Biochemistry and Molecular Biology, Virginia Commonwealth University

The purpose of the project was to create a FLAG tagged dHIF and a HIF dependent reporter construct which would allow the Drosophila to respond to a decrease in oxygen. In future studies, this fly will be used to map the p-element in the fruit fly, pcasper5 and pUAST, to determine the exact location of the p-element in the genome. The location can be on either 2,3,4 or X/Y pair chromosome. We hope to find which genes are up-regulated as a result of hypoxia on the chromosome containing the p-element. Since we did not receive the pCasper5 and pUAST transgenic Drosophila's back in the allotted time, the mapping was done on a XA fruit fly instead. Methods used in the research for cloning the DNA were the use of a Polymerase Chain Reaction (PCR), extraction of DNA from gel (gel extraction), restrictive digest, ligation, bacteria transformation, mini/midipreps, and DNA sequencing. We successfully ligated together the fragments of DNA makings up each vector construct and this DNA was sent off for sequencing. The DNA was then sent off to be injected into Drosophila embryos. Mapping was done with XA crossed into W1118 type and the p-element was located on second and third chromosome.

Further studies will be conducted with other fruit flies with p-elements located on these same chromosomes. The HIF transgenic and XA fruit fly will provide future insight into what genes are up-regulated in hypoxia on the chromosome in which the p-element is located. This will allow insight into diseases linked to low oxygen environments. Our hope is that our studies will lead to further understanding of how hypoxia is linked to cell aging and progression and relate this to cell aging in human cells. *[Acknowledgement: HERO Research Program Virginia Commonwealth University Health Disparities Program]*

Faculty Advisor: Zenora Spellman, zespellman@nsu.edu

25
Comparison of the Rates of Binary Fision Between Two Species of Planarians

Eban Coleman, University of the District of Columbia
Rosie Sneed, University of the District of Columbia

Planarians belong to the Phylum Platyhelminthes and are the most basal of the triploblastic animals. These creatures are well known for their ability to replace lost tissues through cellular regeneration. These organisms also use cellular regeneration as a means of asexual reproduction by binary fission. Planarians may reproduce by asexual means instead of sexual means if a high quality food source is available. In this investigation, the binary fission rate of two species of planarians, Dugesia tigrina and Dugesia dorotocephala, were compared to test the hypothesis that the smaller species, D. tigrina, would have a faster rate of binary fission than the larger D. dorotocephala and thus be a more suitable model of cellular regeneration. Colonies of both species were cultured in the laboratory using artificial pond water with constant aeration. All animals were fed raw beef liver weekly with full water changes at the conclusion of each feeding to maintain water quality.

In groups of ten, animals from both species were individually maintained in 60 millimeter-diameter Petri dishes for the duration of the study period. Experimental animals were fed while control animals were fasted. Starting at 24 hours after feeding and concluding 96 hours after feeding, planarians were monitored for signs of binary fission (i. e., the presence of both main body and shed post-pharyngeal segments). Over the 96-hour observation period, the binary fission rate of D. tigrina was significantly greater than that of D. dorotocephala with 75% of fed D. tigrina producing post-pharyngeal segments by 96 hours compared to 0% of fed D. dorotocephala. In comparison, 8.3% of fasted D. tigrina underwent binary fission during the 96 hour period. These data indicate that the smaller species has a higher capacity for asexual reproduction in the presence of a food source than the larger species. This difference may be due to the greater need for food by a larger body mass. The single feeding used in this study may not be adequate to support binary fission by D. dorotocephala.

These findings will be used in future studies in which the the tissue distribution and activities of neoblasts (planarian stem cells) in tissue regeneration by binary fission will be compared to regeneration induced by traumatic wounding. This research was supported by the NSF-funded STEM Center for Research and Development and the Seed Grant at the University of the District of Columbia, Washington, DC. *[Acknowledgement: NSF/ STEM Center at UDC Seed Grant at UDC]*

Faculty Advisor: Rosie Sneed, rsneed@udc.edu

26

Biomphalaria glabrata: Differences in Hsp70 Stress-level Protein, Between Infected Susceptible and Resistant Snails

Oumsalama Elhelu, University of District of Columbia

The stress protein Heat shock protein 70 (Hsp 70) 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 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. These data will aid in understanding molecular events involved in stress response transcriptional regulation of Hsp 70 in juvenile snails. This study will pave a way towards the eventual identification of genes involved in schistosome/snail interactions. *[Acknowledgement: Funded by UDC NSF HBCU-UP grant and NIH grant 5R25CA129035-04]*

Faculty Advisor: Carolyn Cousin, ccousin@udc.edu

27

Detection of Phage DNA Within Host Cell's Genome During Lysogeny

Loretta L. Grey Cloud, Salish Kootenai College

Mycobacteriophages (phage) are viruses that need a bacterial host cell to reproduce. They infect the cell with its genome to "hijack" the cellular machinery. The phage then uses the host's machinery to carry out its life cycle. Some phages can enter a stage of life where it coexists within the host. This is called lysogeny. This research entails proving integration of the phage genome within the host cells genome. The phage Sedona was discovered in 2008 at Salish Kootenai College and has not been previously characterized. This research is focused on the genetic characteristics of the Sedona lysogen. A growth curve shows that the Sedona lysogen grows very rapidly after an initial delay, as compared to non-lysogenic Mycobacterium smegmatis mc2 155. DNA was isolated from the lysogen, phage and M. smegmatis. Primers were designed around the phage attP integration site based on the Bxb1 phage. PCR was done on phage DNA with positive results; which means detection of the attP site in Sedona phage genome is possible. Primers were also designed around the M. smegmatis attB integration site. PCR has been done with positive results; which means the attB site within the bacterial genome is possible. Primers have been mixed to detect the integration site in the lysogen genome. This site should have been created from half of the Phage site and half of the M. smegmatis site, when recombination took place to integrate the phage. There were no positive PCR results for this integration site. Interestingly, positive results were obtained from using the attP primers in the lysogen genome. This means verification of the phage genome is possible within the host cell's genome. But the integration site is still unknown. All of the PCR products have been sent off to another facility for sequencing. Now that we have verification of Sedona's integration into the host's genome, future work entails further analysis of the lysogen genome to determine the structure of the integration site. It will also be subjected to different stressful conditions to find out what will make the virus return to the lytic life cycle. *[Acknowledgement: This study was supported in part by a grant from the National Institutes of Health (NIH), NIGMS RISE Program R25-GM07632 awarded to Dr. Doug Stevens Director of the Life Sciences Dept. at Salish Kootenai College.]*

Faculty Advisor: Elizabeth Rutledge, elizabeth_rutledge@skc.edu

28

Role of Progesterone Receptors in the Midbrain Dopamine Systems

Jennifer Hartridge, Delaware State University
Ashlee V. Gourdine, Joan K. Mogire, and Princy Quadros Mennella, Delaware State University

The midbrain dopamine systems modulate many essential behavioral functions such as voluntary movement, reward salience and cognitive function. Major sites for dopamine production in the midbrain are the substantia nigra pars compacta (SNc) and the ventral tegmental area (VTA).The SNc, which is a part of the nigrostriatal system, is important for voluntary movement and some cognitive functions. The VTA, together with the nucleus accumbens, is part of the reward system. Steroid hormones, such as progesterone, play critical roles in modulating neural development as well as adult brain function. Little is known about hormonal contributions toward the development and function of these midbrain dopamine structures. Using transgenic male and female mice that lack functional progesterone receptors (PR knockout mice) and comparing them to wild type (WT) mice, the current project investigated the influence of progesterone and its receptors in the development and/or maintenance of these midbrain dopamine structures. If PRs play a vital role in midbrain dopamine structures then we should observe a change in the number of TH-positive cells. Immunohistochemistry for the rate-limiting dopamine synthetic enzyme, tyrosine hydroxylase (TH), was used to identify dopamine producing cells in the midbrain. We counted three sections per animal and determined the average number of TH positive cells in the SNc and VTA. In the SNc the mean number of TH positive neurons are greater in

knockout (KO) than in WT males ($p<0.05$). Female KO and WT mice showed no difference in the average number of TH positive cells. The average number of TH-positive cells in the VTA was sexually dimorphic in WT animals, with males having more cells than females. This sex difference was absent in the KOs. It seems that PRs in the VTA and SNc have differing functions and may influence the development or maintenance of these structures in a sexually dimorphic manner. We are presently conducting TH cell counts within the zona incerta (a PR negative region), which will determine if effects we observed in the midbrain dopamine regions are PR-specific. The findings from this present study will add to our understanding of how hormones such as progesterone may influence the development and/or maintenance of midbrain dopamine structures. Future studies will examine the consequence of changes in midbrain dopamine cell numbers by assessing dopamine fiber density in the forebrain projection sites for the SNc and VTA. *[Acknowledgement: This research was supported by an NSF grant to the DSU-SMILE program and DE INBRE NIH grant 2 P20 RR016472-19 from the NCRR fund.]*

Faculty Advisor: Princy Quadros-Mennella, pmennella@desu.edu

29

Characterizing the Phenotype of Progesterone Receptor Expressing Cells in the Postnatal Rat Lower Rhombic Lip

Jerè Hutson, Delaware State University

Steroid hormones play a critical role in neural development, mediating processes such as migration, apoptosis and phenotypic differentiation. In addition to testosterone and estrogen, the perinatal brain is exposed to progesterone and sensitivity to progesterone is evident by progesterone receptor (PR) expression in many regions of the brain. One such area is the lower rhombic lip (LRL); PR expression is present at high levels in the LRL on the day of birth (postnatal day 1; P1) and terminates sometime after P7. The LRL is a developmentally transient structure and a site of neurogenesis. Prenatally, neurons born in the LRL migrate to form precerebellar structures that, along with the cerebellum, coordinate sensorimotor functions. PR expression is present as early as embryonic day 18 and as late as P8 in the LRL and demonstrates an age-related increase prenatally with an age-related decrease postnatally. The high level of PR expression in the perinatal LRL suggests that progesterone may potentially influence LRL function. Prenatally, the LRL serves as a source of neurons for precerebellar structures.

Although the postnatal LRL is mitotically active, we wanted to determine the potential influence that PR may have on this function. We used double immunofluorescence for PR and the thymidine analog (bromodeoxyuridine, BrdU) to examine this potential. Only a small percentage (on average 15%) of PR positive cells also contained BrdU suggesting that it is unlikely that PR is influencing cell birth in this structure directly. Since newly synthesized cells migrate following birth, we examined whether PR could be influencing migration in the LRL. We observed about double the percentage (>30%) of PR positive cells that were colocalized with the radial glial marker, vimentin. These findings suggest that PR has the potential to influence migration, rather than neurogenesis, in the developing LRL. Future experiments will examine the functional significance of PR in the LRL radial glia. *[Acknowledgement: SOMAS Grant - Support of Mentors and thier Students]*

Faculty Advisor: Dr. Princy Quadros Mennella, pmennella@desu.edu

30

Identification of Circadian Clock Genes In Synechococcus Elongatus PCC 7492

Darae Jun, University of California, San Diego

The cyanobacteria are the only known prokaryotes that possess a circadian clock. Because of its genetic simplicity, Synechococcus elongatus PCC 7942 is an excellent model to study components of the clock. The focus of this research is to screen for mutants in genes that modify the clock. An insertion library has been constructed through transposon mutagenesis and was screened for circadian mutants using a bioluminescent assay. Using these data, we chose a set of 95 mutant genes that were arrhythmic, period, or phase mutants, relative to wild type. We performed additional bioluminescence assays on a turntable with a CCD camera in order to confirm these circadian phenotypes. We found four genes, trpA, gyrA, ftsZ and a gene encoding for an aluminum resistance protein that displayed an altered period and phase. Currently, we are performing bioinformatic analyses in an attempt to understand their respective functions with respect to the circadian clock. Through this research, we are discovering other genes that affect the clock, which will lead to a better understanding of the circadian clock in cyanobacteria. *[Acknowledgement: Susan S. Golden]*

Faculty Advisor: Susan S. Golden, sgolden@ucsd.edu

31

Measurement of Leptin in African American Women Under Controlled Conditions of Weight Maintenance and Physical Exercise

Sobriquia Kelley, Savannah State University

The discovery of the hormone leptin in 1994 stimulated research into obesity by demonstrating an afferent hormonal signal from adipose tissue to the central nervous system, but the initial hypothesis that a deficiency in leptin leads to obesity in

humans has not held up (Korner, 2003). Instead, there is a complex interaction of neuroendocrine systems that keep adipose tissue from diminishing. The regulation of food intake itself is a complex process that includes interactions among reward pathways in the central nervous system, societal and environmental influences mediated through higher neural centers, and signals along the gut-brain axis (Chaudhri, 2008). Recent efforts at unraveling this complexity have focused on glucagon-like peptide 1 (GLP-1), a gut hormone that enhances postprandial insulin secretion. Once secreted, GLP-1 is rapidly degraded to inactive metabolites (Vilsboll, 2001). Independent of sex, age, adiposity and postprandial changes in other metabolites, the postprandial GLP-1 response is associated with activation of some areas of the human brain that have been previously associated with satiety, meal termination and the regulation of food intake (Pannacciullia, 2007). Obesity, leptin, race, diet, and exercise have each independently been shown to influence GLP-1 levels. In severely obese subjects, the postprandial GLP-1 response is attenuated (Verdich, 2001), though it shows some improvement after weight loss. Leptin has been shown to stimulate GLP-1 secretion from rodent and human intestinal L cells, which suggests that the decreased GLP-1 levels in obese humans could be a result of leptin resistance (Anini, 2003). Compared with obese white subjects, at similar levels of glucose, BMI, fat mass, dietary intake and insulin sensitivity, obese black subjects had significantly higher GLP-1 concentrations at fasting and when stimulated by oral glucose tolerance tests (Velasquez-Mieyer, 2003). Between two groups of obese patients, a hypocaloric, low-fat diet decreased basal GLP-1 levels in correlation with insulin levels while a hypocaloric, low-carbohydrate diet did not (deLuis, 2008). And in a study involving adolescent males who underwent 1 hour of supervised exercise daily for five consecutive days, GLP-1 levels 30 minutes after a liquid meal were elevated in overweight and non-overweight subjects compared with the GLP-1 levels on a similar test administered prior to the five-day exercise regimen *(Chanoinel, 2008)*. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Johnny Johnson, johnsonj@savannahstate.edu

32

HeLa Cell Cryopreservation with Dendroides Canadensis Antifreeze Proteins

Catherine Kemme, Pensacola Christian College, FL

Cryoprotectants are compounds that assist in cryopreservation of a substance at low temperatures. Although the cryoprotectants DMSO and trehalose classically were used for preservation of mammalian cells and donor organs, they continue to propose complications in use. However, in 1969, a new promising type of cryoprotectant arose from a blood component of Antarctic fish species, which allow them to survive temperatures below zero centigrade. Since then, observations of these antifreeze proteins have increased to include many entomological and botanical species. The research aimed to explore the use of antifreeze proteins in mammalian cell cryoprotection. For this study, observation reviewed the cryoprotection potential of the antifreeze protein affected upon HeLa cells subjected to various temperatures below 0˚C. The DMEM environment of the HeLa cells was standardized, except for the manipulation of temperature. This experiment utilized bacteria-synthesized antifreeze proteins modeled from the genome of Dendroides Canadensis. The procedure initiated with HeLa cell growth in T-75 flasks, trypsinization, and suspension in new cell media before submersion in a -12˚C ethanol bath. Hemacytometer counts concluded percent survivorship for each sample. Analogous setups with 0.1 and 0.2mg/ml concentrations of antifreeze proteins presented the effects of the proteins on cryoprotection.

However, antifreeze proteins did not significantly improve survivorship. Observation under a cryomicroscope also did not show any difference in freezing temperature of a cell with or without antifreeze proteins. Therefore, as evaluated here, antifreeze proteins of D. Canadensis did not improve cryoprotection of mammalian cells. Lower concentration of other antifreeze proteins might provide cryoprotection of mammalian cells, but other cell lines should be manipulated. *[Acknowledgement: NSF Research Experience for Undergraduates provided the funding for laboratory experimentation and technique observation within the lab of John G. Duman, University of Notre Dame, Indiana.]*

Faculty Advisor: John G. Duman, duman.1@nd.edu

33

The Impact on Lifestyle-Induced Weight Reduction on Circulating Levels of GLP-1

Po'Teea Morris-Hunter, Savannah State University

The regulation of food intake itself is a complex process including interactions among reward pathways in the central nervous system, societal and environmental influences mediated through higher neural centers, and signals along the gut-brain axis (Chaudhri, 2008). Recent efforts at unraveling this complexity have focused on glucagon-like peptide 1 (GLP-1), a gut hormone that enhances postprandial insulin secretion. Once secreted, GLP-1 is rapidly degraded to inactive metabolites (Vilsboll, 2001). Independent of sex, age, adiposity and postprandial changes in other metabolites, the postprandial GLP -1 response is associated with activation of some areas of the human brain that have been previously associated with satiety, meal termination and the regulation of food intake (Pannacciullia, 2007). Obesity, leptin, race, diet and exercise have each independently been shown to influence GLP-1 levels. In severely obese subjects, the postprandial GLP-1 response is attenuated (Verdich, 2001), though it shows some improvement

after weight loss. Leptin has been shown to stimulate GLP-1 secretion from rodent and human intestinal L cells, which suggests that the decreased GLP-1 levels in obese humans could be a result of leptin resistance (Anini, 2003). Previous research involving obese African American women has not been conducted under carefully controlled dietary conditions of weight maintenance and physical exercise using measures of GLP-1. Therefore we examined the association between serum GLP-1 concentrations in obese African American women who adhere to a healthy change in lifestyle. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Johnny Johnson, johnsonj@savannahstate.edu

34
The Effects of Fenofibrate on Rantes (CCL5) and CCR5: Potential Implications for HIV

Bukola Odeniyi, University of Arkansas at Little Rock
Elvin Price Pharm.D., Ph.D, Ryan Farris Ph.D, Charla Wiley, and Amanda Stolarz, University of Arkansas Medical Sciences

RANTES (Regulated upon Activation, Normal T-cell expressed, and Secreted / CCL5) is a chemokine implicated in many diseases, including cardiovascular disease. RANTES is a natural ligand for the receptor C-C chemokine receptor type 5 (CCR5). CCR5 is a co-receptor required by the Human Immunodeficiency Virus (HIV) to infect host cells. A 32-base pair deletion in the CCR5 gene (CCR5-Δ32) renders the receptor defective, thus limiting HIV entry into host immune cells. This deletion confers HIV resistance in homozygous CCR5-Δ32 carriers and slower progression to AIDS in heterozygotes. Fenofibrate is a lipid-lowering drug with some anti-inflammatory effects. This drug decreases the production of RANTES after the induction of inflammation by IL-1β and has been shown to reduce expression and production of some chemokine family receptors.

Therefore we investigated the effects of fenofibrate on the expression and production of RANTES, and the expression of CCR5 in human micro-vascular endothelial cells of cardiac origin (HMVEC-C). HMVEC were cultured and treated with IL-1β (2ng/mL) and Fenofibrate (10μM). RANTES was measured using ELISA (R&D systems) and normalized to pg/mg of total protein concentration. Gene expression for RANTES and CCR5 mRNA was evaluated using RT-PCR. SPSS version 17.0 was used to perform ANOVA with correction for multiple comparisons with significance set at $P<0.05$. IL-1β significantly induced RANTES by approximately 80-fold over the control (Mean±SEM: 343.61±108.17 pg/mg vs. 4.37±5.74 pg/mg). The fenofibrate (10μM) attenuated the IL-1β induced inflammation, as expected (RANTES was decreased by 64.6%, Mean±SEM: 121.70±60.66 pg/mg). RANTES gene expression correlated with the protein produced. CCR5 mRNA was undetected in the HMVEC-C. Fenofibrate reduced RANTES protein levels and gene expression in HMVEC. However CCR5 mRNA was undetected in HMVEC-C. In future studies CD4 cells treated with fenofibrate may provide insight on whether the drug modulates the production of CCR5. *[Acknowledgement: This project was funded by the UAMS College of Pharmacy New Investigator Funds (Dr. Price), Arkansas Commitment (Bukola Odeniyi) and the UAMS Summer Research Internship Program (Bukola Odeniyi).]*

Faculty Advisor: Dr. Elvin Price, ETPrice@uams.edu

35
Endothelin-1: The Development of an In Vitro Model for Induction

Nakisha Rutledge, Morehouse School of Medicine

The kidneys are vital organs that filter waste from blood and when they are damaged as in chronic kidney disease, their function is lost and patients may require lifelong costly dialysis treatment. HIV-associated nephropathy (HIVAN) is a form of renal disease found predominantly in HIV+ individuals of African descent. The exact etiology of HIVAN is unknown, but it is thought to be the result of direct infection of renal cells with HIV. ET-1 (endothelin-1), a potent vasoconstrictor, causes proliferation of the cells in the kidney and deposition of extracellular matrix protein, both hallmarks of kidney disease. In previous experiments, we found that ET-1 in plasma is higher in HIVAN patients when compared to other HIV + patients. The increased secretion of ET-1 is thought to be caused by direct infection of the kidneys with the HIV protein, Nef.

The aims of this study are to determine if the HIV Nef protein induces the secretion of ET-1 using an in vitro model. This was determined via the treatment of Human Embryonic Kidney cells with two activating agents (lps and pma), a hypoxic mimetic agent (cobalt chloride) and the HIV Nef protein over 0-72 hours. All treatments are compared to the control wells which has no treatment. The supernatants forming the cells were used in a western and ET-1 elisa to determine the levels of endothelin-1 production. A cytotoxicity assay was used to determine at what point did the cells stop growing.These results could indicate that ET-1 can be used as a diagnostic biomarker to detect progression to chronic kidney disease that may lead to early intervention in HIVAN patients and an in vitro model of ET-1 induction in kidney cells would be helpful in the screening of drugs that can inhibit ET-1 that may eventually be used in the treatment of HIVAN. *[Acknowledgement: NIH]*

Faculty Advisor: Gale Newman, gnewman@msm.edu

36
Protein-Protein Interactions in the CRISPR-Cas System

Lesha Spencer, Clark Atlanta University

Cellular systems such as bacteria and archaea must defend themselves against the invasions of viruses and plasmids that are abundant in their native environments. One system that many prokaryotes use is the CRISPR-Cas system. The CRISPR (clustered regularly interspaced short palindromic repeats)-Cas (CRISPR-associated) system is a highly adaptive and heritable RNA-based immune system that provides defense against nucleic acid invaders. Prokaryotes with CRISPR-Cas systems capture and incorporate sequences derived from exogenous genetic material into the CRISPR loci of their genomes. The CRISPR loci give rise to CRISPR RNAs (crRNAs) that form effector complexes with the Cas proteins, which recognize and destroy the corresponding invader. One potential effector complex is composed of the Tneap subtype proteins (referred to here as CasA, B and C). These proteins are proposed to bind a crRNA and guide cleavage of a complementary DNA. Little is known about how these Cas proteins interact and knowledge of the interactions will give scientists valuable insights on how prokaryotes silence their invaders.

Cas protein genes from Pyrococcus furiosus and Thermococcus kodakarensis were previously cloned and inserted into plasmids, which were transformed into BL21-RIPL cells (an expression strain of E. coli). In this work, the Tneap proteins were expressed in E.coli and purified by thermal precipitation. Interactions between the purified proteins were investigated using a pull-down assay method as well as proteins known to interact as the controls for the experiments. The results indicate that CasA forms a strong interaction with CasB. No evidence was seen for interactions between CasA and CasC, or between CasB and CasC.

It was concluded that the Tneap proteins behave similarly in Pyrococcus furiosus and Thermococcus kodakarensis and there is strong interaction between CasA and CasB. Future work includes incorporating crRNA into the pull-down assays and analyzing the protein-complexes formed as a result of its presence. *[Acknowledgement: NSF funded REU Fungal Genomics and Computational Biology at the University of Georgia]*

Faculty Advisor: Michael Terns, mterns@bmb.uga.edu

37

Antiviral Activity of Withaferin A. against Pandemic Influenza Virus

Charne' Thomas, University of Miami Miller School of Medicine

The 1918 Influenza virus killed more than 20-40 million people worldwide. 500,000 died in the US alone. The H1N1 Influenza virus is a reassortmented virus that causes severe respiratory problems. The current vaccine to fight Influenza, Amantadine, Rimantadine, Zanamivir, Oseltamivir, and Peramivir do not work well against the H1N1 strand which is responsible for the 2009 swine flu outbreak. The virus's reassortment ability has made it very difficult to treat individuals suffering with this virus. There is a need for a new antiviral that will work against this strand of virus as well as other strands that can form. Since the current antiviral against Influenza does not work against new strands, we decided to test the compound Withaferin A against the Influenza A virus. We predicted that Withaferin A will inhibit entry of Influenza A because of its antiviral properties. This compound is derived from the ancient Indian medicinal plant Withania somnifera and is commonly used for its anti-inflammatory and anti-cancer effects. The active ingredient, Withaferin A was tested in vitro at different concentration (uM) using six 96 well plates, seated with 8,000 Madin Darby Canine Kidney cells per well to test the cytotoxicity and inhibition of viral replication. The plates contained a virus control (cells infected with virus) and a cell control (just plain cells). The plates were then incubated at different time periods (24, 48, 72hrs.) The data generated demonstrates that Withaferin A was not cytotoxic to cells and that it was able to block the destruction of infected cells at 3 micro molar concentrations. From this the Andreasky lab will test Withaferin A to investigate how well Withaferin A works on other cell lines, and how well Withaferin A works on other Influenza strands. *[Acknowledgement: This study was spported by the NSF/LSAMP Program Awarded to Abdalla Darwish, Ph.D., Coordinator/Campus Director at Dillard University, New Orleans, LA 70122.]*

Faculty Advisor: Dr. Bernard Singleton, bsingleton@dillard.edu

38

Molecular Tools for Visualizing Sensory Structure Development

Joy Walker, Oregon Health and Science University / Tougaloo College

The goal of this experiment was to develop a molecular tool to observe sensory organ development in zebrafish (Danio Rerio). Thus, we theorized that a 7.5 kilobase portion of the Fgf10 promoter would be sufficient to drive expression of a fluorescent protein, in a pattern that reflects endogenous expression of the Fgf10 gene. We amplified a 7.5 kilobase portion of 5' untranslated region (UTR) immediately adjacent to the transcriptional start site using Polymerase Chain Reaction (PCR). We cloned the fragment into the p5' multiple cloning site (MCS) vector and subsequently, we recombined the newly generated promoter vector, p5'MCS-Fgf10UTR, with the protein vector, pME-nls-mCherry, and p3'E-polyA into the destination vector, pDestTol2pA2. Next, we injected the product vector into claudinB:GFP (transgenic) embryos, allowed the embryos to develop until 24 hours post fertilization, and then imaged using a confocal microscope. As expected, there was nls mCherry expression in the otic vesicle (ear) and olfactory bulb (nose) of the claudinB:GFP embryo, two known domains of fgf10 at this developmental stage. Nevertheless, fgf10 expression was not present in the lateral line primordium, a domain also familiar to fgf10 expression. This is likely due to critical regulatory regions

missing in the 7.5 kB Fgf10 promoter, consequently, inhibiting expression in all of the desired organs. This data suggests that the cloned, 7.5 kB portion of the fgf10 was able to partially recapitulate the endogenous expression of the fgf10, therefore partially supporting our initial hypothesis. Overall this new instrument will prove useful in future studies aimed to elucidate the mysteries that underlie sensory organ development. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Wendy White, PhD.,
jbianca_walker09@yahoo.com

39

Mechanisms of the Hyperglycemia-Induced Increase in Red Blood Cell Phospholipid Flip-Flop

Kriscilla Walker, Bennett College
Natasha Crosby, Moshin Mukhtar, and David L. Daleke, Ph.D., Department of Medical Sciences, Indiana University

Previous work has suggested that hyperglycemia accelerates phospholipid flip-flop across erythrocyte membranes. To analyze this hypothesis, we measured the inward movement of a phosphatidylcholine, DiC10-PC, in erythrocytes. We collected fresh human blood from a healthy donor by venipuncture. Erythrocytes were washed with NaCl and isolated by centrifugation. After three suspensions, the supernatant and buffy coat were removed. Cells are stored at 4ºC for up to eight hours prior to use. DiC10-PC was measured using a cell morphological assay to determine the appropriate concentration of lipid to use in subsequent measurements.

The Morpholgical Index was determined by counting the morphological stages of 100 cells per sample and scoring them according to a scale. The Morphological Index was calculated for each point: MI= Σ (# of cells* stage #)/total of cells counted. Red blood cells at 25% HCT in NaCl/Pi were incubated with DiC10-PC at various glucose concentrations (0, 5, 20,50mM) for overnight incubation (18 hrs.) at 37ºC. To measure lipid flip-flop, cells were vortexed, treated with DiC10-PC, and incubated at 37ºC. The result of my experiment was not what was to be expected. My results did not prove that hyperglycemia accelerates phospholipid flip-flop, but the exact opposite. My results showed a decrease in phospholipid flip-flop. The causes for my results could be due to human error. There are many possible reasons why the experiment did not go as planned. There will be more experiments to attempt to prove this hypothesis. *[Acknowledgement: The STEM Summer Scholar Institute Program is funded through the Indiana/HBCU STEM Initiative.]*

Faculty Advisor: Margaret W. Curtis, Ph.D.,
mcurtis@bennett.edu

40

Amyloid Precursor Protein Levels in Anestrogen-Receptor Knockout Mouse

Theresa Williams, Delaware State University

Alzheimer's disease (AD) is an irreversible, progressive brain disease that can be caused by several factors, one of which is mutations in the amyloid precursor protein (APP) gene, leading to the pathological hallmark of AD, plaques. In other cases, the production or failure in production or clearance of APP fragments, by synthetic and/or proteolytic enzymes, can result in accumulation that can ultimately also cause the formation of amyloid plaques. The likelihood of having AD increases substantially after 70 years of age and the incidence of the disease goes up to 50% of people over the age of 85 years. Interestingly, postmenopausal women who undergo hormone replacement therapy are less likely to get AD, suggesting a hormonal influence in this disease. Additionally, demonstrating that APP is capable of hormonal regulation, others have shown that estradiol downregulated APP mRNA levels in both adult and old female mice. Estradiol and other estrogens regulate gene expression through two transcription factor receptors: Erα and ERβ. Using immunocytochemistry, the present study examined the levels of APP immunoreactivity in transgenic mice that lack functional ERα(KO) compared to their wild type (WT) controls. Since the hippocampus and cortex are two brain regions most ravaged by amyloid plaques, we focused our analysis to these regions. If estrogen regulates APP protein levels, then we would expect to observe significantly lower levels of APP in WT mice compared to either of the KO mice strains in both the hippocampus and the cortex. A t-test comparing KO and WT indicated that female KO mice had a greater APP immunoreactivity than ERα WT mice ($p=0.027$) in the hippocampus.These findings support our hypothesis that estradiol reduces the expression of APP. Subsequent studies will examine APP levels in ERβKO mice to determine contributions of ERβ toward APP regulation in the brain. We could compare antibodies to APP processing enzymes to determine if the enzyme levels regulate the way APP is cleaved. Findings from this study can help us better understand how estrogen may affect the production of APP and ultimately contribute toward the prevention of AD. *[Acknowledgement: This research was funded by DSU SMILE and DE INBRE NIH grant 2 P20 RR016472-19 from the NCRR.]*

Faculty Advisor: Leonard Davis, ledavis@desu.edu

Chemistry (not Biochemistry)

41

Quantative Identification of Alpha - A Crystalline C - Truncation Products in Rat Lenses

Vandrea N. Watts, Talladega College
Dr. Stephen Barnes, University of Alabama at Birmingham

Cataract disease is the leading cause of human blindness worldwide. Opacity occurs in the lens when there are alterations in the protein structure and water content. Once lens epithelial cells differentiate to form transparent fiber cells, they can no longer synthesize proteins. Protein truncation is considered to be a contributing factor to or a result of cataract formation. Previous studies have shown truncated A-crystallin in both pre- and post-cataractous ICR/f rat lenses. However, the amount of specific truncation products within the lens is unknown.

The goal of this study is to develop a method based on multiple reaction monitoring (MRM) mass spectrometry with electrospray ionization (ESI) to quantify the amount of truncation products within the lens with respect to full-length A-crystallin. Rat lenses from different time-points of development were homogenized in 25 mM ammonium bicarbonate-8 M urea, pH 7.8, to recover water-soluble/insoluble proteins. After centrifugation and recovery of the supernatant, each extract (10 mg protein) was treated with different proteases (chymotrypsin, Glu-C, trypsin, and combinations of these) to identify specific peptides that had undergone truncation. For the C-terminal region of A-crystallin the 142-173 chymotrypsin fragment was most useful (^{142}**SGPKVQSGLDAGHSERAIPVSREEKPSSAPSS**^{173}) and allowed the independent detection of cleavage at residues 151, 156, 157, 163, and 168 (shown in **bold**). The full-length chymotryptic peptide was also detected. This peptide will be used to determine the relative proportions of the full-length and C-truncated A-crystallin in ICR/f rats at several stages in the formation of cataracts. *[Acknowledgement: This study was supported by a grant from NSF/HBCU-UP awarded to Leonard Cole, Ph.D., Director of Sponsored Program, Talladega College, Talladega, AL 35160.]*

Faculty Advisor: Dr. Alison Brown, AKBrown@talladega.edu

Computer Engineering

42
Biophysical Modeling of the Large Cells of the Crab Ganglion

Autumn Jade Bullard, University of Missouri-Columbia / Norfolk State University

The crustacean cardiac ganglion (CG) runs longitudinally along the midline of the inner dorsal wall of the crab heart and is composed of nine neurons, four small cells and five large cells. These cells are distributed along the ganglionic trunk and provide bombardments of rhythmically recurring action potentials to the single heart muscle causing it to contract. The functions of the neurites of these cells or of the gap junction connections between the various cells of the ganglion are not yet fully understood presently. The neurites are approximately 20 microns in diameter, which makes it difficult to perform electrophysiology experiments on them without damaging the integrity of the neuron. With biological data recorded from the soma in the Schulz Lab, we developed a detailed multi-compartmental biophysical model of the crustacean cardiac ganglion. It is then used to conduct "model experiments" which cannot be typically performed in a wet lab, and to gain more insights into the electrophysiological characteristics of the large cells both individually and in the entire network. Working with the Schulz Lab we developed an 8-compartment model with an active soma and passive axon compartments based on biological measurements. We then added a spike initiation zone, and finally connected all five large cells via gap junctions to develop in a realistic multi-compartment model of the CG network. Parametric studies have been performed with the models. The model is being used to develop predictions that will later be tested in biology. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Zenora Spellman, zespellman@nsu.edu

Ecology

43
Effects of Food Limitation on the Response of the California Mussel to Thermal Stress

Jeremy A. Browning, California State University, Long Beach
Dr. Bengt J. Allen and Lindsay Fitzgerald-DeHoog, California State University, Long Beach

Due to steep gradients in temperature and desiccation stress on rocky shores, many intertidal organisms produce proteins (including so-called heat-shock proteins, HSPs) that help to minimize and repair cell damage in response to environmental extremes. This inducible response is assumed to be energetically expensive and therefore may impose a trade-off between protein expression levels and individual growth or reproduction. Our research is designed to investigate the effect of thermal stress on the production of HSPs and other stress proteins of the California mussel, Mytilus californianus, under different levels of food availability. We hypothesize that M. californianus will generally exhibit elevated expression levels of HSPs and other proteins in response to high temperature, but that the magnitude of the increase will be less under food limitation and/or that stressed mussels will exhibit reduced growth or condition: a trade-off. In a pilot study, mussels were collected from the field and randomly assigned to one of four treatment groups comprised of high and low levels of food availability and high and low levels of chronic thermal stress during simulated low tides. After eight weeks, mussels experiencing high thermal stress or low food availability had significantly less tissue mass than control mussels; there was no evidence of a statistical interaction. Nevertheless, when challenged with a subsequent extreme thermal event, mussels in the high stress groups survived the best, regardless of food level. These data are consistent with the idea that tolerating sub-lethal thermal stress

is energetically costly, but that acclimation to stress increases one's tolerance to subsequent events, presumably in part due to elevated levels of stress proteins.
We are currently conducting a follow-up study with a similar experimental design in which we will use proteomic analyses of the expression levels HSPs and other proteins to improve our understanding of the mechanistic links between food availability, thermal stress tolerance, and demography. Our research represents the first attempt to empirically test for a physiological cost of thermal stress to a rocky shore organism while controlling for the effect of food availability.
[Acknowledgement: This research was supported in part by an NSF- and CSU-funded Louis Stokes Alliance for Minority Participation (LSAMP) Research Fellowship to JB (HRD-0802628.) CSU Council on Ocean Affairs, Science, and Technology (COAST) Graduate Research Fellowship to LF-D.]

Faculty Advisor: Bengt J. Allen, bjallen@csulb.edu

44

Temperature and Feeding Have a Direct Effect on the Common Caribbean Cork Screw Sea Anemones' Temperament

Jacob M. Case, University of the Virgin Islands

Sea anemones are known to use mechanical and chemical stimuli to determine when to fire their cnidocytes, cells on their tentacles that fire a type of toxic filled harpoon for defense or for prey capture, but other factors may influence the degree of the firing of these cells. The common corkscrew Caribbean sea anemone, Bartholomea annulata, is usually quite aggressive yet sometimes seems to be very docile in our holding tanks. We explored several factors which may lead to changes in sea anemones' stinging temperament including temperature and feeding habits. We measured anemone temperament for stinging with a gloved finger poke on a scale of 0-3. We conducted field experiments to explore the effect of feeding on anemone stinging temperament, by comparing temperament before feeding, during feeding and post-feeding (~45min after feeding). B annulata was more aggressive during feeding than before or after feeding (T-test).

To explore the role of temperature, we compared the temperament of anemones in warm (34°C), or cold water (20°C) to their temperament in normal seawater (28°C). We found that anemones in cold water were more aggressive than those in normal or warm water. The changes in anemone aggressiveness may have implications for the cleaner shrimp that inhabit these anemones, such that the shrimp may have to alter their behavior during cooler times and when anemones are feeding. The increase in anemone aggressiveness in colder water may be due to increased oxygen supply in colder water, though we have not tested this directly yet. Furthermore, a large die off was noted during these experiments which coincided with an increase in the acidity of the holding tanks' seawater, suggesting we should further investigate the role of seawater pH in relation to the health and aggressiveness of the corkscrew anemone.
[Acknowledgement: National Science Foundation's (HBCU_UP)]

Faculty Advisor: Stephen Ratchford, sratchf@uvi.edu

45

Effects of Light on Daphnia Ephippia

Tiffany Glover, Langston University
L. J. Weider, University of Oklahoma, Norman, Oklahoma

Daphnia produce resting eggs encased in a protective structure (i.e., ephippium) that can lay dormant in lake sediments for long periods of time (i.e. years, decades, centuries). By hatching these resting eggs, we can gain insight into lake conditions years ago and have viable 'resurrected' hatchlings for experimentation or DNA analyses. This could lead to pertinent information on the diapause period. Previous work has found that seasonal changes in light and/or temperature may be responsible for terminating diapause.

The purpose of this experiment was to determine whether Daphnia resting eggs show differential hatching response to different wavelengths of light. Shallow and deeper layer Daphnia mendotae resting eggs were placed under red, blue and white light treatments to test the hypothesis that Daphnia ephippia would have the greatest hatching rate under the full spectrum white light. Darkness was used for the control. The experiment displayed that the highest hatching rates for the deeper and shallow layers occurred under the white light treatment which supports the hypothesis.

A future question is if the results will change if the experiment is tested on a different species of Daphnia such as the pulex or pulicaria. Understanding which light wavelengths induce the most successful hatching rates can be useful to study microevolutionary changes in response to changes in the environment. *[Acknowledgement: This study was funded by a NSF grant awarded to L. J. Weider Ph. D, Director of University of Oklahoma Biological Station, Kingston, Oklahoma, 2011.]*

Faculty Advisor: John Coleman, jkcoleman@lunet.edu

46

Diversity and Distribution of Marine Gastropod Species Along the Upper Intertidal Zone of Playa San Miguel, Cabo Blanco Absolute Reserve, Costa Rica

Jasmine Hamilton, California State University-Sacramento
Matee Wolf, Humboldt State University
Bridget Santos, California State University-Fullerton

The extensive intertidal habitat of Playa San Miguel within the Cabo Blanco Absolute Reserve on the Pacific coast of Costa Rica supports a diverse gastropod fauna. Little is known about the fine-scaled distribution along the intertidal zone of Playa San Miguel. We hypothesized that gastropod diversity and composition would vary across different sites as well as during day and night due to the presence or absence of certain predators and differences in beach topography among sites. Ten sites were randomly chosen in the uppermost reaches of the intertidal zone and five collection rounds were performed at the sites over a one-week period in the wet season, during July 2011. In total, 5950 individual gastropods were collected; 17 species in 14 families were recorded. The three most abundant species were Nerita scabricosta (Neritidae) comprising 59.8% of the total, Littorina aspera (Littorinidae) comprising 23.2% of the total, and Acanthina brevidentata (Thaididae) comprising 5.4% of the total. Algal grazing species made up 87 % of the individuals, while carnivorous species made up 7%, and detritus feeders or predators on minute organisms made up the remaining 6%. Species diversity of snail species, as measured by species richness and Shannon's diversity index, was higher during the day than during the night.

Two major rainstorms occurred following the baseline collection, dramatically altering the topography and sediment distribution along the beach face. Species diversity of gastropods increased after the first storm, and dropped again after the second storm. Most of the gastropod species were found over most of the study area and during most of the sampling times. Abundance of the very common tooth shell, Nerita scabricosta, dropped after the storm events.

Ordination of samples and species showed a shift in species composition following the storm events, although there was substantial overlap in composition in the two groups. Species composition did not vary in response to day and night nor geographical location along the coast. Although few differences in gastropod composition were shown across sampling sites of Playa San Miguel, a future study may investigate variation in gastropods along different beaches in the San Miguel area.
[Acknowledgement: California State University LSAMP]

Faculty Advisor: Ronald Coleman, rcoleman@csus.edu

47

Feeding, Housing and Defensive Behaviors of He'e Mauli (Octopus cyanea) in Hanauma Bay

Daniel Jennings-Kam, Kapiolani Community College

The Day Octopus, Octopus cyanea, He'e Mauli in the Hawaiian language is the most commonly seen octopus in Hawaii, and is often fished recreationally. Despite the popularity of He'e Mauli, we know very little about their behavior in a natural environment. The focus of this research is to increase the basic knowledge of the behavioral ecology of He'e Mauli in Hanauma **B**ay. Hanauma Bay was chosen because it is a Marine Life Conservation District and is protected by law.
I have three areas of study, feeding, housing preferences and defensive behavior. My hypothesis on feeding is that He'e Mauli are opportunistic feeders eating anything they can get a hold of. For housing, I hypothesize that He'e Mauli prefer to dig dens in rubble and hard substrates. Defensive behavior, I hypothesize that the He'e Mauli in Hanauma Bay show different defensive behaviors towards humans, as humans offer little threat to their wellbeing.

This project started in June of 2011 and is ongoing. I expect to have observed 25 individuals by February 2012. To determine the food sources of He'e Mauli in Hanauma Bay a list of marine invertebrates found is being compiled. Ideally observing He'e Mauli feeding would be the optimal way to determine what they are eating. To assess the preferences of housing behavior, transects and point intersect quadrants were done in various parts of Hanauma Bay, this coupled with relative location of all He'e Mauli found allows us to see any trends in He'e Mauli abundance and substrate type. To test defensive behaviors He'e Mauli found were antagonized and their responses were documented. This will be compared with the behaviors displayed by He'e Mauli in other sights.

This research will allow us to gain a better understanding of various housing, feeding and defensive behaviors of He'e Mauli, possible influences they have on the community, and the relative abundance of He'e Mauli throughout Hanauma Bay.
[Acknowledgement: This project is funded by a grant/ cooperative agreement from the National Oceanic and Atmospheric Administration, Project A/AS-1, which is sponsored by the University of Hawaii Sea Grant College Program, SOEST, under Institutional Grant NA09OAR4170060 from NOAA Office of Sea Grant, Department of Commerce.]

Faculty Advisor: Mackenzie M. Manning, mmanning@hawaii.edu

48

Larval Settlement of the Long-Spined Sea Urchin, Diadema Antillarum, Corroborates Seasonality and Importance of Post-Settlement Processes in the US Virgin Islands

Jamie Spray, University of the Virgin Islands
Teresa Turner, PhD, Summer Undergraduate Research Experience (SURE), University of the Virgin Islands, St. Thomas, USVI (HBCU-UP)

Rapid phase shifts from coral reefs to algal-dominated reefs have occurred throughout much of the Caribbean following a mass mortality event claiming 95-99% of long-spined sea urchins. Such a strong correlation with this event suggests the herbivorous Diadema fulfill an important niche in maintaining coral-dominated reefs. Hence, their reestablishment could enable coral reef recovery. Yet, recovery has been variable and

patchy across and within the region. Possible reasons for this could be a difference in larval supply between localities, preferential settlement, and post-settlement processes acting strongly on certain populations. In continuation of a study instituted in Brewer's Bay, St. Thomas, USVI, we are deploying settlement collectors monthly to test the larval supply between two sites with contrasting adult population densities. Data from 2010 show a possibility of a late spring/early summer seasonal peak in settlement.

Thus, we predicted a similar peak this 2011 season: May-July. Data show a seasonal peak, with one month's difference between years. The observed annual variation could be due to oceanographic conditions or nutrient flux. Additionally, we predicted that if larval supply accounts for the differences in adult populations, the locality with higher adult density (Runway) would show significantly higher Diadema settlement.

The results were that Black Point, the site with low adult density, had the higher amount of settlement, whereas Runway had low settlement for the peak month. Because the site with higher adult density had the lower number of settlers, the larval supply hypothesis is falsified. A t-test performed over the entire study period showed no significant difference in the larval supply. Therefore, post-settlement processes must affect juvenile recruitment, and further study on the behavior and nursery requirements of recently-settled juveniles could lend insight into survival mechanisms to ensure healthy adult populations. *[Acknowledgement: This research is funded by the NSF VI-EPSCoR grant 0814417 and NSF HBCU-UP grant HRD-0506096.]*

Faculty Advisor: Teresa Turner, tturner@uvi.edu

GENETICS

49
Screening for Mutations in the DHODH Gene That Cause Miller Syndrome

Jeffrey Chukwuneke, University of Washington / Rutgers University, NJ

The first successful application of exome sequencing to identify the cause of a Mendelian disorder found that mutations in DHODH cause Miller syndrome - a rare disorder characterized by craniofacial and limb malformations. Miller syndrome is exceedingly rare with fewer than 30 reported cases; therefore, identifying additional mutations in DHODH to support the initial finding is critical.

We sequenced DHODH in eight individuals from three separate kindreds diagnosed with Miller syndrome. In family 1, the proband expired at day 3 of life and DNA was not available. However, DNA from the two unaffected parents was available for sequencing. Photographs of and clinical findings of the proband suggested a diagnosis of Miller syndrome. In family 2, microarray studies had discovered a duplication proximal to DHODH in the proband and his mother. The proband had craniofacial abnormalities, high arched palate and cryptorchidism suggestive of Miller syndrome, albeit with a milder expression.

We hypothesized that the duplication disrupted DHODH and that the father carried a point mutation in DHODH. The proband in family 3 had clinical findings consistent with Miller syndrome including bilateral absence of the 5th digits of his hands, a cleft palate and a peri-membranous VSD. However, all 5 digits of both feet were present with bilateral hypoplastic 4th rays. The proband did not have eyelid coloboma or missing eyelashes. Sanger sequencing of nine coding exons of DHODH in each of the families revealed 2 recurrent and 2 novel mutations. In family 1, each parent carried a non-synonymous missense mutation that had been reported previously, confirming the clinical diagnosis of Miller syndrome. Analysis of family 2 revealed no mutations in DHODH in the proband or either parent.

This suggests that either the proband does not have Miller syndrome or unidentified variants (e.g., in a non-coding, regulatory region) in DHODH are responsible. Finally, analysis of the proband in family 3 revealed two novel mutations in DHODH, a 2 bp deletion in exon 2 resulting in a premature stop codon and a non-synonymous variant in exon 7. These variants were also found in the father and mother, respectively. Control data from 192 chromosomes matched for geographic ancestry confirmed that these variants are rare, with a minor allele frequency of <0.5%. This is consistent with the very low incidence of Miller syndrome. In summary, our findings underscore that mutations in DHODH cause Miller syndrome. *[Acknowledgement: NIH HG02360-11]*

Faculty Advisor: Michael Bamshad, mbamshad@u.washington.edu

50
Additional Individuals with Mutations in TNNT3 and TPM2 That Cause Distal Arthrogryposis type 2B (DA2B) Improve Our Understanding of the Genotypic and Phenotypic Variability in DA2B

Jennifer Cross, University of Washington
Heidi Gildersleeve, Margaret McMillin, Anita E. Beck, and Michael J. Bamshad, Department of Pediatrics, University of Washington

Distal Arthrogryposis (DA) is a group of disorders characterized by multiple congenital contractures of the limbs. Individuals with DA are neurologically and cognitively normal. DA is divided into subtypes based on additional clinical features. DA1 is characterized by isolated contractures of the hands and feet. Mild facial contractures, small mouth and prominent nasolabial

folds distinguish Sheldon-Hall syndrome, or DA2B; whereas, Freeman-Sheldon syndrome, or DA2A, is distinguished by severe facial contractures with H-shaped dimpling of the chin. Mutations in TNNI2, TNNT3, and TPM2 have been found to cause DA1 and DA2B, but have not been reported in DA2A. Twenty-one probands diagnosed with DA1, DA2B, or DA2A were screened using Sanger sequencing for all coding exons of TNNI2, TNNT3, and TPM2 in which mutations causing DA have previously been reported. This includes exon 8 of TNNI2, exon 10 of TNNT3, as well as all exons of TPM2. The objective was to identify additional mutations in these genes that cause DA, and to expand our knowledge about the phenotypic variability of individuals that have mutations in these genes. We identified mutations in TPM2 and TNNT3 in three families, explaining the cause of DA in 14% (3/21) of the families. All three mutations were identified in individuals with a diagnosis of DA2B. Specifically, a mother and daughter with DA2B have a mutation in exon 10 of TNNT3 (c.C187A, p.R63S), and probands from two unrelated families carry a de novo mutation in exon 4 of TPM2 (c.C397T, p.R133W).

These results provide further evidence that mutations in TNNT3 and TPM2 cause DA2B. Nevertheless, a majority of DA cases are still unexplained which supports further investigation of additional candidate genes. *[Acknowledgement: This study was supported by the University of Washington GenOM Project (NIH HG02360-11), Seattle, Washington, and by the Genetic and Molecular Basis of Congenital Contractures grant (NIH HD48895-06).]*

Faculty Advisor: Michael Bamshad, mbamshad@u.washington.edu

51

Effect of OPRM1 and COMT Gene Polymorphisms on the Analgesic Effect of Intrathecal Fentanyl During Labor Analgesia

Rebecca de Frates, University of Washington
Dr. Ruth Landau, University of Washington Medical Center / University of Geneva, Geneva, Switzerland
Dr. Cynthia Wong and Robert McCarthy, Northwestern University Feinberg School of Medicine
Jean Louis Blouin, University of Geneva, Geneva, Switzerland

Childbirth is considered one of the most painful events a woman may experience. Labor analgesia with an epidural or intrathecal opioids is an option that most women opt to receive nowadays. It has been hypothesized that genetic variability explains, at least in part, the large inter-individual variability in the observed response to neuraxial opioids. Pain perception and the analgesic response to opioids are most likely polygenic (affected by multiple single nucleotide polymorphisms across different candidate genes).

The Landau Lab is investigating the association between the analgesic effect (potency) and duration of action of intrathecal fentanyl (ITF) in parturients and common polymorphisms of μ-opioid receptor gene (OPRM1) and catechol-O-methyltransferase (COMT) gene. We hypothesized that duration of ITF will be longer in A118 homozygotes of OPRM1 and Met158 of COMT (A/A-Met/Met) compared to women carrying a different allelic combination. We performed a secondary analysis on data from a study on 184 parturients receiving a combined-spinal epidural for labor analgesia. The primary outcome was duration of analgesia from ITF dose (25mcg) to request for additional analgesia (via epidural). There was no significant difference between genotypic groups (p=0.358) although there was a trend for longer duration of ITF in A/A-Met/Met women [n=38; 81min (CI 95% 70, 92)] compared to Met/Met not A/A women [n=11; 63min (CI 95% 46, 80]. These findings suggest that genetic variants of OPRM1 and COMT genes may affect the response to intrathecal fentanyl for labor analgesia and warrant further investigation as this may have relevant clinical implications. *[Acknowledgement: This study was funded by the University of Washington GenOM Project (NIH HG02360-11), Swiss National Foundation grant (SNF 3200B0-114129), and the National Institutes of Health R01HD48805 (RMS).]*

Faculty Advisor: Ruth Landau, rulandau@u.washington.edu

52

Age-dependent Expression of Calbindin and Semaphorin 3G in the Developing Mouse Cerebellum

Thomas Anthony Mota, California State University, Long Beach

A variety of neural functions, such as motor coordination, cognition, and emotion, are regulated by the cerebellum. Although many of these functions are sexually dimorphic, the cerebellum was not considered as a brain region with distinct differences in neural structure between the sexes. Calbindin D-28K (Calb1) and semaphorin 3G (Sema3g) are highly expressed in the developing cerebellum and are believed to play important roles in neural development and function. Calb1 is a calcium-binding protein that maintains calcium homeostasis in neurons. Calb1 knockout mice show impairments in motor skills, coordination, spatial learning, and visual and vestibular processing.

A recent study has discovered that at weaning, female mice show greater mRNA and protein levels of Calb1 in the cerebellum than male mice. However, it is not known at what age the sexually dimorphic expression of cerebellar Calb1 appears. Sema3g is a member of the semaphorin-class 3 family implicated in the control axon guidance and outgrowth during brain development. Although the exact function of Sema3G is still unknown, an age-dependent increase in Sema3g expression in the rat cerebellum indicates that Sema3g may act in a similar manner as the other semaphorin members.

Thus, we hypothesized that sexually dimorphic expression of Calb1 and Sema3g in the mouse cerebellum occurs on the day of birth (PN0) and continues during early development. The cerebellum was collected from male and female mice on PN0, 7 days (PN7), and 14 days (PN14) after birth (n=8 per sex per age). Total RNA was extracted from each sample, and mRNA levels of Calb1, Sema3g, β-actin (Actb), and glyceraldehyde 3-phosphate dehydrogenase (Gapdh)in the cerebellum were measured using quantitative RT-PCR. Relative expression of Calb1 and Sema3g were calculated by normalizing Calb1 and Sema3G levels against those of Actb, and Gapdh. Our data showed no sex difference in expression of Calb1 or Sema3G in the developing cerebellum ($p=0.792$ and $p=0.097$).

However, cerebellar mRNA levels of both Calb1 and Sema3g increase with age ($p<0.05$ and $p<0.05$). With further analysis of individual groups, increased mRNA levels of Calb1 were observed in the male cerebellum on PN7 (M>F), which disappeared on PN14. We are currently investigating if Calb1 and Sema3g expression in the mouse cerebellum is sexually dimorphic at weaning. *[Acknowledgement: This research is supported by CSUPERB Faculty-Student Collaborative Research Seed Grant and CSULB Startup fund.]*

Faculty Advisor: Houng-Wei Tsai, htsai@csulb.edu

53

Genomic Sequencing of Gram Positive Bacterium Clostridium Taeniosporum

Patricia Romaniuk, Miami Dade College

Clostridium taeniosporum is a Gram-positive obligate anaerobic bacterium that is related to Clostridium botulinum Type B Group II. Clostridium botulinum Type B Group II produces the most deadly neurotoxin and it is non-proteolytic. Clostridium taeniosporum seems to be 99.9% homologous to C. botulinum, and it is nonpathogenic. The goal of this project is to generate a complete genome sequence and annotation for C. taeniosporum. The annotation will assist in us in deciphering the fate of the toxin gene in C. taeniosporum, and will provide insights as to the function of its ribbon-like endospore appendages. DNA sequence was purified from active cultures and subjected to next-generation sequencing using Life Sciences 454 pyrosequencing technology (Roche®). Eighteen scaffolds were assembled for annotation. We used bioinformatics software Geneious Pro v5.5.3 to provide for a partial annotation of the genome sequence scaffolds. Partial annotation of C. taeniosporum DNA genome seems to confirm its relatedness to C. botulinum Type B Group II. With a few scaffolds partially annotated we have observed 86% sequence homology. This is consistent with previous reports in the scientific literature.

Further genome annotation will elucidate novel homologies that could assist researchers with the biochemical characterization of the ribbon-like appendages of this organism and elucidate the fate of toxin in C. taeniosporum. *[Acknowledgement: This research would not have been possible without the funding of the National Science Foundation program 'The Biotechnology Research Learning Collaborative (BRLC)' grant ATE DUE 0802508.]*

Faculty Advisor: Dr. Candelaria, egines@mdc.edu

54

Comparing Levels of Yellow Expression in Two Species of the Drosophila dunni Subgroup in Relation to Abdominal Phenotypic Variation

Madeline Twiss, University of Notre Dame / Clarkson University, NY
Jeffrey Steimle and Hope Hollocher, University of Notre Dame

The Drosophila dunni subgroup of the Drosophila cardini group is endemic to Puerto Rico and the islands of the Lesser Antilles. This subgroup displays clinal interspecific variation in abdominal pigmentation phenotypes. One of the genes involved in the pigmentation pathway is yellow, which is involved in pattern specific melanin production in the adult fly cuticle, and has shown to have diversifying selection in the D. dunni subgroup, with variation in the amino acid sequences of the N-terminal signal peptide.

This study aims in identifying the important genetic mechanisms that underlie speciation events. The expression levels of yellow were measured in Drosophila arawakana and Drosophila nigrodunni. These two species are closely related but also phenotypically distinct, with D. arawakana being light and D. nigrodunni being the most pigmented in the dunni subgroup. It was hypothesized that there were no significant differences in the levels of yellow gene expression between the two species. The expression levels of yellow from stages 14 and 15 female pupae were measured using qRT-PCR techniques, with cytochrome oxidase subunit II used as a control. The CT values were normalized according to 2^{-DDC_T} method, and a Student's t-test was run to see if there are any significant differences that suggest either a pre-transcriptional or a post-translational modification.

Results showed that there is a significant difference in gene expression levels, therefore the expression levels are different, and selection is most likely acting on a genetic element such as transcription factors or binding sites. If the levels were the same, then that would lend support to the idea of selection likely acting on the N-terminal signal peptide coding sequence. Future work should include measuring the levels of yellow expression between both males and females, as well as measuring other insect pigmentation genes such as tan and ebony. *[Acknowledgement: The National Science Foundation and the 2011 Notre Dame REU in Biological Sciences]*

Faculty Advisor: Dr. Hope Hollocher, hope.hollocher.1@nd.edu

Geosciences and Earth Sciences

55
Fluorescence in Extremophiles

Hillari Howard, Delaware State University

Within this research project the fluorescence of extremophiles is being observed; that is the wavelengths of light absorbed and emitted by various genii and species of these microorganisms. Four psychrotolerant (thrives in low temperatures) species that were studied include: Trichococcus patagoniensis and Proteocatella sphenisci and two that have not been published. Eight alkaliphilic (high pH) mesophiles were also examined and include: Spirochaeta africana, Spirochaeta americana, Spirochaeta dissipatitropha, Desulfonatronum lacustrae, Desulfonatronum thiodismutans, Tindallia californiensis, Tindallia magadiensis, and Anaerovirgula multivorans. This research is critical to NASA's future research plans. The information derived from this project will be used to create a fluorescence database in order for NASA to search for life on other planets.

This particular research is the first to be done on these specific species. To conduct the experiment Richard Hoover sent the extremophiles to Delaware State University on dry ice. Specimens were thawed and vortexed prior to use. Then 5 l of pure culture were placed on a slide with water. With the help of a Lecia Confocal Microscope the slides were run under various wavelengths of light. As the slides were studied, pictures were continuously being taken of the cultures. The fluorescence peak for each species was compiled onto Igor, a program like Excel. From there graphs were constructed and comparisons made. It was found that most of the spectra are similar; sometimes having identical peaks.

Therefore, a majority of the species that were studied absorbed and emitted the same wavelengths of light. The total average of all studied species displayed no significant differences. The one spectra that differed from the others was from Anaerovirgula multivorans. Their spectra had the same peak as the other species (in the 450-550nm range), but they did not continue to fluoresce until 750nm like the others. Instead, the Anaerovirgula multivorans fluorescence ended at around 600-650nm wavelength. Future research includes NASA compiling the results of this project in conjunction with other research to design a fluorescence database. *[Acknowledgement: CREOSA, NSF, CREST]*

Faculty Advisor: Dr. Chandran Sabanayagam, chandrans@udel.edu

Materials Science

56
Value Added Processing of Agricultural Waste: Bio-Ethanol Production

Erica Lafrades, Shaw University
Dr. Christopher Njue, Shaw University

People are becoming more health conscious. This has led to a lot of people buying produce from their local farmers markets. The State Farmers Market in Raleigh, North Carolina caters to the city of Raleigh residents and residents of the surrounding areas. Every year, tons of produce waste are generated and this waste requires recycling in one form or another. The current recycling method involves conversion of this produce waste into compost that is then recycled into the farmlands. This processing option is becoming less and less attractive due to cost overruns. Our research involves development and optimization of cheaper and alternative process/ processes for taking this produce waste and converting it to high value added product(s). Our first project in this area involves developing methods for the production of bio-ethanol from waste plant sources. Results pertaining to the optimization of the bio-ethanol production methods and quality control procedures for bi-ethanol will be presented. Future directions for this project will involve a mobile bio-ethanol unit for community outreach and for K-12 demonstration projects. *[Acknowledgement: NSF SHAW University HBCU-UP NSF, "Targeted Infusion to develop bio-based technology capability among minority students at Shaw University."]*

Faculty Advisor: Dr. Christopher Njue, cnjue@shawu.edu

Microbiology/Immunology/Virology

57
Histological Survey of Encysted Muscle Parasites in Raptors from North Carolina

Samantha Barnes, Johnson C. Smith University
Kevon Stanford, Johnson C. Smith University, NC
David S. Lindsay, Virginia-Maryland Regional College of Veterinary Medicine, Virginia Tech
David Scott, Carolina Raptor Center, NC

Parasitic protozoans can cause fatal disease in birds of prey. Toxoplasma gondii, Sarcocystis falcatula, and S. neurona are protozoan parasites that develop in muscle and other tissues and can cause fatal encephalitis. Few studies have been conducted in the United States to determine how often these parasites infect raptors. For the present work, we initiated a histological investigation to examine muscle tissues from raptors for encysted protozoans. Heart and pectoral muscle samples were collected from 53 raptors in North Carolina. Raptorial

species included: 14 red-shouldered hawks, 12 barred owls, 7 red-tailed hawks, 7 Cooper's hawks, 4 great horned owls, 3 black vultures, 2 American kestrels, 1 eastern screech owl, 1 broad-winged hawk, 1 turkey vulture, and 1 Mississippi kite. Muscle tissues were preserved in 10% neutral buffered formalin and prepared for microscopic examination. Histological sections were examined by light microscopy. Parasitic tissue cysts were observed in cardiac muscles from 53 birds of prey. Results from histology will be compared to PCR analysis on the same muscle tissues for species identification of parasitic protozoa. This research will allow us to determine the diversity and prevalence of encysted muscle parasites infecting raptors in the United States. *[Acknowledgement: Smith Institute for Applied Research at Johnson C. Smith University, Charlotte, NC]*

Faculty Advisor: Dr. Alexa Rosypal, acrosypal@jcsu.edu

58
Characterizing Pathogenic B Cells that Cause Autoimmune Diabetes

Klondy Karina Canales, Johns Hopkins University School of Medicine / University of Washington
Abdel Rahim Hamad, Johns Hopkins School of Medicine

Type 1 Diabetes Mellitus (T1D) is caused by a permanent destruction of insulin-producing β-cells of the pancreas by autoreactive T cells. Despite advances in insulin therapy, patients often face serious cardiovascular and neurological complications. Since most patients are children and young adults, it is imperative to identify therapeutic targets to prevent the disease without causing generalized immunosuppression. Using autoimmune prone non-obese diabetic (NOD) mice (the widely used model of T1D) with spontaneous gene mutations in either Fas (lpr) or FasL (gld), we hypothesize the involvement of a specific population of B cells in the disease process. These B cells express Fas ligand (FasL), which is part of the pathway involved with T cell homeostasis. FasL expressed in these cells break immune tolerance in autoimmune prone NOD mice. Using flow cytometry B cell populations were characterized in spleen, pancreatic and inguinal lymph nodes, and in peritoneal cavity of NOD mice as well as in C57BL/6 and Balb/c mice. We detected FasL expressing B cells in the spleens of all three mouse strains tested (NOD, C57BL/6, and Balb/c), but higher levels were detected in NOD mice. In addition, gld/gld mice B cells did not up-regulate FasL, CD23, or CD86 like the NOD Wt mice which was illustrated by activation with LPS and anti-IgM. We looked for apoptosis among FasL+ B cells in the spleen of NOD, B6 and Balb/c and found higher annexin V levels in B6 and Balb/c than NOD, supporting the hypothesis that B cells in NOD mice, are pathogenic. *[Acknowledgement: NIH/NIAID 5-T32A1007247-29]*

Faculty Advisor: Dr. Abdel Rahim Hamad, ahamad@jhmi.edu

59
Microbial Contamination on Cellular Devices of Collegiate Students at Dillard University

Joshua Daye, Dillard University, New Orleans

Mobile phones are used for communication and they are in close contact with the faces of individuals. These devices can therefore serve as vectors for the transmission of microorganisms between individuals (Elkholy and Ewees, 2010). The purpose of this study was to evaluate the role of mobile phones in acting as vectors for the transfer of bacteria. The study was conducted using 43 cell phones of Dillard University students. The phones were swabbed using sterile cotton swabs and plated on 3 different types of media, Eosin Methylene Blue (EMB), Nutrient agar, Hektoen enteric to detect specific microbial growth. As a control, separate agar plates of each media did not contain bacteria. Numerous pink, dark purple, and metallic sheen colonies on EMB plates indicated the presence of Escherichia Coli and Enterobacter aerogenes. These suspected colonies were then subcultured into phenol red broth test using the sugars dextrose, mannitol, lactose, and sucrose. The results of the phenol red broth indicated the various bacteria, such as Shigella Flexnari, Salmonella typhymurium, Klebsiella pneumonia, E. Coli, and Enterococcus faecalis. Each sugar and phenol red broth without bacteria served as the control.

In the gram stain procedure, there was a mixture of gram negative rods and gram positive cocci. Gram negative bacteria are very important in causing nosocomial infections such as Gastro enteritis and Legionellosis. These diseases can occur as a result of touching phones while eating, rubbing eyes, touching the nose, and sharing these devices among each other without proper hand washing after use. This experiment shows that cell phones may serve as vehicles of transmission of communicable bacterial diseases. Future considerations include genetic analysis which will further confirm our results. *[Acknowledgement: Louisiana Alliance for Minority Participation]*

Faculty Advisor: Bernard Singleton, bsingleton@dillard.edu

60
Antiviral Activity of Gloverin Against the Budded Virus of Autographa Californica M Nucleopolyhedrovirus (AcMNPV)

Angelica Dulce, California State University Long Beach
Eric Haas-Stapleton, Ph.D., Daniela A. Moreno-Habel, and Peter Garcia, California State University

Gloverin is an immune-regulated protein expressed in Lepidoptera larvae such as Trichoplusia ni in response to bacteria and baculovirus infection. The anti-bacterial properties of gloverin are to inhibit outer membrane protein synthesis and

is also hypothesized to perforate the cell wall of bacteria. However, its role during viral infection is unknown. Our research shows that gloverin is also induced in T. ni larvae systemically infected with budded virus (BV) the baculovirus Autographa californica M nucleopolyhedrovirus (AcMNPV). To determine the role of gloverin during AcMNPV infection, two gloverin genes were cloned using mRNA isolated from AcMNPV-infected hemocytes isolated from T. ni larvae and tagged with 6x-His and V5 epitopes to facilitate protein isolation and detection. The supernatants from cultured Sf9 cells stably transfected with the two gloverin expression plasmids reduced the quantity of infectious AcMNPV BV to 26.6 % and 8.3 % of vehicle treated BV. We found that gloverin, purified using affinity chromatography, displays less antiviral activity than gloverin present in the supernatant of stably transfected cells. These results suggest that gloverin is antiviral against the BV of AcMNPV and that there may be additional factors that contribute to the antiviral properties of gloverin. The broader impacts of this research will be tested using other families of enveloped viruses. Future directions include identifying the biologically active regions of the protein by introducing mutations that truncate the protein and testing the resulting antiviral activity. *[Acknowledgement: This work was funded by grants from the US Department of Agriculture (2008-03990), the National Institutes of Health Research Initiative for Scientific Enhancement program (5R25GM071638) and by the National Science Foundation Louis Stokes Alliance for Minority Participation program (0802628).]*

Faculty Advisor: Dr Eric Haas-Stapleton, www.ehaas@csulb.edu

61

Engineering of a Dual Promoter Construct to Quantitatively Evaluate TCDD-Induced Immune Suppression in Primary Human B Cells

Marvin Harbour, Michigan State University

2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) is a halogenated aromatic hydrocarbon and a persistent environmental toxicant known to produce marked immunosuppression in virtually all animal species where it has been tested. Specifically in B cells, it impairs IgM secretion and B cell to plasma cell differentiation. In the cell, it is a high affinity ligand for the cytosolic aryl hydrocarbon receptor (AhR). Upon entry into the cell, TCDD forms a multiunit complex, translocates to the nucleus, and binds to dioxin response elements (DREs) in the regulatory regions of multiple genes such as cytochrome P450 1B1 (Cyp1B1), cytochrome P450 1A1, and IgH. In this study, we designed and are constructing two dual promoter plasmids that will allow for the unprecedented simultaneous measurement and correlation of TCDD:AhR to DRE binding with B cell functional parameters such as IgM production and B cell to plasma cell differentiation. This dual construct promoter will be inserted into B cells via a lenti viral system. The final plasmids will contain GFP under the control of the human B cell CD19 promoter and either a luciferase or a RFP under the control of a shortened human Cyp1B1promoter (with five DREs), and a woodchuck hepatitis virus posttranscriptional regulatory element (WPRE), which increases the stability of mRNA. Thus far, the GC-rich CYP1B1-promoter has been amplified using betaine with "Slowdown" PCR while WPRE was amplified using a standard PCR protocol. These two cassettes were transferred 5' and 3', respectively, of luciferase in a reporter plasmid. Subsequently, the Cyp1B1-luciferase-WPRE cassette was amplified and ligated behind the CD19-GFP in a lentiviral transfection system host plasmid generating the dual reporter construct, pLexDC-L. Further work will exchange the luciferase cassette in pLexDC-L with an RFP cassette making pLexDC-R. *[Acknowledgement: This work is supported in part by NIH ES002520 and 5R25HL103156]*

Faculty Advisor: Norbert Kaminski, Schuyler Pike, kamins11@msu.edu, skypike@msu.edu

62

Production of Sclerotium Folfsii Sclerotia in the Laboratory and Antimicrobial Activity of the Sclerotial Extracts

Isis Holloway, Alabama A&M University

Sclerotium rolfsii is a soil-borne fungus that causes disease on a wide range of plants and agricultural crops. It is known to produce sclerotial exudates which are thought to help the fungus survive. Analyzing sclerotial extracts (SCE) for anti-microbial activity for use as biopesticide is of much interest. S. rolfsii grows best under warm moist conditions which are conducive for infection of host vegetables such as tomato. When the pathogen attacks its host, a mass of mycelia is produced on the surface. Penetration occurs when the pathogen releases an enzyme that obliterates the host's outer cell layer leading to tissue decay and subsequent production of sclerotia. This research involved producing sclerotia under laboratory conditions and testing their extracts for fungal and bacterial growth inhibition. The objective of the research was to evaluate different media for sclerotia production and determine antimicrobial activity on various plant pathogenic fungi and bacteria in culture. S. rolfsii was isolated from a rotted stem of tomato and cultured on potato dextrose agar (PDA). Pure cultures were grown on V8 agar, oatmeal agar, cornmeal agar, 2% water agar and PDA. Furthermore, sclerotial extracts were tested on other pathogens, namely, Leptosphaeria maculans, Alternaria solani, Erwinia amylovora and Xanthomonas campestris. More sclerotia formed in PDA than in V8 juice, oatmeal, cornmeal and water agar. Although sclerotial extracts did not affect the growth of A. solani, they reduced the growth of L. maculans and completely inhibited the growth of E. amylovora and X. campestris. These results suggest that S. rolfsii sclerotial extracts have considerable antimicrobial activity against some plant pathogenic fungi and bacteria. *[Acknowledgement: HBCU-UP]*

Faculty Advisor: Leopold Nyochembeng, leopold.nyochembeng@aamu.edu

63

The Effects of EUK 134 and Aging on CD4 and CD8 T Cell Production

Brennon Luster, University of Arkansas at Pine Bluff
Derek Walker, Brandon Banks, Ginny Lewis, Ph.D., and Jeannine Durdik, Ph.D. University of Arkansas

The older population among humans is increasing at an unprecedented rate. With recent advances in medical technology and better nutrition, people are living longer than ever, especially in developed countries where the life expectancy has nearly doubled from 45 in 1900 to 80 in 2000. To provide adequate health care for the elderly, scientific study of the medical aspects of the aging process is necessary. We wanted to determine the effects of EUK 134 and aging on CD4 and CD8 T cell production because we hypothesize that if lymphocytes could be preserved longer post activation, more would be able to transform into memory cells and confer lasting immunity. Furthermore, we wanted to determine how EUK 134 alters the level of apoptosis found in activated cells. For this study we used aged mice- C57Black/6J mice at approximately 2 years of age and injected the mice intraperitoneally everyday for fourteen days, euthanized the animal on day 15 and harvested the thymus. Thymic single-cell suspensions were made and the cells were counted using an automated cell counter and stained with CD4-PE, CD8-PE/Cyc, and Thy1-APC then analyzed by flow cytometry. The results suggest the compound EUK 134, a mimic of catalase and SOD (superoxide dismutase) activity, decreased the levels of apoptosis in the thymus cells during differentiation. This remains promising as the results show the number of cells increased in aged EUK treated mice. Therefore, we believe the immune responses are augmented in EUK treated mice. This increase will allow new responses to new antigens upon infection or upon vaccination. Also, this would increase quality of life, along with a decrease in morbidity and mortality from infectious disease observed in aged individuals. *[Acknowledgement: This study was supported, in part, by a grant from the National Science Foundation REU in Cell and Molecular Biology to Dr. Jeannine Durdik, University of Arkansas, Fayetteville, AR 72701.]*

Faculty Advisor: Dr. Jeannine Durdik, jdurdik@uark.edu

64

An Investigation of Bacteria in Louisiana Oysters from the Area of the BP Oil Spill and from an Area in Texas

Breanna Ryan, Dillard University
Robinette Love, Dillard University, LA

Raw oysters have proven to be a favorite. This poses a potential hazard for the consumer because it is a breeding ground for food borne pathogenic microorganisms. The British Petroleum (BP) Oil Spill has raised concerns about Louisiana seafood.

The purpose of this study was to compare the difference in the types of microbes found in the TX and the LA oysters. The Louisiana oysters were caught out of the Houma Bayou while the Texas were out of the San Antonio Bay. The LA and TX oysters were shucked and then cultured on Eosin Methylene Blue (EMB) and Nutrient agar plates. The plates were incubated for 48 hours. The LA oysters had the most growth. The Colonies grew on the EMB plates were pink or dark purple. This indicated the presence of fermenting bacteria. To further identify the type of bacteria from some colonies they were sub-cultured into Phenol Red Broth tubes with simple sugars in them.

The results showed in some sugar tubes a drop in the pH below 6.8. Gas bubbles in the durham tube was also present indicating gas production as a result of fermentation. Other broths indicated a rise in the pH above 7.4. Gram-stain was performed on microbes from the EMB plates; results showed gram-negative rods. These preliminary results indicated the presence of E. coli in some the oyster samples from LA and TX. The future considerations for this research include confirming the identity of the types of bacteria found on the agar plates by DNA analysis. *[Acknowledgement: This study was supported by the NSF/LSAMP Program Awarded to Abdalla Darwish, Ph.D., Coordinator/Campus Director at Dillard University, New Orleans, LA 70122.]*

Faculty Advisor: Dr. Singleton, bsingleton@dillard.edu

65

Immunization Against Mycobacterium Tuberculosis Using a Nanoparticle Vaccine Platform

Cynthia Wainaina, University of Washington
Crystal Dinh, Natalie Miller, Albanus Moguche, Shahin Shafiani, Hong Shen, and Kevin Urdahl, University of Washington and Seattle Biomedical Research Institute

Despite widespread global immunization with the current tuberculosis (TB) vaccine, BCG, TB remains a big problem, killing almost 2 million people every year. In addition, because BCG is a live vaccine it is unsafe to give to immunocompromised individuals, especially those with AIDS. Therefore, a new and effective vaccine that is safer is urgently needed. Here we test nanoparticles blended with polymers, designed to stimulate CD4 and CD8 T cells, as a delivery system for a TB vaccine.

Nanoparticles coated with M. tuberculosis epitopes recognized by both CD4 and CD8 T cells were used to immunize mice either subcutaneously or intranasally. T cell responses were detected in immunized mice using both MHC class I and II tetramers, and

also by intracellular cytokine staining. Immunized mice, or unimmunized controls, were then challenged with M. tuberculosis via the aerosol route. Mice immunized with the nanoparticles displayed robust T cell responses in the lung and controlled Mtb infection with a lower bacterial burden. Future studies are needed to further optimize protection provided by the nanoparticle vaccine platform. *[Acknowledgement: This study was supported, in part, by a grant from the Paul G. Allen Family Foundation awarded to Dr. Kevin Urdahl, MD, PhD, Affiliate Assistant Professor of Immunology, University of Washington, Assistant Member, Seattle Biomedical Research Institute; Cynthia Wainaina was supported by a stipend from University of Washington Genome Training Grant.]*

Faculty Advisor: Kevin Urdahl, kevin.urdahl@seattlebiomed.org

66
Purification of the COP9 Signalosome via Streptavidin-Binding Peptide

Phillip Webster, San Diego State University
Aleksander Stotland, Roland Wolkowicz, and Laura Pruitt, San Diego State University

The Human Immunodeficiency Virus-1 (HIV-1) must alter intracellular processes of its host cell by using its own proteins to interact directly or indirectly with host proteins for efficient infection. Our lab has implicated one of the subunits of the COP9 Signalosome (CSN) as possibly playing a role in the viral life cycle. In order to study the protein-protein interactions during infection, we utilized streptavidin-binding peptide tag (SBP) to purify the entire CSN through one of its subunits. Previous studies have demonstrated that CSN can be purified via subunit 1 (CSN 1). Using this strategy we fused the SBP to the N-terminus of CSN1 and, as a control GFP, and introduced it into the retroviral vector pBMN.i.mcherry. Retroviruses produced by the construct were used to infect SupT1 cells, and the infected cells were sorted on the basis of fluorescence. Proteins bound to CSN were purified using magnetic streptavidin beads, followed by western blot analysis with an SBP-GFP eluate as the negative control and SBP-CSN1 as our experimental sample. Western blot analysis of proteins recovered from SupT1 cells expressing SBP-GFP or SBP-CSN1 showed full recovery of CSN subunits. There was also successful recovery of Cullin 4a, an integral member of the E3 ubiquitin ligase complex, regulated by CSN. Interestingly, the SBP-CSN1 SupT1 cells appeared to be more susceptible to infection by HIV-1 as determined by GFP expression following infection with non-replicative HIV-1. Recovery of the COP9 Signalosome subunits and bound protein Cullin 4a affirms the success of purification via SBP. Furthermore, FACS data of the SupT1 SBP-CSN1 cells implies a possible role of CSN1 in successful infection by HIV-1.

Future studies include performing the protein pull-down of CSN in the presence of HIV-1 or its proteins, either by infecting cells with high titer non-replicative virus or co-transfecting the proteome of HIV-1 into 293-T cells along with SBP-CSN1 or SBP-GFP. This will allow us to determine the viral proteins that bind the CSN during infection, or detect the absence or presence of proteins whose interaction with the CSN is affected by HIV-1. *[Acknowledgement: This study was supported by Dr. Roland Wolkowicz., Associate Professor, SDSU, San Diego, CA (California HIV/AIDS Research Program (CHRP)) and NSF to Phillip Webster (#0802628).]*

Faculty Advisor: Roland Wolkowicz, roland@sciences.sdsu.edu

Physiology and Health

67
Synthesizing Carotenoid Pathway in Yellow Wonder

Angela Clark, Fort Valley State University

Blindness affects more than 22 million people by age 40 and older. The dietary intake of provitamin A carotenoids is related to lower prevalence of age-related blindness. The two major pigments in carotenoid, lutein and zeaxanthin, are very powerful antioxidants that provide protection against light-induced oxidative damage, giving the eyes an additional long-term protection. By accumulating a diet rich in carotenoids, we could decrease cataract or macular degeneration, which ultimately causes blindness. Carotenoids are also linked to other health benefits including cancer prevention, boosting the immune system, and reducing asthma. However, humans are unable to synthesize carotenoids so they have to rely on their diet for it.

The aim of this project is to enhance the carotenoid content in Rosaceae crops. This would increase the nutritional value of these fruits which are consumed worldwide and are readily available. Since carotenoids are synthesized using multiple enzymes, we aim to carry out multistep engineering. Analysis of the expression of genes involved in the carotenoid biosynthetic pathway revealed the genes that do not express in the fruit tissues. In conclusion, we will have to engineer the missing carotenoid biosynthesis genes in fruit tissues to increase the carotenoid production in Rosaceae fruits. In order to ingress the cloned genes in strawberry, we utilized an efficient strawberry regeneration and transformation system established in the WSU Genomics laboratory. These cloned genes will be integrated in strawberry via Agrobacterium and biolistic methods. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

68
The Search for RAGE (AGER) in Avians

Farid Eythrib, University of Arizona, Tucson

AGEs, advanced glycation end-products, are the products of a non-enzymatic reaction between serum albumin and glucose that occurs in the blood stream as the first stage of glycation. RAGE, receptor for advanced glycation end-products, is a transmembrane protein which binds AGEs. RAGE was first characterized as a member of an immunoglobulin protein family (Neeper et al. 1992). When AGEs bind to RAGE, it initiates an inflammatory response. Although this is most likely a natural immune response, in diseases that result in high levels of AGEs in the blood, such as diabetes, the inflammation caused by over-activation of RAGE can cause damage to the vasculature by altering the microenvironment of the basal membrane. This creates what can be described as 'leaky' vasculature (edema), which can be detrimental to patients suffering from diabetes. This effect has been linked with gangrene in the lower appendages of diabetics, promoting Alzheimer's and supporting the spread of pancreatic cancer.

The mourning dove, which has a blood glucose level 4-5 times higher than that of a fasting diabetic human, does not suffer from these RAGE-related symptoms. It was hypothesized that avians may not express the RAGE protein; however, early SDS-Page electrophoresis and Western Blots have identified the likely presence of RAGE in mourning dove vasculature when treated with a RAGE-specific antibody derived from rabbits. The western blot technique will be improved to show a more definitive presence of RAGE in avian vasculature. If the presence of RAGE is confirmed, the protein will be sequenced and compared to other mammalian (including human) RAGE protein sequences to identify possible differences in the protein structure. *[Acknowledgement: WAESO LSAMP]*

Faculty Advisor: Eldon Braun, ejbraun@u.arizona.edu

69
Automated External Defibrillators: Public Awareness of Use and Safety

Ariel C. Harrison, Southern University A & M College
Troy Dawley, Steven Maher, Dr. Kimberly Fulda, and Dr. Michael L. Smith, University of North Texas Health Science Center

Cardiovascular Disease is a leading cause of death for adults over the age of forty. Cardiac arrest is the cause of the majority of sudden deaths of individuals who are not admitted into the hospital. Cardiac arrest is provoked when the heart's electrical system fails in some way resulting in ventricular fibrillation (VF) and, for which, defibrillation is the only intervention that can save the life. Automated External Defibrillators (AEDs) are small and portable devices containing electronic circuitry that systematically diagnose and treat VF when applied to a patient. These devices are very safe and accurate in detecting serious heart rhythms and sending shocks only when appropriate. Thus, they can be life-saving.

Recently, AEDs have been placed in many public locations throughout communities nationwide. Despite the increased placement of AEDs in many public places, we hypothesize that the public awareness of AEDs, and the ease of use and safety of use is lacking. Therefore, the purpose of this proposal was to survey the general public on their knowledge of the use of an AED. A simple survey instrument was developed for this purpose and was administered to students, faculty and staff at UNTHSC and at 2 locations in the general public.

Preliminary findings from students, faculty and staff at a health science center revealed that 1) 90-95% of respondents know what an AED is and 2) 68-74% think they could use an AED. However, >56% responded that they would be afraid of misusing an AED if the situation arose.

Based on these preliminary findings, we observed that the majority of people working in a health science environment know what an AED is and could use one, but despite this knowledge, greater than half fear misusing it. This ongoing study supports the premise that the general public's knowledge of the use and safety of AEDs is sub-standard. *[Acknowledgement: Funded by the U.S. Department of Education, McNAIR grant P217A030039.]*

Faculty Advisor: Dr. Wesley Gray, dr1wggray@aol.com

70
Preparation and Characterization of Liposomal Form of Prostaglandin E2 for Treatment of Pulmonary Fibrosis

Lauren Henderson, Oakwood University

Pulmonary fibrosis is a fatal disease that does not have any FDA approved treatment and can be induced by the drug bleomycin. Research studies have shown that liposomes are an instrumental form of drug delivery because of their physical characteristics of hydrophilic and hydrophobic phospholipid bilayers making them an ideal candidate for drug delivery by inserting drugs into their hydrophobic membrane or hydrophilic core. Studies have proven that Prostaglandin E2 (PGE2) limits fibroblast proliferation and collagen secretion and shows that pulmonary fibrosis prevents PGE2 from effectively working.

We hypothesize that delivery of exogenous PGE2 into the lungs infected with lung fibrosis will limit the progression of the disease preventing high mortality from pulmonary fibrosis. In this experiment, the cytotoxicity of A549 cells with bleomycin was studied and found that the appropriate dosage of

bleomycin to administer to the SKH1-hr hairless mice to induce pulmonary fibrosis was .75microliters and then the histopathological analysis of the organs displayed the effects of bleomycin. The QRT-PCR will then display the gene expression. The genotoxicity of liposomes will show the genetic damage of Prostaglandin E. to the liposomes. Survival rate increased after administration of treatment proving that PGE2 does indeed limit or inhibit the development of pulmonary fibrosis. For future study, once the liposomes with the drug are characterized and prepared, various tests will be run to show the effectiveness of treatment of pulmonary fibrosis using an aerosol formulation of liposomal prostaglandin E delivered by inhalation. *[Acknowledgement: Howard Hughes Medical Institution]*

Faculty Advisor: Kenneth Lai Hing, klaihing@gmail.com

71
Periaortic Fat in Older Adults at High Cardiovascular Risk

Racheal Kennedy, Johnson C. Smith University
Dr. Tina Brinkley, Wake Forest University School of Medicine

For years, researchers have studied and placed their attention on the effects of abdominal/visceral fat on the overall health of an individual. However, in recent studies it was discovered that the location of the fat may be more important than the total amount of fat. Specifically, the study examined the relationship between higher body mass (BMI) and the increase of fat in the cardiovascular system. The overall purpose of the study was to test the relationship between preexisting cardiovascular conditions and the potential chance of a life-threatening cardiac event.

Subjects with predispositions (hypertension, diabetes and/or coronary artery disease) were deemed eligible for the study. From the potential participant pool, 100 individuals ranging from 55-90 years of age were randomly selected. Participants were asked to undergo procedures including a MRI scan and a stress test to see if these procedures could give information that could predict the occurrence of these types of diseases in other elderly patients. Participants were excluded from the study if they could not participate in the cardiovascular magnetic resonance (CMR) stress testing.

Data were collected on age, race, height, weight, smoking habits, blood pressure, and heart rate. MRI scans were used to obtain actual images of each participant's midsection. For each subject, the amount of periaortic fat that developed around the descending aorta was determined.

Through this study, it was concluded that periaortic fat is highly variable in older adults at high cardiovascular risk; and high periaortic fat volume is associated with older age and higher BMI and blood pressure. Future studies should determine whether periaortic fat contributes to the development of cardiovascular disease. *[Acknowledgement: NSF-funded Historically Black Colleges and Universities Undergraduate Program at Johnson C. Smith University.]*

Faculty Advisor: Dr. Tina Brinkley, mwinters@jcsu.edu

72
PLGA Coil Promotes Endothelial Cell Ingrowth in Vascular Repair of Aneurysms

Marcel Lindsey, University of the Virgin Islands

Brain aneurysms are weaknesses in the walls of arteries causing swelling or bleeding into the tissues of the brain (subarachnoid hemorrhage).The occurrence of subarachnoid hemorrhages usually leads to a high mortality rate in patients due to the severe brain damage caused by loss of blood in the brain. The main techniques used to prevent re-bleeding in subarachnoid hemorrhages are through endovascular coiling or surgical clipping, however it has been studied and investigated that endovascular coiling of ruptured aneurysms in the brain leads to better results than surgical clipping. The risk of death or substantial disability has been mentioned to have a higher rate in clipping than in coiling in several studies (Johnston). A specific study done by ISAT claimed that at one year patients treated with endovascular coiling was 22.6 percent lower than patients treated with surgical clipping (Johnston). Based on these results, this research hoped to identify a protein compound to be used in coiling that will significantly support vascular repair of aneurysms.

In finding an effective biodegradable protein to use in the hopes of supporting cerebral aneurysms, a Bradford protein assay was used to measure the concentration of the MCP-1 protein. In conducting the protein assay, the essential observation desired is that the reaction between the reagent dye and the protein of interest will shift or increase the absorbance of a particular wavelength. In testing the protein release rate of MCP-1, the most quantifiable results correlated to the similarity of the bare coil concentration and the MCP-1 coil.

Results in this experiment reveal that there is no significant difference between the release rate of bare coil and MCP-1 infused coil. We expected that the coil coated with MCP-1 would show a linear tread of concentration vs. time and bare coil would show little to no concentration of protein release. Due to the possibility of contamination or altercation of coils, results disclose no relevant conclusions to make about the usage of MCP-1 in the production of coils to be used in endovascular procedure. Our experiments are currently under revision and in studying this material, future research is to be conducted to properly replicate in coil using specific protein concentrations. *[Acknowledgement: HHMI]*

Faculty Advisor: Dr. Brian Hoh, brian.hoh@uf.edu

73
The Effect of Sympathetic Innervation on Cardiomocyte Maturation and Cell Size in Neonatal Rat Pups

Chika Okafor, Brandeis University / Florida Agricultural & Mechanical University

In the United States, cardiovascular disease is the leading cause of death, accounting for 25% of deaths in 2007. In 2006, nearly 2300 Americans died daily of cardiovascular disease. Cardiovascular illness is also the most prevalent congenital ailment. There is a noticeable difference in innervation of healthy heart tissue and heart tissue in a diseased state, suggesting the effects of the sympathetic nervous system is of great importance.

Prior to birth, cardiomyocytes undergo hyperplasic growth. Shortly after birth, cardiomyocytes withdraw from the cell cycle and continue to grow via hypertrophy. Cardiomyocytes grow via two pathways of hypertrophy: pathological and physiological. Physiological hypertrophy occurs under normal conditions of bodily stress such as pregnancy and exercise. Pathological hypertrophy occurs after heart illnesses. Understanding the mechanisms underlying the maturation of cardiomyocytes before exiting the cell cycle may lead to a form of chemotherapy to revert pathologically hypertrophic cells back to the cell cycle.

In this work, we aim to determine the developmental characteristics of neuronal and cardiomyocyte maturation in a coculture system. Previous work has shown that sympathetic neurons halt the increase of hypertrophic growth, acting, at least in part, via noradrenergic signaling. We then asked whether these sympathetic neurons play a corresponding role in the control of the withdrawal of cardiomyocytes from the cell cycle. Cardiomyocytes were grown in the presence or absence of neurons and some were treated with the beta adrenergic antagonist propranalol for 2 to 6 days. We showed that cardiomyocytes withdraw from the cell cycle along a similar time frame as that seen in vivo. We also demonstrated that sympathetic neurons may play a role in regulating the dynamics of cardiomyocyte cell cycle withdrawal and that there may be a role for beta adrenergic signaling. This suggests that the sympathetic nervous system is a key regulator of the developmental switch from cardiomyocyte growth via hyperplasia to hypertrophy. *[Acknowledgement: NSF grant DBI-1062136 for the REU site: Cell and Molecular Visualization at Brandeis University.]*

Faculty Advisor: Susan Birren, birren@brandeis.edu

74
TCDD Treatment Enhances Markers of Activation in LX-2 Human Hepatic Stellate Cells

Jalisa Robinson, Boise State University

Wendy Harvey and Kristen Mitchell, Department of Biological Sciences, Boise State University

2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) is an environmental pollutant that has been shown to modulate vitamin A metabolism and decrease vitamin A storage in the liver; vitamin A is involved in several important processes in the body, including vision, gene transcription, and immune function. Hepatic stellate cells (HSCs) are nonparenchymal cells in the liver that store the majority of vitamin A in the body. When these cells are activated during inflammation or liver disease, they lose the ability to store vitamin A and transition into a myofibroblast phenotype, characterized by expression of α-smooth muscle actin (α-SMA), secretion of cytokines and growth factors, and production of collagen type I. In this study, we used immortalized human HSCs (LX-2 cells) to test the hypothesis that exposure to TCDD directly activates HSCs, with the long-term goal of understanding how TCDD treatment dysregulates vitamin A metabolism. LX-2 cells were treated with 10 nM TCDD or vehicle (DMSO) for 0, 4, 24, and 48 hours. Expression of α-SMA was measured by confocal microscopy, and production of the chemokine monocyte chemoattractant protein (MCP)-1 was measured by ELISA. Results indicate that TCDD treatment increased α-SMA expression in LX-2 cells and elicited a two-fold increase in MCP-1 production after 24 hours in culture. These novel findings indicate that HSCs may be directly targeted by TCDD treatment. Future studies will investigate the causal relationship between HSC activation and altered vitamin A metabolism in TCDD-treated cells. *[Acknowledgement: This project was funded by the NIH grant P20RR016454 from the INBRE Program of NCRR and the NIH grant R15DK088749 from the NIDDK-Grant HRD-0901996 from the Louis Stokes Alliance for Minority Participation.]*

Faculty Advisor: Dr. Kristen Mitchell, kristenmitchell@boisestate.edu

75
Assesing Mercury Exposure Among WIC Participants on the Flathead Indian Reservation, MT

Trey Saddler, Salish Kootenai College

The main route of exposure to mercury is as methylmercury through consumption of fish. Methylmercury has been linked to neurodevelopmental deficits in young children and children exposed in-utero, as well as cardiovascular disease in adults. Previous studies of lake trout from Flathead Lake, Montana, have shown elevated levels of methylmercury, resulting in updated fish consumption guidelines. Thousands of lake trout are donated to reservation food banks through the “Mack Days” fishing tournaments. Pregnant women, women who may become pregnant, women who are nursing and young children are the most sensitive to mercury’s negative neurodevelopmental effects. Participants in the Women, Infant

and Children program (WIC), receive free fish from the food banks, which may include these lake trout. A previous survey of local Native women in the WIC program showed that approximately 50% eat fish, but that the majority were not aware of any potential adverse effects of mercury or of any fish consumption advisories. However, dietary surveys are frequently inaccurate, therefore, a follow-up with actual hair mercury analysis was necessary to determine if any of these participants are at an elevated risk from excessive methylmercury exposure. Hair samples were collected on various days and at multiple food bank locations on the reservation. Mercury levels were determined in samples of 20-25 mg of hair, 3 cm of length, representing a 3-month integrated exposure, using EPA method 7473.

Preliminary results demonstrate that the hair levels in ~90% of the participants sampled were below the national average of 200 ppb mercury, indicative of one or fewer fish portions per month. None were above the 1000 ppb threshold of concern. This shows that although women in the program are offered free fish from the local Mack Days event, many do not take advantage of this resource. Explanations for low fish consumption will be determined after further review of the surveys. The preliminary results of the data suggest that lack of dietary omega-3 oils from not eating enough fish may pose a greater risk than the deleterious effects of mercury from eating too much fish. *[Acknowledgement: NIGMS RISE Program, NIH Award R25-GM076323; Montana INBRE Program, NIH Award 20 -RR016455.]*

Faculty Advisor: Doug Stevens, doug_stevens@skc.edu

76
Low-Level Fructose Diet Reduces Mouse Health in Organismal Performance Assays

Mirtha Sosa, University of Utah
Sara Hugentobler, Ruth E. Tanner, James S. Ruff, and Wayne Potts, University of Utah

Due to the insensitivity of current animal models for safety and toxicity assessment suspected toxicants are administered at levels dramatically higher than those normally experienced by people. To address this problem we have developed an assay which we call the Organismal Performance Assay (OPA), this approach allows mice to compete for mates and resources in a semi-natural environment. Due to the intense nature of this competition, differences in performance between experimental and control mice become quantifiable. To highlight the sensitivity of this assay, we present data demonstrating profound degradation of health due to a level of fructose exposure currently considered safe and experienced by 20% of Americans. In order to evaluate the health impacts of dietary fructose, we conducted an OPA assessment of mice fed either 25% High Fructose Corn Syrup (HFCS) or a diet free of refined sugars. OPAs revealed that female mice on the HFCS diet experienced a 3-fold increase in mortality compared to females raised on sugar-free diets. Males on the sugar-free diet obtain social dominance at 4-times the rate and produce 50% more offspring than males fed HFCS.

These results suggest that incorporating moderate levels of fructose in a mammalian diet adversely impacts health and performance by increasing mortality and decreasing fitness. These data now represent the lowest observed adverse effect level (LOAEL) for added sugar at 25% of calories. To further investigate impacts of dietary fructose, OPA assessment of the two most common forms of fructose (HFCS vs. Sucrose) were conducted to determine if these two sources have differential health impacts. In this assessment mice were fed either 25% sucrose or 25% HFCS, and it was revealed that the females fed HFCS still experienced a 3-fold increase in mortality compared to the sucrose fed females, however no difference in male performance was observed. Our OPA methodology can be implemented for almost any treatment that is suspected of degrading mammalian health, such as food additives and environmental contaminants. Currently we are implementing OPAs to evaluate the safety of pharmaceuticals.
[Acknowledgement: M.S. was supported by the Western Alliance to Expand Student Opportunities (WAESO) and the Louis Stokes Alliances for Minority Participation.]

Faculty Advisor: Wayne Potts, potts@biology.utah.edu

Plant Research

77
Molecular Phylogeny of a Rare New Zealand Species of Lepidium (Brassicaceae)

Nadya Ali, University of Washington, Seattle

Endemic to New Zealand, Lepidium sisymbroides, L. tenuicaule, and L. naufragorum are the three species used in this study. The goal of this project was to understand the phylogenetic placement of these relatives of the model plant Arabidopsis thaliana, including the only dioecious member of the Brassicaceae (L. sisymbrioides), and its close hermaphroditic relatives, L. tenuicaule and L naufragorum.

An additional goal was to test whether these endangered New Zealand species belong to a monophyletic group. For that purpose we sequenced an intron of the floral transcription factor PISTILLATA (PI), a gene responsible for making petals and stamens. We used the intron to build a molecular phylogeny that places the three species studied within the larger Lepidium phylogeny as a first step towards understanding the evolution of dioecy in this flowering plant. Sequences were aligned and a phylogenetic tree was obtained using other published Lepidium species as an out-group. These results will advance the study of

the evolution of separate sexes from hermaphroditism in plants, while making use of the tools available in the related model system. *[Acknowledgement: University of Washington, Seattle Biology Department. The University of Washington GenOM Project (NIH P50HG02360-09).]*

Faculty Advisor: Veronica Di Stilio, distilio@u.washington.edu

78

Valeria Regeneration and Agrobacterium-mediated Genetic Transformation

India Brown, Fort Valley State University

Valeriana officinalis is a perennial, flowering herbal plant native to Europe and parts of Asia. It is a medicinal plant used as a muscle relaxer for anxiety relief, as well as, a sleep aid. Due to its variations, poor seed production and germination, and traditional breeding effects on cost and time, plant tissue culture and genetic engineering techniques are the only way to produce large scale homogeneous plants with high yields of Valerian.

The goal of this work was to establish a simple one step method for the plant regeneration using nodes as explants and transient gene expression system using *Agrobacterium tumefaciens* into different explants from which the whole transgenic plants can be regenerated. Leaf explants from one-month-old *in-vitro*-grown plants were infected by *A. tumefaciens* carrying a binary vector that harbors a β-glucuronidase (GUS) and Neomycin Phosphotransferase (nptII) genes. The infected leaf explants were incubated for three days before they were subjected to GUS histochemical assay. The transformability was determined as the percentage of leaf explants expressing the GUS gene and as the intensity of gene expression (blue color). Several parameters including different concentrations of acetosyringone during co-cultivation, the length of the pre-culture period of explants prior to infection, co-cultivation period, different bacterial density (OD) and duration of immersion periods were tested.

The results based on transient GUS gene expression of explants suggested that one-month-old leaf explants inoculated for 60 minutes with 0.4 OD and 150 μm acetosyringone and co-cultivated for 3-4 days in MS medium with 2, 4-D showed 80-90% transformation efficiency. To our knowledge, this is the first report of Valeria susceptibility to *A. tumefaciens*-mediated genetic transformation. This procedure will allow us to introduce relevant genes in order to control of the synthesis of secondary metabolite through metabolic engineering. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

79

Somatic Embryogenesis and Genetic Transformation of Stevia via Bombardment

Mariah Christian, Fort Valley State University

Stevia rebaudiana is a perennial shrub and is known to be a "no calorie" sweetener, 30 times sweeter than sugar. The objectives of this study were to develop the effective protocol for plant regeneration via somatic embryogenesis and to introduce β-glucuronidase (GUS) or Green Fluorescent Protein (GFP) genes to evaluate stable gene expression using microprojectile bombardment. Callus was initiated from leaf explant of young plant on Murashige and Skoog's medium (MS) supplemented with 2, 4-dichlorophenoxyacetic acid (2, 4-D) 1.0 mg l^{-1}, + BAP (0.2mg/l) + TDZ (0.2mg/l), 3% sucrose and 0.9% agar. The calli showed differentiation of globular structure embryos when transferred to MS medium containing 2, 4-D and BAP. The maximum globular structure embryos were further enlarged and produced somatic embryos in MS basal medium supplemented with BAP + NAA. Continued formation of globular embryo and germination of embryos occurred in this medium. Complete plantlets were transferred to the garden soil with more than 85% survival rate. To optimize the condition for gene expression, leaf segments and embryogenic calli were bombarded with 1.0 μM gold particle coated with a plasmid DNA vector containing a GUS or GFP reporter gene fused to 35S constitutive gene promoter at various levels of acceleration pressure (450-1800 psi). Bombardments with DNA produced tissue sectors expressing GFP that could be visually selected under the fluorescence microscope over multiple subcultures.

An average of 10 to 12% leaf segments and young embryogenic callus tissue expressed transient GUS or GFP gene expression at 1100 psi with a 6 cm distance from stopping screen to target tissue using gold particles. Leaf and embryogenic tissues bombarded with a GUS or GFP gene were sub-cultured on embryo induction medium. Embryos at various developmental stages (globular, heart and torpedo shaped) expressing GUS or GFP genes were being recovered. Furthermore, this method should allow the development of assays for the transient and homogeneous expression of promoters of various genes in *S. rebaudiana*. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

80
Arabidopsis plc Mutants Exhibit Novel Phenotypes During Abiotic Stress

Konstantin Divilov, North Carolina State University / Hunter College, NY

The phosphoinositide signaling pathway is important in plant responses to abiotic stress, (e.g. salinity, extreme temperature, and drought). In response to a signal, phospholipase C (PLC) hydrolyzes the membrane lipid phosphatidylinositol 4,5-bisphosphate (PtdIns(4,5)P2) to produce the second messengers inositol 1,4,5-trisphosphate (InsP3) and diacylglycerol. Arabidopsis thaliana contains seven active isoforms of PLC and expression of AtPLC genes is upregulated by abiotic stresses. To investigate how changing the flux of InsP3 affects plant growth and stress responses we compared T-DNA insertional mutants of AtPLC1 and AtPLC7 as well as a transgenic plant line expressing the mammalian type I inositol polyphosphate 5-phosphatase (InsP 5-ptase). This enzyme hydrolyzes InsP3 to InsP2, inhibiting the downstream effects of InsP3-mediated signaling.

Earlier experiments showed that InsP 5-ptase plants have greatly reduced levels of InsP3 and are drought tolerant when compared with wild type plants. For salt stress responses, plc1 and plc7 mutant seedlings were exposed to different concentrations of salt and root growth was monitored. For drought treatment, six week old plants were deprived of water for nine days, the relative water content was measured and expression of drought-inducible genes was monitored using RT-PCR and qPCR. Both plc1and (to a lesser extent) plc7 mutants showed inhibited root growth and an increased sensitivity to salt stress compared to the wild type. However, only plc1 mutants showed increased drought tolerance, similar to the InsP 5ptase plants, while wild type and plc7 mutants exhibited wilting and increased expression of drought-inducible genes.

Additionally, InsP3 levels were reduced more dramatically in plc1 compared with plc7, and phenotypic analysis revealed abnormal leaf development and increased root hair growth in plc1. These results suggest that AtPLC1 plays a greater role in growth and development than AtPLC7 and highlight important functional differences between the AtPLC isoforms in stress responses. Future research will further delineate the roles of AtPLC1 and AtPLC7 by determining their threshold for salt and tolerance to extreme temperature. The knowledge will aid in the development of crops that have innate tolerance to abiotic stress, thereby preserving yield under adverse conditions.
[*Acknowledgement: This work was funded by the NSF Synthetic Biology REU program (Grant 0754010) and by NSF Grant MCB 0718452.]*

Faculty Advisor: Imara Perera, iperera@ncsu.edu

81
Effect of NaCl Salinity on Three Cultivars of Camelina Sativa

Monica Effi, Cheyney University of Pennsylvania
Dr. Puthiyaparambil Josekutty and Dr. Sairam Rudrabhatla, Penn State Harrisburg

Camelina sativa (L.) Crantz is a short season, low input, oil crop with wide adaptability. Camelina seeds contain 30-40% oil and the oil is used to make biodiesel. The oil is rich in unsaturated fatty acids and is edible. Salinity is a major constraint for crop production affecting over 800 million hectares across world. We hypothesized that different varieties of Camelina, vary in their salinity tolerance. To verify our hypothesis, we germinated the seeds of cv. Blaine creek, Suneson and Cheyenne in vitro on control [MS medium (Murashige and Skoog 1962) supplemented with 20 g/l sucrose, pH 5.8 and gelled with 7 g/l agar (C0)] and media C1-C6 (medium C0 + 50, 100, 150, 200, 250 and 300 mM NaCl) and seed germination rate was recorded ten days from plating on the medium. The seedlings were grown for 21 days under 12 hr. light at 25°2°C and their growth was determined in terms of fresh and dry weight. Twenty seeds were plated in each Petri dish and 5-6 replicates were used for every treatment. Proline content of the seedlings was determined in triplicate as an indicator of salinity tolerance following Bates et al. (1973) and all the experiments were repeated. Although germination occurred in medium supplemented with 300 mM salt in 15 days, the seedlings did not develop further. Seedlings were progressively smaller in accordance with the increase in the salinity levels in the medium. The roots became shorter and highly branched as the NaCl concentration reached 100 mM or more. All the varieties included in the study had similar levels of proline in the control, however, a drastic increase in the proline levels was observed in all varieties challenged with 100 - 250 mM salt. Proline is an osmoprotectant and its levels in stressed plants are correlated to stress tolerance of plants. The results indicated that Camelina can tolerate up to 150 mM salinity without significant effect on early growth and cv. Cheyenne is the more tolerant to salinity compared to the other cultivars. Future plan is to compare response of these varieties in a greenhouse experiment and compare the results.
[Acknowledgement: The authors thank NSF for supporting this research through the NSF-REU grant 1063064.]

Faculty Advisor: Dr. Puthiyaparambil Josekutty, pcj11@psu.edu

82
Species Authentication and Validation of Actaea Racemosa (Black Cohosh) by DNA Barcoding

Chanae Fraser, Bowie University College
Akinola Vaughan, Bowie State University
Martin J. Spiering and Edward Eisenstein, Institute for Bioscience and Biotechnology Research, University System of Maryland

The goal of this proposal was the authentication and validation of Actaea racemosa using a molecular DNA barcoding method based on PCR amplification and sequencing of rDNA and chloroplast DNA. Our aim is to develop a facile and reliable approach for the rapid genetic identification of plants so that black cohosh in the market is not adulterated and to ensure the quality of this medically and economically important botanical dietary supplement on the market.

Black Cohosh is wild harvested for use as a dietary supplement for vasomotor menopausal symptoms, and has found increased use since the Women's Health Initiative described such adverse effects as increased risk of breast cancer and cardiovascular disease from hormone replacement therapy. A key issue involving the safe and effective use of black cohosh is an accurate analysis of the authenticity of plants in the field, which is commonly based on morphology of the flowering organs, and is of critical importance when roots and rhizomes are harvested for extraction and preparation of over-the-counter supplements. A. racemosa shares many macro- and micro-morphological features with its closely related congenerics, which presents considerable difficulties for authentication of plants and plant materials in the wild.

We assessed the use of the DNA barcoding method as a simple, reliable and rapid approach to plant authentication. The PCR-amplified DNA sequences from a variety of plant stocks ranging from specimens grown from USDA certified germplasm, collected from Virginia, West Virginia, North Carolina and Maryland by certified harvesters, and purchased from a spectrum of nurseries and natural plant suppliers from Alabama to Massachusetts, were compared to corresponding sequences from authentic A. racemosa and other members of the Actaea species in GenBank.

BLAST searches of the ITS and CP sequences indicated that 77 accessions had sequence identity of >99% to authentic DNA sequence from Actaea racemosa. *[Acknowledgement: Funded By HBCP - Bowie State University]*

Faculty Advisor: Dr. Anne Osano, aosano@bowiestate.edu

83
Agrobacterium Tumefaciens-Mediated Genetic Transformation in Alfalfa

Jeronda Hunt, Fort Valley State University

Medicago sativa L. is a flowering legume of the pea family Fabacea. For centuries, alfalfa has served as forage for cattle and as medicine to heal digestive tract disorders and arthritis. The goal of this study was to transform alfalfa leaf explants using Agrobacterium tumefaciens. It was projected that by doing so, eventually an entire transformed alfalfa plant could regenerate via somatic embryogenesis. For this purpose, some important parameters like sensitivity of explants to Kanamycin, age of explants, types of explants, co-cultivation time, acetosyringone and optical density (O.D.) of Agrobacterium culture medium were studied. Agrobacterium strain containing neomycin phosphotransferase (NPTII) gene as a selectable marker and β-glucuronidase (GUS) as a reporter gene was used for transformation. Results were tabulated on the basis of the percentage of GUS expression. Kanamycin at a concentration of 50-150mg/l was used to select transformed cells. Transient and stable GUS expressions were studied in transformed explants and regenerated calli respectively. Using the 0.2 OD level as a reference, we were able to standardize the system for the acetosyringone elution gradients. Acetosyringone concentrations were employed on alfalfa leaf explants. Highest transient GUS (70%) expression was observed at pH 5.8 after 3 days of co-culturing in 2-days-old explants. Optical density of 0.2 was considered optimal to obtain the highest transformation rate (70-75%). We found that acetosyringone at 200mM (for GUS expression) and 150mM (for GFP expression) yielded the highest transformation. We are using the developed protocol to transform alfalfa explants with several maker genes using Agrobacterium tumefaciens. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

84
The Effects of Sunlight on Grass Epidermal Cell Shape

Thien-Y T. Le, University of Washington
Regan E. Dunn and Dr. Caroline A.E. Strömberg, University of Washington

Phytoliths, microscopic plant silica bodies, constitute a fossil record of plants, allowing for reconstruction of past flora, climate, and ecosystems. Existing methods for reconstructing vegetative structure and habitat type (open vs. closed) using phytoliths depends on taxonomic occurrences of presumed open-habitat grass types. This method may lack resolution to reliably reconstruct vegetation when open habitat grass phytoliths are absent, and depends on the assumption that open-habitat grasses have always been so. Therefore, a taxon-free, morphological approach is needed when considering fossil phytolith assemblages.

This study looks at the effects of light variation on epidermal cell shapes in modern grasses as a first step in creating a proxy for determining habitat type from the fossil record. Based on patterns observed in dicotyledonous plants, we hypothesize that epidermal grass cells will be more undulated when grown in reduced lighting conditions. To test this, five species of grasses [Chusquea culeou 'Gigantea' (CC), Poa secunda (PS),

Schizachyrium scoparius (SS), Sporobolus asper (SA), and Stipa viridula (SV)] were grown in varying light treatments (20%, 60%, 100% (control), and 120% relative to the control). We took morphometric measurements from two types of grass cells, long and short cells from epidermal peels using Adobe Photoshop. For each cell, undulation was calculated using the undulation index (UI), a dimensionless value representing the ratio of the circumference of the measured cell to the circumference of a circle with the same area.

Results show that SA, SS, and SV long cells had higher UI in deep shade (20% light) than in enhanced light (120% light), although the relationship is non-linear in SA and SS. Long cells of CC show no statistical differences among treatments. Similarly, UI patterns of short cells varied between species and only SV, which has polylobate-type short cells, displayed increased UI as light levels decreased. Thus, data from SS, SA, and SV long cells show the greatest promise for use in the fossil record because of the marked differences in UI between the deep shade and enhanced light treatments. To further test the usefulness of this methods for paleoecological work, the UI of epidermal cells in soil phytolith assemblages from known modern habitat types will also need to be examined in order to see whether the correlation between UI and light exists also in the field. *[Acknowledgement: This study was supported by a grant from the University of Washington Howard Hughes Medical Institute Integrative Research Program and the University of Washington Early Identification Program Boeing Scholarship.]*

Faculty Advisor: Caroline A.E. Strömberg, caestrom@u.washington.edu

85

Effect of Carbohydrate, Environment and Media on Callus and Shoot Induction in Panicum virgatum

Emily McGlone, James Madison University

Biofuels reduce negative environmental impact by converting renewable energy sources into useable enegy. Switchgrass (Panicum virgatum), is a perennial bunchgrass native to the United States that has incredible potential as a biofuel crop because it can grow on marginal land. This study aimed to improve micropropagation techniques to ultimately achieve in vitro flowering and seed set for advancing traits through breeding. In vitro flowering could significantly reduce the natural breeding cycle thus accelerate production of novel, improved switchgrass varieties. The effect of light and dark treatments, carbohydrate type and media were studied in four upland varieties of switchgrass namely, Blackwell, Cave-in-Rock, Shelter and Forestburg.

The responses to these parameters were determined to be genotype dependent based on the finding that Shelter variety performed poorly on all the media irrespective of the modifications and light conditions used. Shoot development was most efficiently achieved in maltose medium in the light with all four varieties. Callus induction was most efficiently achieved in maltose medium incubated in dark with all the varieties. Each variety responded differently to each media. Modified MS (Murashige and Skoog 1962) containing B5 (Gamborg et al. 1968) vitamins, 2.0 mg/L Thidiazuron (TDZ), 1.0 mg/L Benzylaminopurine (BAP), and 3% (w/v) maltose was best medium for shoot formation in vitro. However, callus induction was most effective on the modified MS medium (MS nutrients + B5 vitamin) containing 4.0 mg/L 2, 4-D and 3% (w/v) maltose. Future projects include in vitro breeding of switchgrass and further research on the effect of carbon source, light treatment and growth regulators on shoot and callus regeneration in switchgrass. *[Acknowledgement: Research was funded by the National Science Foundation and Central Pennsylvania Laboratory for Biofuels.]*

Faculty Advisor: Dr. Sairam Rudrabhatla, svr11@psu.edu

86

Venus Flytrap: Energetics and Forces of Plant Movements

Veronica A. Murphy, Oakwood University
Jacqueline I Clemmons and Alexander G. Volkov, Oakwood University

The Venus flytrap is the most famous carnivorous plant. The electrical stimulus between a midrib and a lobe closes the Venus flytrap upper leaf in 0.3 s without mechanical stimulation of trigger hairs. The force exerted between the Venus flytrap has never been found by closing the trap electrically and mechanically. Energetics and electrical memory can be estimated as the Venus Flytrap closes. Using piezoelectric thin film and Fuji Prescale film, the closing force was found to be 0.14 N and the pressure between the rims of the lobes to be 38 kPa. We evaluated theoretically using the Hydroelastic Curvature Model and compared with experimental data velocity, acceleration and kinetic energy from the time dependencies of distance between rims of lobes during the trap closing. The Charge Stimulation Method was used for trap electrostimulation between the midrib and lobes. From the dependence of voltage between two Ag/AgCl electrodes in the midrib and one of the lobes, we estimated electrical charge, current, resistance, electrical energy and electrical power dependencies on time during electrostimulation of the trap. Studies on the Venus flytrap will continue to understand the morphing of this structure. *[Acknowledgement: This research was funded by the National Science Foundation HBCU-UP Program. Grant 0811507]*

Faculty Advisor: Alexander G. Volkov, agvolkov@yahoo.com

87
Electrotonic Potentials in Aloe Vera and Arabidopsis Thaliana

Lawrence O'Neal, Oakwood University

Electrostimulation of biologically closed electrical circuits in the Aloe vera or Arabidopsis thaliana induces electrotonic impulses propagating along their leaves. Stimulation by the instantaneous increase or decrease in voltage generates a nonlinear response representing potential that includes partial excitation of plant tissues. Any electrostimulation that is not instantaneous, such as sinusoidal or triangular functions, results in linear responses in the form of small graded potentials. The amplitude and sign of electrotonic potentials depend on the polarity and the amplitude of applied voltage during electrostimulation. The duration of electrotonic potentials does not depend on the amplitude of stimulating voltage. Using the synchronous electrostimulation of a leaf from two different points allowed further study of the interaction between the electrotonic potentials. Uncouplers (CCCP, FCCP), blockers of K+ channels (TEACl) and anion channels (A-9-C) inhibit the generation of electrotonic impulses in the leaf of the Aloe Vera either partially or completely. *[Acknowledgement: HBCU-UP, STEMER]*

Faculty Advisor: Alexander Volkov, gvolkov@oakwood.edu

88
Effect of Salinity on Seed Buoyancy and Germination in Pochote (Pachira quinata: Malvaceae), a Tropical Wind-dispersed Tree

Danielle Perryman, San Jose State University

Pochote, Pachira quinata (Jacq.) is a tropical tree species found in lowland areas on the Pacific coast of Costa Rica. Seeds are dispersed by wind when a dry capsule opens, releasing seeds covered with silky kapok fibers. These diaspores, or seeds with their fluffy kapok threads attached, are held aloft and float from the parent tree on currents of air.

This study was performed to explore the potential for secondary dispersal by water in pochote, and in particular to determine: (i) the length of time pochote seeds could remain afloat in sea water, in brackish water, and in fresh water and (ii) whether the amount of time spent in each of those media affects the ability of pochote seeds to germinate. Pochote diaspores with kapok fibers were able to remain afloat in sea water for over a month. Bare seeds remained afloat for over a week in sea water, and for 3 days or less in fresh water.

Germination of pochote seeds immersed in fresh water reached around 40% after 6 days of observation. No germination took place while seeds were immersed in sea water. However, removal of seeds after 6 hours, 24 hours, 72 hours and one week in sea water, followed by immersion in fresh water, led to germination rates equal to those of seeds that had been immersed in fresh water alone. In addition, removal of seeds after 24 hours, 72 hours, and one week in brackish water, followed by immersion in fresh water, led to germination rates equal to those of seeds that had been immersed in fresh water alone.

Seeds stored for three months had lower levels of buoyancy and substantially lower germination rates than seeds collected fresh at the time of fruiting. Comparatively to known water dispersed trees, pochote had significantly lower success.

The results of this study confirm the potential for secondary dispersal by fresh water for pochote, and raise the possibility of secondary dispersal in sea water. Further studies are needed to determine the maximum length of time which pochote diaspores might be able to float, and the maximum length of time pochote seeds are able to survive immersion in sea water and remain viable. Adult pochote trees showed a clumped dispersion pattern. The density of pochote did not differ between shoreline and inland transects, although the frequency of samples with pochote was higher in the inland samples. In future studies one might consider testing soil composition in areas where there was an observed clumped distribution. *[Acknowledgement: Chancellor's Office of the California State University and NSF grant HRD-0802628 from the LSAMP program of the National Science Foundation.]*

Faculty Advisor: Diana Lieberman, liebermv@racsa.co.cr

89
Characterization of Double Knockout Mutants of Arabidopsis Thaliana for Use in Lipid Profile Studies

Terry Phillips, Langston University

Four A. thaliana knockout mutant lines of genes involved in the composition of plant oxidized lipids are employed in a study to determine the effect of abiotic stress on plant lipid profiles. The genes MOP9.2, LOX 4, LOX 5 and MES 1 are all plant lipoxygenases and acyl hydrolases. All alleles of these mutants have to be completely knocked out for us to study the effects of these genes in lipid metabolism. We hypothesized that the genotypes of all lines we are studying are null or complete knockouts. The Polymerase Chain Reaction (PCR) and RT- PCR were utilized to confirm that the mutants were homozygous and that no mRNA transcript was produced. To achieve this we describe protocols established to obtain plants free of biotic components and soil grown plants suitable for nucleic acid extraction and seed production. Gene amplification protocols were optimized using wild type (Columbia ecotype) plant DNA and genes that are constitutively expressed in plants grown under normal conditions. Primers were designed using the iSelect primer design tool from the SALK Institute for the left border of the t-DNA insertion and for the gene specific 3' prime

end. Different combinations of polymerases, primers and amplification conditions were studied. Gel electrophoresis was used to examine gene products obtained from successful amplifications. PCR parameters with annealing temperatures that were stringent and highly specific allowed successful identification of the double knockout plants for each gene. Exon-spanning primers of the actin gene were used in the RT-PCR to confirm that there was no mRNA product of these genes. This information was analyzed and the data verified that our source of mutants were indeed null mutants. The seeds of these confirmed lines were grown to maturity and harvested for use in our future lipid stress experiments. *[Acknowledgement: This work was supported in part by grants from NIH –K-INBRE made to K. J. Abraham PhD, Department of Biology , Langston University, Langston, OK 73050 and NSF 0920663 made to Ruth Welti, PhD, Division of Biology, Kansas State University, Manhattan, KS 66506.]*

Faculty Advisor: J. K. Coleman and G. Naidoo, Jkcoleman@lunet.ed, gnaidoo@lunet.edu

90
Impact of Organic Fertilizer "Fish Agra" on Growth and Development of Tomato

Rajah Singh, Langston University, OK

Fertilizers are commonly used on crops to effect growth and development, and can be produced from different sources including soil, plant materials, and bird, animal or human manure. "Fish Agra", which is one of fewer fertilizers produced from fish, has been touted by the manufacturer to enhance plant tolerance to heat and more improve growth and yields, compared to conventional fertilizers. This study was designed to investigate those Fish Agra's attributes on local tomato cultivars, Heatware and Merced, and test the hypothesis that Fish Agra improves heat tolerance and causes superior plant growth and development compared to conventional fertilizers. To achieve this goal, Fish Agra was applied in combination with BF-888, as recommended by the manufacturer. BF-888 is a product that contains a broad spectrum of beneficial bacteria cultures and enzymes needed for efficient use of the Fish Agra. Dyna Green (12-12-12), a local fertilizer commonly applied to tomato, was used as control. Both fertilizers were applied to soil as liquid once daily or weekly, in summer heat ranging from 90 to 175°F, for three months.

Twenty potted seedlings, purchased from Lowe's store, were randomly assigned to each fertilizer treatment; and each potted plant was used as an experimental unit for observations. The results showed that tomato plants treated with Fish Agra produced greater biomass, plant height, number of flowers, and yields than those treated with Dyna Green. Although it might be of lesser significance, the first flowering for plants treated with "Fish Agra" was observed five days earlier than the control. Better plant recovery from summer heat was observed from plants treated with Fish Agra compared to control plants. Overall, the agronomic attributes of Fish Agra claimed by the manufacturer were confirmed in this study. Future research could enlighten the effect of individual nutrients, which are contained in Fish Agra and lacking from conventional fertilizers. *[This study was supported, by an education grant from CSREES/ USDA awarded to Dr. George Acquaah and Dr. Kanyand Matand, Research and Extension/School of Agriculture, Langston University, Langston, OK 73050.]*

Faculty Advisor: Dr. J.K. Coleman, jkcoleman@lunet.edu

91
Biological Clocks in Plants

Joseph D. Wooten, Oakwood University
Astian J. Waite and Alexander G. Volkov, Department of Chemistry, Oakwood University, AL
Vladislav S. Markin, Department of Neurology, University of Texas, Southwestern Medical Center

The biological clock regulates a wide range of physiological processes in plants. The biologically closed electrochemical circuits in the leaves of C. miniata were analyzed in vivo using the charge stimulation method. C. miniata memorizes daytime and nighttime. The biologically closed electrical circuits with voltage gated ion channels are activated the next day, even in the darkness. At continuous light, C. miniata recognizes nighttime and increases the input resistance to the nighttime value even under light. These results show that the circadian clock can be maintained endogenously and has electrochemical oscillators, which can activate voltage gated ion channels in biologically closed electrochemical circuits. The activation of voltage gated channels depends on the applied voltage, electrical charge and speed of transmission of electrical energy from the electrostimulator to the C. miniata leaves. We present the equivalent electrical circuits in C. miniata and its circadian variation to explain the experimental data. The mechanism of the biological clock is the center problem in plant physiology and by researching it we can make many advances in this field. *[Acknowledgement: This work is funded by the National Science Foundation HBCU-UP Program Grant 811507.]*

Faculty Advisor: Alexander G. Volkov, agvolkov@yahoo.com

POLLUTION/TOXIC SUBSTANCES/WASTE

92
A Study on the Effect of Clorox® Concentrations on the Growth of *Bacillus Sphaericus*

Brittney Fontenot, Paine College
Priyanka Yarlagadda, Dr. B. Mohanty, Dr. C.P. Abubucker, and Dr. C.R. Nair, Department of Mathematics, Sciences, and Technology, School of Arts and Sciences, Paine College, GA

Microbial resistance to disinfectants and cleaning agents is a serious environmental health concern. There are new data emerging on the role of bacterial resistance to variety of cleaning products including Clorox®. In aqueous environment, it has been well documented that the reactive chlorine of unionized HOCl in Clorox® is a very potent bactericidal agent. The purpose of the study is to examine the bactericidal effect of a Clorox® on *B. Sphaericus 2362* and to look for development of chlorine resistance patterns of *B. sphaericus* in soil samples. It was hypothesized that bactericidal action of Clorox® is concentration- dependent and may alter in chlorine-resistant bacterial forms.

This study was carried out to assess the effect of different chlorine concentrations on the growth of *Bacillus sphaeriucs* and its comparative resistance to sodium hypochlorite concentrations. Clorox® (Clorox Co. Oakland CA) used in the study was purchased locally and contained 6% sodium hypochlorite with 5.7% available chlorine. The experimental system for the study included *B. sphaericus* preparations and serial dilutions of Clorox® in a final volume of 10 ml with resultant sodium hypochlorite concentrations ranging from 1.5-0.15 %(v/v). The bacterial preparations were kept in contact with Clorox® for 30 minutes in a soil suspension by spiking with identical amount of *B. sphaericus* preparations. The contents were centrifuged at 2000g for 20 minutes and 50 µL of supernatants were used for seeding the bacterial lawn on the TSA plates. Identical bacterial lawn on TSA plates with no Clorox® served as controls. The plates were incubated at 35 ºC for 48 hours and examined for bacterial growth. The result of the study indicated that all dilutions of Clorox® lower than 1.5% permitted growth of the bacteria indicating the presence of varying amount of chlorine resistant bacteria in the bacterial lawns. *[This study was supported by a grant from Department of Energy awarded to Paine College, Augusta, GA.]*

Faculty Advisor: Dr. C.R. Nair and Dr. Mohanty, cnair@paine.edu

93

The Effects of Environmental Aquatic Pollution on the Thyroxine Hormone and Development of Pre-metamorphic Amphibians

Alissa Harrell, Norfolk State University

The impact of agricultural and pharmaceutical water pollution is detrimental to the growth, development, and vitality of marine organisms. The major pollutants examined in this investigation are Triclosan and Ammonium Nitrate. Triclosan is an antimicrobial chemical agent that is found in many antibacterial products. Triclosan prevents the growth of mildew, bacteria, fungus, and deodorizes the surface of the skin. Triclosan blocks the active site on enoyl- acyl protein reductase enzyme, which is an essential enzyme in fatty acids synthesis of bacteria in humans. Ammonium nitrate found in nitrogenous-based fertilizer commonly used in agriculture and pollutes aquatic ecosystems through runoff. This study examines the growth and development of Rana catesbeiana and the effects of pharmaceutical and agricultural pollutants on the hormone thyroxine. Thyroxine, the hormone responsible for metamorphosis in amphibians was used in conjunction with pollutants ammonium nitrate and triclosan to illustrate the inhibitory effects of the polluted aquatic environments on development and metamorphosis in marine animals. Rana catesbeiana pre-metamorphic tadpoles at five weeks of development were placed in polluted aquatic environments containing and 3mg/L and 5mg/L triclosan, 10mg/L of ammonium nitrate, and 1 µg/L of thyroxine. The tadpoles were exposed to the pollutants and thyroxine for 14 days for bioaccumulation. The pre-metamorphic tadpoles were monitored and observed daily for ten weeks of development for the onset of metamorphosis, which is characterized by hindlimb emergence, forelimb emergence, and the resorption of the tail. This research determined that pre-metamorphic tadpoles exposed to ammonium nitrite disrupted the thyroxine hormone and retarded metamorphosis. All tadpoles exposed to this pollutant become susceptible to the fungi Batrachochytrium dendrobatidis (Bd). Chytridomycosis affects the skin of amphibians because of their cutaneous respiration. As a result, their skin appears bloodshot or sloughs off excessively. This demonstrated the toxic effects of triclosan pollution on the aquatic ecosystem. The pre-metamorphic tadpoles exposed to triclosan exhibited an increased mortality rate. The results of this study show the importance of the thyroxine in metamorphosis in amphibians. The ammonium nitrate and triclosan acted as developmental disruptors by inhibiting the action of thyroxine in Rana catesbeiana during the pre-metamorphosis stages from tadpole to frog development. This research establishes that pharmaceutical and agricultural water pollution is detrimental to the growth and development of marine organisms. *[Acknowledgement: National Science Foundation Grant 1000286]*

Faculty Advisor: Maureen Scott, mscott@nsu.edu

94

Ameliorative Effect of Diallyl Disulfide on the Cytotoxicity and Apoptotic Proteins in Cadmium-Treated Liver Cells

Suenita Smith, Florida A&M University

Cadmium is a toxic and carcinogenic metal that naturally occurs in the environment and is a pollutant due to increased usage in industry and agriculture. The primary source of cadmium exposure to humans is cigarette smoke, food and water. In this study, the ameliorative effect of diallyl disulfide (DADS) on the viability and apoptotic proteins in cadmium treated normal rat cells were evaluated. Cadmium is found in high levels throughout the environment and both the environment and

humans, often unaware, come into contact with the toxic, it is important to discover a reagent to protect our environment and people.

The importance of this research will allow scientists to study the mechanism of reversing or preventing damage caused by cadmium in the liver. The cells were treated with cadmium chloride (0, 50, 150 μM) alone or DADS (150, 600 μM) alone or cotreated with cadmium chloride (150 μM) and diallyl disulfide (150, 300,600 μM) for 24 h. The cells were pretreated with DADS for 2 h prior to cadmium chloride treatment. The viability was measured by the Crystal Violet assay and the apoptotic proteins expression was measured by Ray Biotech's apoptotic array. The viability of cadmium treated cells was decreased to 37% in comparison to control cells (100%), while in cotreated cells with cadmium chloride (150 μM) and diallyl disulfide (150 μM) the viability was increased to 67% in comparison to cadmium alone treated cells (37%). In cadmium treated cells, nine apoptotic proteins (BID, BIM, Caspase 8, cIAP-2, HSP60, HSP70, IGFBP-5, p21, survivin) expression out of 43 proteins on the array was decreased in comparison to control cells. In the cotreated cells, three apoptotic proteins (BID, BIM, HSP-70) expression out of nine down-regulated proteins in cadmium treated cells was increased. These results clearly show the ameliorative effect of Diallyl disulfide on the cytotoxicity and apoptotic proteins in cadmium- treated CRL-1439 rat normal liver cells and suggest that diallyl disulfide can be used as preventative agent for metal toxicity. Now that research has shown that cadmium is toxic to proteins in the cell and that DADS works as a protective agent, future research can be designed to use DADS as an antidote in animal models to test the significance of the compound. *[Acknowledgement: This work was supported by grants from National institutes of Health National center for Research Resources (NIH NCRR 0030 20-21) and DOE-HBGIP 031 B40108-08.]*

Faculty Advisor: Dr. Caroline Odewumi, caroline.odewumi@famu.edu

95

A Comparative Study of the Tolerance between Bacillus subtilis and Escherichia Coli in the Presence of Triorganotin

Hirut Yimer, University of the District of Columbia

Triorganotins, compounds with three Sn-C bonds, are known to have biocidal activities against various species including fungi and bacteria. Previous studies have shown that triorganotins are toxic to Escherichia coli; however, there is little data on its effect on B. subtilis. B. subtilis is a gram-positive bacterium regularly found in the soil, and is often used in the laboratory as the gram -positive alternative to gram-negative E. coli, since it is easily cultured. Further, B. subtilis is very significant, since it is often used in laboratories as a reference or standard organism in which other similar single celled organisms can be compared. It is of interest to determine whether B.subtilis would be as susceptible to the toxicity of triorganotins as E. coli. The objective of this project is to compare the toxicity of triorganotins on B. subtilis. The compounds 2,2,3,3-tetramethylcyclopropane carboxylate (Carboxylates) and 2-(p-chlorophenyl)-3-methylbutyrates (Methylbutyrates) were synthesized according to literature. The stock solutions were prepared by dissolving either the Carboxylates and Methylbutyrates in acetone. The gram-positive bacterium, B.subtilis, was exposed to multiple dosages of both of the triorganotins and placed in a 37 degree shaking water bath for 24 hr. After the 24 hr period, the absorbance was recorded by using a Unico® 1200 spectrophotometer at 600nm. Results indicated that the most effective derivative of the Carboxylate complexes had an absorbency of 5.27 ppm while Methylbutyrates had an absorbency of 7.87 ppm. These data indicate that Carboxylates are more effective against B. subtilis than Methylbutyrates. In both instances, their ethyl derivatives were the most effective. Another modified components/ fragments of pyrethroids (triorganotin 2,2-dimethyl-3-(2-methyl -1-propenyl)cyclopropanecarboxylate) will be screened against Bacillus subtilis to determine which modified fragment is the most effective. When both compounds were treated with the compound, both were less toxic on B. subtilis than E. coli. Results from the study will indicate if this series of triorganotins should be investigated further as a possible biocide. *[Acknowledgement: STEM Program at the University of the District of Columbia]*

Faculty Advisor: Dr. Caroline Cousin, ccousin@udc.edu

CHEMISTRY & CHEMICAL SCIENCES

BIOCHEMISTRY (NOT CELL AND MOLECULAR BIOLOGY AND GENETICS)

96

Effect of Non-Nutritive Sweetener on Gastrointestinal Hormones

Kiesha Cherry, Norfolk State University

Over the past few years the consumption of non-nutritive sweeteners has greatly increased. The previous notion that glucose metabolism was not altered by non-nutritive sweeteners has since been repudiated. Recent studies have shown that non-nutritive sweeteners do play some type of active metabolic role. Rother et al have previously shown that the gastrointestinal hormone glucagon like peptide-1[GLP-1] increased on consumption of diet soda with a glucose load. This study examines the isolation of a sole non-nutritive sweetener, sucralose and its effects on secretion of GLP-1 and other gastrointestinal hormones. The purpose of this study was to confirm that non-nutritive sweetener, sucralose; versus the other ingredients found in a diet soda would increase glucose-

stimulated GLP-1 secretion. Twenty, healthy subjects were given randomized increasing dosages of sucralose over the course of 120 minutes at four different time periods. Levels of glucose, insulin, GLP-1 and other gastrointestinal hormones in the plasma were measured. The preliminary data shows an increase in GLP-1 levels on sucralose consumption though it was not statistically significant. More subjects are currently being recruited and the later goal of the study is to compare the response of non-nutritive sweetener in healthy individuals to those with diabetes and determine if both groups make more insulin with the intake of artificial sweeteners. *[Acknowledgement: NIH-NIDDK]*

Faculty Advisor: Dr. Katina Hall-Patrick, khpatrick@nsu.edu

97
Capillary Based Biosensors

Aatirah Holmes, Los Alamos National Laboratory / Norfolk State University

The mission to create an inexpensive and portable biosensor has been ongoing and research on the subject has greatly progressed in recent years. This technology is urgently needed, and could be especially useful in disease stricken countries with low return rates of patients, as well as in remote settings. In our labs we use planar optical waveguides for signal transduction. An optical waveguide is a physical structure that guides electromagnetic waves in the optical spectrum. Our current waveguides are hampered by their expense and complexity and a simpler, less costly system is needed. Capillaries are ideal for resource-poor or remote settings because they are small, inexpensive, and disposable. The goal of this project was to develop techniques to clean and coat capillary tubes for use as a signal transduction platform. Herein, the cleaning and coating of the inner surface of capillaries, as well as the apparatus created to complete these processes, are described. Further, we discuss a simple assay using streptavidin-coated quantum dots. Future work will include coupling laser light and a spectrophotometer through the side of the capillary to allow for fluidic connections and permit multiple injections. These steps will allow the use of capillary tubes in sandwich immunoassays and will pave the way for a more cost-effective biosensor. *[Acknowledgement: Los Alamos National Laboratory]*

Faculty Advisor: Aaron Anderson, aaronsa@lanl.gov

98
Characterization of Dopamine Release in a Penicillin Model of Seizure

Taylor Hood, Washington State University / Alabama A&M University

Neuronal seizures, as in epilepsy, are caused by random neuronal activity which produces interruptions in normal neuronal functioning. Effective treatments for preventing and/or recovering from a seizure require knowledge about the timing of neurotransmitter fluxes during seizures. Penicillin G, a well studied seizure-aminobutyric acid (GABA)γ inducer, is known to block depressant action of interneurons and has been used in multiple studies to produce seizure activity. Although it is widely used, it has not been biochemically characterized. The overall goal of this current research is to characterize neurotransmitter release in an experimental model (i.e., rat) of seizure and define the neurotransmitter's time of release in relation to the seizure process. The rotating disk electrode voltammetric model is used to probe the anatomical differences in dopamine functionality in rat striatal tissue in vitro, using single addition KCl stimulated dopamine release to probe its timing, magnitude, and subsequent reuptake. Experiments were performed in the absence and presence of Penicillin G. Initial results show that Penicillin G increases the dopamine release in the rat striatal tissue by approximately 7/10 of a micromole per gram wet weight of tissue with no apparent changes in timing. The GABA interneurons are inhibitory and thus they may be inactivated by Penicillin. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. James Schenk, geni@wsu.edu

99
Inorganic Biochemistry of Clofibric Acid with Fe3+

Jasmine Scott, LeMoyne-Owen College
Dr. Yahia Hamada, LeMoyne-Owen College, TN

The reaction of clofibric acid with Fe3+ in aqueous solutions at 25ºC was studied. This ligand, Clofibric acid, binds to peroxisome proliferator-activated receptor (PPAR). PPAR are a group of nuclear receptor proteins that function as transcription factors regulating the expression of genes. PPARs play an essential role in the regulation of cellular differentiation and metabolism of carbohydrates, lipids, and proteins. The main techniques used to carry out this research were potentiometric titrations and UV-Vis spectroscopy. From the potentiometric titrations of Fe3+:Clofibric acid in different molar ratios, it appeared that the measured potentials are in total agreement with Nernst Equation. These potentiometric data are novel for this reaction system. We also gathered novel UV-Vis-spectroscopy for this system that shows evidence of binding between Clofibric acid and Fe3+. It appeared also that a ternary Fe3+:Clofibric acid:Hydroxo (OH) complexes have been formed. These new data will be discussed.

Why is the research important? Clofibric acid, binds to peroxisome proliferator-activated receptor (PPAR) which are a group of mammalian nuclear receptors.

Statement about the problem being investigated

- If there is a binding between Fe3+ and the nuclear membrane (a ligand, or an agonist) (Clofibric acid)
- How Clofibric acid would bind to Fe3+
- Find out the binding ratio of the Fe3+ to Clofibric acid, 1:1:1 Fe:Clo:OH

Conclusion

1. We have novel data from the titration of clofibric acid with Fe3+
2. We were able to measure the pka value for clofibric acid which is 4.32 ± 0.06 (n=10).
3. There is a clear binding between Fe3+ and the ligand Clofibric acid.

Future work

- Investigate crystals to determine exact composition.
- Complete UV-vis study on the complex.
- Additional titrations of the complex at various ratios.

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Faculty Advisor: Dr. Yahia Hamada, yahia_hamada@loc.edu

100
Model Peptides in Nonionic Reverse Micelles

Cecilia Turcios, University of Pennsylvania / Cornell University

The thermodynamic properties of helical peptides depend on the degree of backbone hydration. Yet, it is difficult to experimentally study the effect of limited hydration on the secondary structure of a peptide in a systematic manner. Reverse micelles can be used to investigate how the degree of hydration and confinement affect the biophysical properties of encapsulated peptides in a controlled way. More precisely, it has been shown that encapsulating peptides into reverse micelles of different sizes controls the degree of hydration of the peptide backbone. Reverse micelles are spherical aggregates of surfactant molecules in apolar solvent.

In contrast to normal micelles, the polar hydrophilic head group of the surfactant molecule is directed towards the interior of the aggregate forming a polar core which can solubilize water while the hydrophobic tail is exposed to the organic solvent. The size of a reverse micelle is dependent on the water loading parameter, w0 , which is [water]/[surfactant]. Previous experimental studies have used sodium bis(2-ethylhexyl) sulfosuccinate (AOT) to form reverse micelles that encapsulate peptides. The interior of the AOT reverse micelles is made up of charged head groups, known to interact strongly with polar groups of the peptide.

The intent of this study was to gain further understanding of the role of the surfactant head group on the conformation of the encapsulated peptide. This study used a nonionic surfactant, such as polyoxyethylene(4)lauryl ether (Brij-30), to form reverse micelles. The peptides studied have the sequence YGAKAAAA (KAAAA)nG, n=2-6 (AKAn), a model peptide with a repeating unit designed to have high helical propensity and to be soluble. We employed far-UV circular dichroism measurements on these peptides encapsulated in nonionic reverse micelles. Similar to observed effects of these peptides in AOT reverse micelles, there was increased helicity of the peptides in the Brij-30 reverse micelles at low w0 values. A significant finding from this work is that the peptides encapsulated in nonionic reverse micelles show a lower tendency to form aggregates than in ionic reverse micelles. By comparing the thermodynamic properties of the alanine-rich peptide in nonionic reverse micelles to the ionic reverse micelles has shown to provide insight on the role that the ionic head group plays. *[Acknowledgement: This study was supported, in part, by a grant from NSF awarded to the Nano-Bio Interface REU.]*

Faculty Advisor: Feng Gai, gai@sas.upenn.edu

Biomedical Engineering

101
Secondary Protein Structure Analysis of Cu, Zn Superoxide Dismutase Aggregates Found in Amyotrophic Lateral Sclerosis using Fourier Transform Infrared Microspectroscopy

Daphne Meza, University of New Orleans
Megan Bourassa, Stony Brook University, Joan S. Valentine, University of California, Los Angeles
David R. Borchelt, University of Florida
Lisa Miller, Brookhaven National Laboratory, NY

Approximately 20% of familial Amyotrophic Lateral Sclerosis (fALS) cases are caused by mutations in the Cu/Zn superoxide dismutase gene. These mutations each result in different mutant proteins which aggregate in the motor neurons of fALS patients. This study seeks to compare the secondary structure of the protein aggregates in four common mutations of Cu/Zn Superoxide Dismutase (SOD1) in order to understand how SOD1 mutant protein aggregates cause motor neuron cell apoptosis.

Chinese hamster ovary cells (CHO) were grown on silicon nitride windows and transfected to express SOD1 mutations (A4V, H80R, D125H, G37R, wild type, and non-transgenic controls) co-expressed with yellow fluorescent protein (YFP). CHO cells were transfected for 20-30 hours, fixed with methanol, and subjected to transmission mode Fourier transform infrared spectroscopy from which amide I peaks was analyzed for protein secondary structures. Live CHO cells were also subjected to the same procedure using a specially designed flow cell to be able to monitor protein aggregation in real time. Different transfection time rates with different degrees of aggregation were discovered among the mutations. Comparing non-transgenic

(NTG) to wild type (WT) and the other 4 mutations NTG had higher alpha helix content to total protein ratio than the WT probably because unordered proteins can be part of its composition as well. H80R and D125H contained less beta-sheet than the wild type and mutations that bind metals. We hypothesize this lack of metal binding makes the protein lose its structural stability and its ability to function as an antioxidant. Knowledge gained about the different SOD1 mutation's secondary structure and aggregate formation is key to understanding their methods of toxicity in ALS. Understanding the mechanism of cytotoxic aggregate formation can lead to a cure for ALS. *[Acknowledgement: The U.S. Department of Energy, Brookhaven National Lab]*

Faculty Advisor: Ashok Puri, apuri@uno.edu

Cancer Research

102
Screening of Organic Compounds for use as Photosensitizers in Photodynamic Therapy Treatment of Cancer

Kara Baker, Oakwood University
Ciara Batiste and and Kenneth LaiHing, Oakwood University, AL

Photodynamic therapy (PDT) is a cancer treatment used for various types of malignancies. It is a minimally invasive alternative to traditional surgical, radiation, and chemotherapy treatments, which can be extremely harsh on patients and have severe and sometimes permanent side effects. The components of PDT are a photosensitive agent, light, and tissue oxygen. Studies have shown that photosensitive agents, or photosensitizers, absorb light at selective wavelengths and can be activated to chemically change the internal environment of cancer cells by exciting oxygen molecules to the singlet state. These singlet oxygen molecules react quickly with nearby tissues, causing cell death to the cancer cells while leaving the surrounding tissue unaffected. Thus, PDT is rapidly emerging as a highly efficient means of specifically targeting and eradicating cancerous cells without harming healthy tissue. Because PDT it is such a new treatment alternative, very little is known about what components are necessary to produce a highly efficient compound.

In this project, we explore the light absorbing properties of a variety of compounds, using UV-Visible spectroscopy, to determine their potential as photosensitive agents and to select the most efficient species. We also explore derivatives of these photosensitizers to determine which will be the best suited for use as a PDT drug. *[Acknowledgement: This research was supported by a grant from the National Science Foundation HBCU-UP Program. Grant 0811507.]*

Faculty Advisor: Dr. Kenneth LaiHing, laihing@oakwood.edu

103
Qualitative Analysis of Dibenzoylmethane and Licorice Root Extracts using GC/MS and HPLC

Evan DuBose, Spelman College
Michelle Reid, Marisela D. Mancia, and Kimberly M. Jackson, Spelman College
James A. Campbell, Pacific Northwest National Laboratory, WA

Licorice root (Glycyrrhiza glabra), a herbal Chinese medicine, has shown medicinal uses in therapeutics and cancer prevention. Dibenzoylmethane (DBM), a small β -diketone, is a minor constituent of licorice and a known deregulator of human prostate cancer cell cycle; also decreases the expression and function of a major prostatic protein, the androgen receptor. Characterization of the phytochemical profiles of various licorice root forms including commercially available DBM will advance our search in identifying novel reagents for prostate cancer therapeutics. Gas chromatography-mass spectrometry (GC/MS) was used for detecting DBM and other components in the licorice root extracts. DBM and all licorice forms (bark and powder) exhibited a component at retention time of 14.5 minutes. The major fragmented ions detected were m/z 77, 105, 147, 223 and 224 (parent ion) at the identified retention time. Multiple reaction monitoring scans confirm DBM as a minor constituent of Glycyrrhiza glabra (G. glabra). High performance liquid chromatography (HPLC) analysis showed a retention time for DBM between 19-20 minutes. Biological assays performed with licorice root extracts exhibit antiproliferative effects on the LNCaP prostate cancer cell line. For further analysis, HPLC and liquid chromatography-mass spectrometry will be utilized to characterize licorice root fractions exhibiting bioactivity. *[Acknowledgement: NIH/MBRS-RISE 2R25GM060566-09A1 DOE -FaST/NSF/HBCU-UP Supplement 1036403NIH/NCMHD 2P20MD00215-08]*

Faculty Advisor: Dr. Kimberly Jackson, kjackson@spelman.edu

104
Using Benzimidazole-Based Ligands to Inhibit the PI3K/Akt Pathway for Prostate Cancer Treatment

Donyeil Hoy, Jr., Spelman College

Prostate cancer is the most prevalent cancer found in males, the majority of which are usually African American based on current and previous statistics. According to the American Cancer Society, approximately 241,000 men will have suffered from prostate cancer by the end of the year 2011, an 11% increase from the previous year. Due to the consistent year to year increase, it is of increasing importance to develop drugs capable of inhibiting prostate cancer proliferation. Literature suggests that the upregulation of the PI3K/Akt pathway plays an important role in the successful proliferation of prostate cancer. The specific task of this research is to synthesize several

benzimidazole-based compounds that can potentially inhibit the PI3K/Akt pathway, preventing cancer cell proliferation. The synthesis and biological activity of these compounds will be presented. *[Acknowledgement: NIH/National Center on Minority Health and Health Disparities 5P20MD000215-070002 Teledyne ISCO Grant 2425, NSF HBCU-UP 0714553]*

Faculty Advisor: Dr. Leyte Winfield, lwinfield@spelman.edu

105
Synthesis, Purification and Characterization of β-Nitrostyrene Compounds

Tamera Hughes, Tougaloo College, Leadership Alliance SR-EIP, Howard University
Terry Reid, PhD, Amol Kulkarni, PhD, Alicia Hayes, Kaylan Celestin, Howard University, School of Pharmacy

β-nitrostyrene has been used to form antifungal, antiplatelet and amphetamine-like drugs. It is believed that β-nitrostyrene derivates also have the ability to act as a drug for many potential antibacterial agents, antiparsitics, and chemopreventive compounds. Fully understanding these compounds are important in drug discovery. This study will focus on the synthesis, purification and characterization of various β-nitrostyrene derivatives. Methodology and results developed from this study will be applied to other β-nitrostyrene compounds currently under investigation at Howard University.

The purpose of this study To synthesize, purify and characterize various β-nitrostyrene derivatives

Methods: 1.) Synthesis of beta-nitrostyrene compounds o Stoichiometry, 2.) Henry Reaction Purification of beta-nitrostyrene compounds, 3.) Recrystallization, 4.) TLC plating Characterization of beta-nitrostyrene compound; and 5.) Proton NMR Results:

Conclusion: The beta nitrostyrene compound was able to be synthesized, purified and characterized. NMR graph shows peaks at correct locations, but are not sharp due either to impurities in the compound, concentration of compound or a faulty machine.

Methodology and results developed from this study will be applied to other β-nitrostyrene compounds currently under investigation at Howard University. *[Acknowledgement: NIH contracts N01-HC-95170, N01-HC-95171, and N01-HC-95172 provided by the National Heart, Lung, and Blood Institute and the National Center for Minority Health and Health Disparities in conjunction with Tougaloo College, who is also supported by the NIH under Grant No. NIH-NHLBI-HC-04-27.]*

Faculty Advisor: Wendy White, wendywhite2001@yahoo.com

Chemistry (not Biochemistry)

106
Evaluation of Small Molecule Specificity in Inhibiting Activator-Coactivator Interactions

Jasmine Allen, University of Michigan / University of South Florida, Tampa
Chinmay Y. Majmudar and Anna K. Mapp, Department of Chemistry, University of Michigan

Regulated gene expression in eukaryotes incorporates the interactions of transcriptional activation factors (TAF), coactivators and components of the basal transcription machinery. Deviation in the expression of genes has been implicated in the presentation of many types of cancer. Therefore, understanding the activator-coactivator interactions provides a platform at the molecular level for the synthesis of transcription-based therapeutics and the use of mechanistic probes capable of altering gene expression. The cAMP-response element-binding (CREB) protein acts as a bridge between the TAFs and the transcriptional machinery to regulate gene transcription. Within the CREB-binding protein (CBP) lies the KIX domain, an essential complex for activation of CBP. A molecule that can compete or inhibit the activity of KIX, preventing interaction between CREB and CBP can also impede transcriptional activity. Thus, investigating the molecules that bind to KIX can help contribute to the overall knowledge of what role the KIX domain plays in gene transcription, how it functions at the molecular level and assist in the synthesis of transcription -based therapeutics. In experiments, the KIX protein was expressed in E. coli and purified. Fluorescence polarization (FP) binding assays were performed to determine if the small molecule, sekikaic acid, identified in a high throughput screen (HTS) previously by the Mapp lab competes and inhibits the binding of the endogenous KIX domain ligands KID, MLL and VP2. The further evaluation of sekikaic acid and its analogues in cellular transcription assays will lead to the development of the first generation of transcription-based therapeutics for the modulation of gene expression. *[Acknowledgement: NSF REU/ University of Michigan Interdisciplinary Research Experience for Undergraduates]*

Faculty Advisor: Anna Mapp, amapp@umich.edu

107
Synthesizing Benzimidazole Molecules Using Solid State Chemistry

Mandisa Mosi Bell, Spelman College

Cancer is the general name for a group of more than 100 diseases in which abnormal cells begin to grow out of control in a part of the body. In this research, the focus is on prostate cancer. Prostate cancer is a health disparity among African

Americans. Because of this, there is great need to produce chemotherapeutic drugs. The over activity of the PDK-1 pathway creates the progression and development of many tumors. Therefore, our research focuses on designing drugs that will inhibit the activity of this pathway. In this lab the focus has been on designing benimidazole-based molecules using MOE and synthesizing the molecule using microwave and other traditional methods. Some of the original methods for synthesizing the molecules produced low yields in intermediate steps. In most cases, the intermediates were difficult to isolate from the reaction mixtures. Therefore, we have explored solid state procedures for the synthesis and purification of several intermediates. The results will be presented herein. *[Acknowledgement: Dr. Leyte Winfield]*

Faculty Advisor: Dr. Leyte Winfield, lwinfield@spelman.edu

108
Progress Toward the Synthesis of Flinderole C

Allen Benson, Delaware State University
Dr. Bryan Wakefield, Michael Brown, and Nicole Williams, Delaware State University

Malaria, which is caused by a protozoan parasite of the genus Plasmodium, is a vector-borne disease carried by female mosquitoes of the Anopheles genus. This disease affects nearly all areas in tropical climates infecting 190 million people worldwide with sub-Saharan Africa accounting for the majority of the fatalities. The presence of multidrug-resistant parasites and the lack of new treatments have hindered the fight against this disease. Flinderole C, which was discovered from the bark of the plant, Flindersa amboinensis, has displayed antimalarial activity against a number of parasite lines including Dd2, which is chloroquine resistant. This activity combined with a good selectivity index (SI) makes flinderole C an ideal compound for synthesis and drug development. The key step in the synthesis is a Lewis Acid promoted Friedel-Crafts cyclization. To date, two model systems have been synthesized that demonstrate the viability of this reaction and providing access to the tricyclic core of flinderole C. The cross-metathesis used to construct the cyclization precursor has proven to be irreproducible and an alternative route is planned for application to the natural product. *[Acknowledgement: NSF/HRD for an award to Dr. Bryan Wakefield through the DESU SMILE Program NIH/NIGHMS through a MARC fellowship awarded to Allen Benson.]*

Faculty Advisor: Bryan Wakefield, bwakefield@desu.edu

109
Triphenyltins as Possible Larvicidal Agents Against Anopheles stephensi Mosquito Larvae

José DelaO Hernández, University of the District of Columbia

Triorganotins (R3SnX) are reported to have various biocidal properties. Different species of unicellular and complex organisms are susceptible to diverse triorganotin compounds, with the toxicity of the triorganotins being species specific. The organic R group attached to the tin atom is responsible for the species specificity of triorganotins. Mosquito larvae have been reported to be affected by various triphenyltins. A factor that may play a role in the effectiveness of triorganotins as bio-agents is their solubility.

It is hypothesized that the toxicity may increase with a more soluble triorganotin. To that extent, a diverse series of ionic triphenyltins were synthesized and evaluated against Anopheles stephensi (An. stephensi) larvae. The compounds included the diethylammonium, diisobutylammonium, and di-n-butylammonium salts of thiolactatotriphenylstannate. Stock solutions (300 parts per million) of the triorganotin complexes were prepared in 95% ethanol. Toxicity studies were performed in 100 x 15 mm Petri dishes using 10 larvae. The An. stephensi larvae were transferred into the Petri dishes along with 15mL of deionized water and aliquots of the triorganotin solution. The dissolution of the triorganotin in the organic media was to facilitate the dispersion of the compound in water. Additional water was added to adjust the triorganotin solution to the desired concentration. The total assay in each volume was 20mL. Both positive (solvent and water) and negative (water) controls were used in the assay. The assay was done in triplicate. The larvae were exposed to the triorganotin complexes for a period of 24 hours, and the mortality rates were determined by visually counting. Mosquito larvae that showed the slightest reflex to disturbance were counted as being alive, and the LC50 values were obtained using a Probit analysis. The LC50 values for the diethylammonium, diisobutylammonium, and di-n-butylammonium salts were 5.04 ± 0.47, 5.67 ± 0.70, and 5.13 ± 0.31, respectively.

The preliminary results are similar to the results found for other triphenyltins. This would suggest that this series of compounds can be considered as potential larvicides against An. stephensi larvae. Furthermore, no substantial difference in toxicity was observed between the complexes, suggesting that changing the amine portion of the molecule would not alter the toxicity of the compounds. *[Acknowledgement: Financial support from the Science, Technology, Engineering, and Math Program at the University of the District of Columbia and the National Institutes of Health Minority Biomedical Research Support Program (MBRS/SCORE, GM08005) are gratefully acknowledged. The Entomology Department at the Walter Reed Army Institute of Research is gratefully acknowledged for providing the Anopheles stephensi mosquito larvae.]*

Faculty Advisor: George Eng, geng@udc.edu

110
Interactions of 1,3-Butanediol and Water

Vahid B. Eyorokon, Central State University
Christopher Booker and Daqing Gao, Central State University, OH

Structures and binding free energies between protonated 1,3-butanediol and one, two, and three water molecules are being extensively studied by ab initio molecular orbital and density functional theory calculations at different theoretical levels with a variety of basis sets, including HF, B3LYP, X3LYP, B971, B972, HCTH, MP2, M06, M06-L, M06-2X, as well as several newly developed dispersion corrected DFT-D methods. This ongoing study provides a timely validation of new theoretical methodologies, as well as confirmation and clarification of experimental observations. A number of challenging issues associated with this research are pursued, such as the sites of protonation, conformational search and BSSE. All the optimized conformers are confirmed as local minima structures from frequency calculations. The computed binding enthalpies, entropies, and free energies are compared to the latest experimental values from the electrospray ionization high pressure mass spectrometry obtained by scientists from the National Institutes of Health, and to accurate MP2/CBS and CCSD(T)/CBS extrapolation benchmark results.
[Acknowledgement: This research is supported, in part, by a HBCU-UP grant from NSF awarded to Dr. Daqing Gao, Central State University, Wilberforce, Ohio.]

Faculty Advisor: Dr. Daqing Gao, dgao@centralstate.edu

111
Oxidation of Ferrocytochrome *c* by Aryl Diazonium Ions: Electrochemical Reduction of Aryldiazonium Ions and Diazenes

Micah Fernandez, Regis University
Hong T. Lee, Nhan V. Pham, Ryan P. Farmer and Surendra N. Mahapatro, Regis University, CO

Aryldiazonium ions and diaznes are known to induce "Heinz bodies" due to irreversible inactivation of hemoglobin. The molecular basis of diazonium ion and diazene toxicity is a current area of research. The aryl diazonium ion's ability to oxidize deoxy-hemoglobin and the concomitant capture of the aryl radical as the stable σ-aryl complex with iron (III) has been demonstrated (Doyle, M.P. Mahapatro, S.N.; Van Zyl, C.M.; Hester, M.R. Electron transfer in the Heme pocket of Hemoglobin. *J. Am. Chem. Soc.* 1985, 107, 6136-6137). In spite of the extensive literature on the redox chemistry of diazonium salts, to the best of our knowledge, there are no biochemical studies on the electron transfer reactions between diazonium salts and cytochrome *c.*

We have studied the extremely fast oxidation of ferrocytochrome c by *p*-nitro and *p*-cyano aryldiazonium tetrafluoroborate salts by stopped-flow UV-Vis spectrophotometry. The observed electron transfer rate constants are in agreement with calculated rate constants using Marcus equation for outer-sphere (non-bonded) reactions. In the absence of a reproducible set of red-ox potentials for aryldiazonium ions, the electrochemical reduction of a series substituted aryldiazonium tetrafluoroborate salts has been studied in acetonitrile, aqueous acetonitrile phosphate buffer (pH 7-7.4) and phosphate buffer (pH 7-7.4) by cyclic voltammetry (platinum, glassy carbon and PGE working electrodes). Substituted aryldiazonium tetrafluoroborate salts were synthesized by literature methods (Doyle et al. *J. Org. Chem*. 44 (1979) 1572-1574; Tour et al, *J. Am. Chem. Soc*. 2001, 123, 6536-6542). Aryldiazene (p-nitro) was synthesized by the method of Kosower & Huang (*J. Am. Chem. Soc*. 1968, 90, 2354-2361) andTraylor & McKenna (*J. Am. Chem. Soc.* 1971, 93, 2313-2314).

As reported in earlier electrochemical literature, the reproducibility of peak potentials in repetitive scans was influenced by electrode fouling and history of the working electrodes with regard to mechanical abrasion. Substituent effects have been analyzed using Hammett substituent constants (σ and σ^+). Consistent with our earlier reported work in aqueous acetonitrile, for aryldiazonium salts with electron withdrawing substituents (nitro and cyano), one-electron quasi reversible waves ($\Delta E_p > 58/$ mV; $i_{pa}/i_{pc} < 1$) were observed (241 National Meeting of the American Chemical Society, March 27-31, 2011). The pH dependence of the quasi reversible waves implicated the anti-diazotate derived from the diazonium ions in aqueous acetonitrile phosphate buffer. Spectrophotometric titrations confirmed the rapid formation of the anti-diazotates of the aryldiazonium ions with electron withdrawing substituents. We attribute the quasi-reversible waves to one–electron oxidation of the anti-diazotate to the diazotate radical (Ar-N=N-O). Future directions for our work will involve copper containing proteins such as spinach-plastocyanin and cytochrome *c* oxidase, complex IV, of the electron transport chain in mitochondria. *[Acknowledgement: WAESO, Hispanic Research Center, Arizona State University]*

Faculty Advisor: Dr. Surendra Mahapatro, smahapat@regis.edu

112
Purification and Utilities of Hydrogenase for Biohybrid Catalysts

Kole M. Grain, University of Massachusetts, Amherst / Southern University of Shreveport, LA

Hydrogen has become a growing interest in the economy due to the dwindling petroleum reserves, increased energy demands, and environmental effects of CO2 emissions. Hydrogen, unlike petroleum, has no natural reserves. The current problems of hydrogen utilization lie within the storage, transportation,

production, and delivery of hydrogen. Our current H2 production methods consist of reformation, electrolysis, and microbial reformation. These reformation methods all generate CO2 emissions, while the electrolysis method is inefficient. Therefore, a catalyst must be developed that increases the efficiency of H2 production and H2 oxidation, and remain environmentally friendly.

Thus my project consisted of the study and research of Hydrogenase (H2ase) isolated from the bacteria Thiocapsa Roseopersicina. The H2ase was purified from 350 g of Cell Paste to 27 mg of H2ase through the uses of filtering, ion exchange chromatography, hydrophobic chromatography, fast liquid protein chromatography, and gel electrophoresis. Currently this isolated enzyme is going to be used in conjunction with nanoparticles to create a biohybrid catalyst with a high efficiency. We are currently awaiting the results. *[Acknowledgement: The National Science Foundation]*

Faculty Advisor: Crisjoe A. Joseph, joseph@chem.umass.edu

113
Synthesis of Novel Agents for use in Addiction Treatment

Kierra Hill, Savannah State University

Drug addiction is a widespread problem of increasing concern in the United States. Sharing injection drug works such as needles or syringes with someone who is HIV positive is the second-most -common way of contraction HIV among both black men and black women. Because drug use and particularly methamphetamine use, which is on the increase among African Americans is often associated with higher incidence of unprotected sex, then it can be reasoned that an appropriate strategy for fighting HIV transmission is to treat drug addiction. Post-mortem studies of drug addicts indicate elevated levels of D3 receptors in the mesolimbic regions of the brain responsible for feelings of reward and pleasure. The concentration of dopamine D2 receptors may be critical targets for effective therapeutic intervention to assist in treating addiction. Benzazepine derivatives have been reported to possess anti-depressant properties and are quite useful in the treatment of chronic neurological disorders including brain damage resulting from epilepsy, stroke, Alzheimer's disease, drug abuse and AIDS-related dementia.

Our immediate objective in the project is to determine dopamine D1, D2, D3, D4, D5 and serotonin 5-HT receptor binding affinities of novel benzofuro-benzazepine-6-12-dione derivatives. In general, we expect to assist in the development of D3 receptor selective antagonists or partial anognists for use as antipsychotics in the treatment of addiction-related psychosis. The overall aim of this project is to contribute to a better understanding the role of D3 receptors in addiction as well as to assist in the development of a therapeutic pharmacophre for central nervous system disorders. *[Acknowledgement: The National Science Foundation]*

Faculty Advisor: Dr. Karla-Sue Marriott, marriottk@savannahstate.edu

114
Stabilization of Acyclic N4 by D-Block Metals

Shanese Jasper, Alabama State University

Complex forms of nitrogen are of interest for their potential as high-energy materials, but many nitrogen molecules Nx are very unstable, which limits their application. Acyclic N4, for example, is essentially unbound, dissociating to N2 + N2 with a near-zero barrier. In the current study, several molecules MN4 (M = metal atom or ion) are examined by theoretical calculations to determine the energies of their dissociation and rearrangements. Energetic differences between electronic states are also calculated and discussed. Predictions will be made as to which d-block metals are best able to stabilize the N4 molecules with respect to dissociation. *[Acknowledgement: NSF/HBCU-UP/ NIH/RIMI/ NIH/MARC/PRF]*

Faculty Advisor: Douglas Strout, dstrout@alasu.edu

115
Broadband Nitrile Reaction Screening

Kiera Matthews, Johnson C. Smith University
Hanifah K.L. Hendricks, Nathan A. Seifert, and Daniel P. Zaleski, University of Virginia

The analysis of electrical discharge chemistry resulting from the two abundant interstellar species, H2S and CH3CN, has suggested a correlation between molecules synthesized in the discharge and interstellar survey species. By identifying these known molecules and understanding their formation pathways, further screening of the laboratory data against interstellar survey spectra for unassigned transitions can lead to new interstellar detections. The molecular carriers can then be identified using chemical principles. The current testable hypothesis is that many of these nitriles may have similar formation chemistry in regions such as Sgr B2(N). A broadband reaction screening of these nitriles has been performed. The chemical processes identified are radical formation followed by radical-radical recombination, and energetically feasible loss of molecular hydrogen.

Based on this chemistry two new molecules have been identified, mercaptoacetonitrile and cyanothioformaldehyde. Because of the bias of the discharge nozzle to create interstellar species, these are potential candidates for interstellar detection even though they don't appear in the PRIMOS survey.

Furthermore, the assignment of HCSCN is confirmed by obtaining the atom positions of sulfur and nitrogen. *[Acknowledgement: NSF-funded Virginia-North Carolina Louis Stokes Alliance for Minority Participation (LSAMP)]*

Faculty Advisor: Daniel Zaleski, mwinters@jcsu.edu

116
Chemopreventive Potential of Coffee and Cocoa against Azoxymethane-Induced Aberrant Crypt Foci in a Rat Model

Breanna McArthur, Alabama A&M University

On a per capita basis in the U.S., chocolate is third behind coffee and tea as a daily source of antioxidants. Phytochemicals in cocoa and coffee can be related to their health-benefits. Although antioxidant properties of chocolate and cocoa have been known for some time, there has been no examination of its place in the U.S. diet as a chemopreventive agent. The purpose of this study was to investigate chemopreventive potential of cocoa and coffee on Azoxymethane-induced aberrant crypt foci (ACF) in Fisher 344 rat model and to determine Glutathione S-transferase (GST) and Catalase (CAT) activities.

Fisher 344 rats were randomly assigned to 9 groups after a 1-week acclimatization period. One group (n=5) was assigned to a control diet (C) (AIN-93G) and 4 groups (n=5) were assigned to; CF and CC as drink and meal (0.5% and 1%). Rats received 2 s/c injections of AOM at 7 and 8 wks of age @ 16mg/kg body weight. Biweekly body weights and daily feed and fluid intakes were recorded. At 17 wks of age, rats were killed by CO2 asphyxiation. Colon and liver samples were collected and stored until analysis using standard protocol. ACF induced in rats fed C was significantly ($p<0.05$) higher (120) compared to rats fed 0.5% and 1% CF (69.5,62.3) and CC (100.8, 71.2) as meal and CF (60,44.52) CC as drink (79,64). CF drink was more effective in reducing ACF compared to other treatments. GST (µmol/min/ml) was significantly ($p<0.05$) higher in rats fed CF (1.550) and CC (1.789) compared to C (0.477). CAT activity (µmol/ml) was 0.84, 0.81 (CF), 0.86 and 0.85 (CC) in rats fed 0.5 and 1% as meal and 0.78, 0.8(CF) and 0.88, 0.74 (CC) at 0.5 and 1% as drink compared to C (0.2).

Consumption of CF and CC reduced Azoxymethane-induced ACF and may have implications in prevention of chronic diseases such as colon cancer. These results suggest the need to further explore the metabolism of phytochemicals in coffee and cocoa and its relation to human health. *[Acknowledgement: HBCU-UP]*

Faculty Advisor: Martha Verghese, martha.verghese@aamu.edu

117
Biological Chemistry of Chromium(V)

Macedonio Mejia, Regis University
Joshua Gallegos and Surendra N. Mahapatro, Regis University, CO

Since the first report of the reaction of chromates with nucleic acid and nuclear proteins (Herman and Speck, *Science*, 1954, 119, 221), there has been resurgence in the biological chemistry of chromium (Vincent, J.B.; *Acc. Chem. Res*. 2000, 33, 503-510) especially involving chromium(III) picolinate as a dietary supplement and the undefined role of chromium(III) in the glucose tolerance factor (GTF) (Mertz et al., *Fed. Proc.* 1974, 33 2275-2289). Chromium(V) has been clearly implicated in biological impairment resulting from chromates. The electron transfer and ligand binding properties of chromium(V) are important to the understanding of the molecular basis of chromium toxicity. The "*Synthesis of a Pyridinum Bis[citrato(2-) oxochromate(V) complex and Its Ligand Exchange Reactions* (Mahapatro et al, *Inorganic Chemistry*, 2003, 42, 6458-6468) has provided a more realistic and physiologically relevant model for the study of chromium toxicity at the molecular level. Negatively charged chromium(V) complexes encounter a charge barrier as they approach the negatively charged DNA.

It is therefore import to learn the chemistry and biochemistry of oxochromium(V) cations or neutral complexes that could be potentially damaging to DNA due to the absence of the columbic barrier. Toward this end, we have studied the kinetics and equilibria of ligand exchange at the substitution-labile chromium (V) centers with biologically important ligands such nicotinic acid (one of forty essential human nutrients), nicotinamide, and guanine, maltol and salen (Schiff base).

Biscitrato-chromium(V) complex was synthesized by following our published method. Ligand exchange experiments with 0.1 M nicotinate and nicotinamide did not show any new signal with characteristic nitrogen hyperfine structure. Our results demonstrate the critical need for 2-carboxylate (picolinate) for facile ligand exchange at a Cr(V) center. Interestingly, no ligand exchange with guanine was observed in DMF. As the carboxylic acid group is one more carbon removed (relative to picolinic acid) from the nitrogen, the bite distance necessary for complexation to chromium both in Cr (V) and Cr(III) may not be optimal. This was reflected in the inability of the above mentioned ligands to exchange at the Cr(V) center. Preliminary ligand exchange reactions with maltol were initiated by dissolving the Cr(V) solid in a dimethylformamide (DMF) solution of maltol (2 mg/mL). In addition to the original Cr(V)-citrate signal signal (g_{iso} = 1.9781 in both DMF and H_2O), a new signal (g_{iso} = 1.973) was observed indicating ligand exchange. The relative ratio of the two signals was approximately 70:30. Both the signals decayed in first-order processes. We are currently extending our work to the Schiff base ligand salen. *[Acknowledgement: WAESO, Hispanic Research Center, Arizona State University]*

Faculty Advisor: Dr. Surendra N. Mahapatro, smahapat@regis.edu

118
Emissions Measurements of Dairy Facilities in Central California

Catalina Olea, California State University, Fresno
Dr. Alam Hasson, Kennedy Vu, Austen Scruggs, Lucien Nana, Ramya Addala, Srikar Middala, Jeff Cole, and Shawn Ashkan, California State University, Fresno

Emissions from dairy facilities are thought to be an important contributor to air quality violations in Central California. The emissions inventories from these sources contain significant uncertainties. In this work, Volatile organic compounds (VOC), greenhouse gas (CO2, N2O and methane) and particulate matter precursors (primarily ammonia) emissions were measured from Central California dairies during 2010 and 2011. These compounds affect the environment in different ways, VOC compounds have an impact on lower atmosphere layer, the greenhouse gases affect the temperature of the earth and particular matter can cause health related problems.

The gas samples were collected using different methods and at different heights. Flux measurements were made using two approaches: a) isolation flux chambers were used to measure direct emissions from specific dairy sources; and b) upwind/ downwind ambient profiles were measured from ground level up to heights of 100 m and then back-trajectory calculations were used to determine emissions. Samples were collected using a combination of canisters and sorbent tubes, and were analyzed by GC-MS. Additional in-situ measurements were made using infra-red photoaccoustic detectors and Diode Laser Absorption Spectroscopy. Temperature and ozone profiles up to 250 m above ground level were also measured using a tethersonde. Substantial fluxes of a number of VOCs including alcohols, volatile fatty acids and esters were observed at both sites.

Implications of these measurements for regional air quality will be discussed, and the two techniques used to measure fluxes will be compared. Determining the amount of emission can lead to determining a method of control of these compounds. *[Acknowledgement: This study was supported by the National Science Foundation, National Oceanic and Atmospheric Administration, and the United States Department of Agriculture: National Science Foundation (Grant 080262)]*

Faculty Advisor: Dr. Alam Hasson, ahasson@csufresno.edu

119
Nelfinavir (Viracept®) and Its Silicon Analogue As HIV-1 Protease Inhibitors: Synthesis and Evaluation

Victoria Parker, Norfolk State University

There is no known cure for HIV/AIDS, and it is imperative to develop a drug that will prevent the replication of the virus, without the stressing concern for resistance as well as creating a mechanism that will slow down the mutations of the virus and isolate viral load in the infected human.

This study considers the history of HIV-1 inhibition therapy and utilizes the drug Nelfinavir (Viracept®) as a starting platform for the preparation of a newly improved drug with silicon analogue implementation. This modified drug was being chemically synthesized by parts and by using processes such as reflux, evaporation and vacuum filtration. The identity of each synthesized compound was then confirmed by IR spectroscopy. SYBYL software was then used to test and compare the effectiveness of Nelfinavir against the silanediol analogue along with five other silanediol analogues. The original silanediol analogue had a docking measurement of 4.48 protein/ligand and Nelfinavir had a docking measurement of 2.68 protein/ ligand. The most effective silanediol analogue, according to SYBYL software, proved to be the fifth silanediol analogue with a docking measurement of 5.69 protein/ ligand. In conclusion, each part of the modified drug was successfully synthesized and confirmed by IR spectroscopy. The modified drug with the silanediol implementation proved to be more effective than Nelfinavir according to the Surflex dock calculations from the SYBYL software. *[Acknowledgement: The National Science Foundation]*

Faculty Advisor: Dr. Wondwossen Arasho, wdarasho@nsu.edu

120
Characteristics and Activity of Hydrotalcite

Vannary Sann, California State University, San Bernardino

To model a reaction where hydrotalcite catalyzes a conversion of 2-allysesamol to 2-propenylsesamol in the third step of Carpanone synthesis, eugenol is used to test the effects of hydrotalcite's activity and stability on reaction outcome. Hydrotalcite samples are prepared at three different pH ranges: 9-10, 10-11, and 11-12 by mixing a basic solution which contains NaOH and Na2CO3 with an acidic solution that contains Mg (NO3)2, 6H2O and Al(NO3)3, and 9H2O in a round bottom flask. The flasks heated in a 60°C oil bath for 10 hours. The pH 9-10, 10-11, and 11-12 samples yield an average 70.17%, 75.22%, and 7.56% conversion of eugenol to its isomers respectively. Hydrotalcite samples that store under nitrogen gas maintain the highest reactivity but the catalyst becomes less active when exposed to air over a long period of time. *[Acknowledgement:*

Department of Chemistry and Biochemistry, California State University San Bernardino Louis Stokes Alliance for Minority Participation grant NSF HRD-0802628.]

Faculty Advisor: Kimberley Cousins, kcousins@csusb.edu

121
Uptake of Novel Antioxidants across the Blood-Brain Barrier (BBB) in Bovine Brain Microvessel Endothelial Cells (BBMEC)

Phillisia Sims, University of Arkansas at Pine Bluff
Oderah Nwankwo, Kelin Key, Johnmesha Sanders, Trenton Ware, Antonie H. Rice, PhD., Abul B. Kazi, PhD., and Grant Wangila, PhD., University of Arkansas at Pine Bluff

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 BBMECs and to demonstrate that active transporters exist at the BBB that may provide alternative routes for delivering therapeutics to the brain.

In this study, we are assessing the uptake properties of newly synthesized antioxidants that may also show possible uses in treatment of oxidative stress caused by neurodegenerative diseases such as Alzheimer's disease. Compounds containing bis -benzimidazole family were shown to exhibit potent antioxidant activity. We, therefore, embarked upon the synthesis of imidazole-bridged dinuclear Cu and Mn complexes with 2-(2-pyridyl) benzimidazole as chelating ligands, with the hope that such complexes will strongly mimic native SOD.

Preliminary data from ABTS assay indicates that Rib-Cys and its copper and manganese complexes have strong antioxidant activity as indicated by their trolox equivalence of antioxidant capacity (TEAC) values. However, metal chelation appears to have no significant impact on the antioxidant activity of this ligand. The next step was to evaluate the uptake properties of the compounds across the BBB. The compounds screened were: 1)Tetrakis (3, 5-diisopropylsalicylato) Copper (II) = Cu2(DIPS)4, 2) Tetrakis (3, 5-ditertiarybutylsalicylato) Copper (II) = Cu2(DTBS)4, 3)Tetrakis (3, 5-dibromosalicylato) Copper (II) = Cu2(DBS)4, 4) Tetrakis (3, 5-dichlorosalicylato) Copper (II) = Cu2(DCS)4, 5) Tetrakis (3, 5-diiodosalicylato) Copper (II) = Cu2(DIPS)4, 6) Cu and Mn chelates of 2-Ribosylthiazolidine-4-carboxylic acid (Rib-Cys). All of the compounds were screened in vitro to determine if they were potential P-glycoprotein substrates by employing the Rhodamine 123 fluorescent assay.

The results of the uptake experiments provide evidence that the copper complexes as well as the Cu and Mn chelates have reduced affinity for p-glycoprotein and may potentially cross the BBB. Future studies to explain the reduced P-gp affinity observed includes evaluation and determination of in vitro permeablity coefficients via transport experiments, and the mechanistic determination of the transport pathways of the compounds. *[Acknowledgement: This study was supported, in part, by NIH Grant P20 RR-16460 INBRE Program awarded to Dr. Antonie Rice, Chair, Chemistry & Physics, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.]*

Faculty Advisor: Dr. Antonie Rice, ricea@uapb.edu

122
Synthesis of New Liquid for Dissolving Cellulose

Porshia Williams, Savannah State University

Cellulose is the most abundant biomass in nature. It is a natural polymer comprised of D-glucose as basic units. There is a growing interest in converting cellulose into D-glucose for the purpose of ethanol production. However, cellulose cannot be dissolved easily in most organic solvents, and its high crystallinity prevents the effective conversion of cellulose into sugars. Recent studies have suggested that some ionic liquids, a new type of non-volatile solvents, could dissolve substantial amounts of cellulose as an effective pretreatment method.

We hypothesize that an glycol-grafted ammonium based ionic liquid of acetate is capable of dissolving cellulose. The new ammonium based ionic liquid was synthesized through a multi-step reaction strategy by grafting a polyethylene glycol chain to the cation. We observed that the new ionic liquid is capable of dissolving 6% (wt) microcrystalline cellulose, and also possesses other favorable properties such as low viscosity, high biodegradability, low toxicity, and being inexpensive. The structure of new ionic liquid was confirmed by 1H and 13C NMR analysis. In conclusion, our new ionic liquids has been prepared successfully, and can be used for the pretreatment of cellulose. *[Acknowledgement: National Science Foundation (NSF)]*

Faculty Advisor: Dr. Hua Zhao, zhaoh@savannahstate.edu

123
Chromatogram Distortion Caused by Passive Headspace Sampling

Pahoua Xiong, California State University, Fresno
Seth Yates and Dr. Eric Person, California State University, Fresno

Automation of the comparison of unknown sample chromatographic data to libraries of reference data is problematic due to chromatogram distortion that can occur as a result of evaporative weathering of the sample, use of non-ideal sampling conditions, or small differences in the operating

conditions when difference instruments are used to collect the library and sample data. Previous work in our group has resulted in a chromatogram comparison approach for ignitable liquid data that is significantly less sensitive to evaporative distortion than conventional approaches to chromatogram comparison. The purpose of this project is to generate test samples showing the types of chromatogram distortion that may result in passive headspace concentration sampling (ASTM E1412) and to evaluate the ability of the ACCID algorithm to successfully identify the ignitable liquid in a chromatogram library.

Distorted samples were generated by varying the sampling oven temperature (25°C to 100°C), the length of heating (24 to 72 hours), and the size of the charcoal strip (0.79 cm^2 to 1.5 cm^2). Samples with low heating temperatures and short heating time showed light, volatile compounds, but did not show the heavy, volatile compounds. This is consistent with expectations based on the limited rate of transfer to the strip. Samples with high temperatures or long heating times showed loss of light volatile compound. This is consistent with overloading of the sampling strip where heavy products were expected to have a higher affinity for the strip and displace light components.

When analyzed against a library of over 113 unique source ignitable liquid products, the test samples generated in this study showed correct matches to the exact sample and matches another samples in the same ASTM product classes (e.g. other gasolines). The detection of the loss of heavy range products is the limitation of the algorithm. This illustrates that the ACCID algorithm was successful with loss of volatile compounds similar to evaporative distortion, but not for the loss of late volatile compounds.

The result of the algorithm demonstrates that the pre-processing strategy reduces the sensitivity of chromatogram distortions caused by passive headspace sampling. Future work is needed to modify the code of the ACCID algorithm to correctly identify the exact matches for the light petroleum distillates and kerosene. *[Acknowledgement: This work was funded and supported by the LSAMP Research Internship and LSAMP Scholar, which is funded by the NSF grant HRD-0802628-515291.]*

Faculty Advisor: Dr. Eric Person, eperson@csufresno.edu

124

Synthesis and Structure Characterization of Ionic Triphenyltin Complexes with Oxalic and Thiolactic Acids

Woldegebriel Yeibyo, University of the District of Columbia
Dain Thorpe, Andrei Callejas, Xueqing Song, University of the District of Columbia
Robert Pike, College of William & Mary, VA

There is a large need for the development of novel metal-based anticancer agents due to the low solubility and high organ toxicity of metal-based compounds such as cisplatin and its analogues. Triorganotins have been well established as having various biological activities. However, their low solubilities in water may have limited their effectiveness. On the other hand, ionic triorganotin complexes may have improved solubilities due to their partially ionic characteristics. The reaction of two diprotic carboxylic acids (oxalic acid and thiolactic acid) with triphenyltin hydroxide in the presence of dipropylamine yields two ionic triphenyltin complexes. The structures of the complexes are characterized by Infrared and 1H NMR spectroscopy and confirmed by X-ray crystallography to be monomeric. Both ionic complexes consist of an anionic moiety, and a dipropylammonium as the counterion. The anionic moieties of triphenyltin complex with thiolactic acid has a distorted cis-trigonal bipyramid (TBP) geometry with two carbon and one-sulfur atoms occupying the equatorial positions and an O atom and phenyl group occupying the axial positions. The ionic triphenyltin complex with oxalic acid shows similar geometry around tin atom. Both crystal structures show that the complexes exist as a dimer formed via an extensive hydrogen-bonding network between the carboxylate groups (OCO) from the stannate anions and the N atoms from the dipropylammonium cations.

The results indicate ionic triphenyltin complexes can be successfully obtained in a condensation reaction of triphenyltin hydroxide with a diprotic carboxylic acid in the presence of an organic amine. Future studies will be focused on relationship between aqueous solubility and biological activity. *[Acknowledgement: This study was, in part, by the University of the District of Columbia STEM program, Washington, DC 20008. Further funding provided by MARC U*STAR Honors Program.]*

Faculty Advisor: Dr. Xueqing Song, xsong@udc.edu

EDUCATION

125

The Salix Project: A Vertically Integrated, 'Project-based' Chemistry Module

Jamie Cahoon, Salish Kootenai College
Doug Stevens PhD., Salish Kootenai College, MT

Chemistry is an essential course in all programs in the life sciences and is often a stumbling block to many students. The objective of this pilot project is to emphasize fundamental concepts of chemistry such as, extraction, chromatography, rates and activation energy, and esterification, using a common, natural product-based approach. In this way, the learning process becomes fun, visual, active, and experiential. Willow was chosen not only because it is the basis of the most successful drug in history (aspirin) but also because it is

abundant, culturally relevant, to many Native American tribes (without being proprietary), and with ample amount of history to augment the classes (context). By using such a natural product-based vehicle it was felt that this would lead to an increase in comprehension and retention of these fundamental concepts.

The three courses involved were: Fundamentals of Organic Chemistry (a survey course), General Chemistry, and Organic Chemistry. The Fundamentals of Organic Chemistry class was responsible for collecting, extracting and identifying active constituents in the bark, i. e. salicin, a glucoside of salicyl alcohol (extraction chemistry, ester chemistry, thin layer chromatography). The Organic Chemistry class was then responsible for the isolating the salicin (column chromatography). Then the General Chemistry class hydrolyzed salicin to salicyl alcohol by both chemical and enzymatic means (reaction rates/activation energies). The salicyl alcohol was then oxidized to salicylic acid and purified by Organic Chemistry class (aromatic oxidation and recrystallization). Finally, the salicylic acid was esterified to acetyl salicylic acid (aspirin) by the Fundamentals of Organic Chemistry class with the upper Organic class students as mentors in the future. At the end of the five-week pilot project all three classes, will convene to evaluate the project through surveys and suggest improvements. *[Acknowledgement: This work was funded by NIGMS RISE Program, NIH Award 5-R25-GM076323.]*

Faculty Advisor: Dr. Doug Stevens, doug_stevens@skc.edu

Environmental Engineering

126
Optimal Methods for the Production of Biofuels from Waste Resources

Candace Daniel, Shaw University
Dr. Christopher Njue, Shaw University

The need for alternative energy sources has led to a renewed interest in the bioprocessing technologies for the production of biofuels. Our first initiative in this arena was in the processing of waste cooking oil into bio-diesel. Our current effort involves the optimization of the bio-diesel production methods and procedures. A comparison of the quantity and quality of bio-diesel obtained from waste cooking oil sources with that obtained from canola grown in Bertie County, North Carolina will be presented.

Results pertaining to the optimization of the bio-diesel production methods and quality control procedures for the bio-diesel will be presented. Future directions for this project will involve a mobile bio-diesel unit for the outreach of this technology to the community and for educational purposes to K-12 students. *[Acknowledgement: (1) NSF Shaw University HBCU -UP; (2) NSF "Targeted Infusion to develop bio-based technology capability among minority students at Shaw University"]*

Faculty Advisor: Dr. Christopher Njue, cnjue@shawu.edu

Materials Science

127
Development of a Nano-structured Cathode Materials in Lithium-Ion Batteries

Monica Quintero, California State University, Los Angeles

Lithium rechargeable batteries have become the main power source for electronics due to high energy and long battery life. The uses of these batteries are not only applicable to computers, but for powering vehicles, cutting down on the emissions of CO2. Lithium ion batteries offer the largest energy density and output of all known rechargeable batteries. However, transition metal oxides, commonly used as cathode materials, in these batteries are wrought with safety concerns, poor rate capacity and capacity degradation over a long period of time. Hence the current lithium batteries cannot be used in vehicles. This study focuses on creating a cathode to ultimately be used for a lithium ion battery. In building such a cathode, metal phosphates are used to synthesize carbon-coated LiMPO4 (M=Co,Mn,Ni) nano-particles (NPs). These new lithium materials are expected to have high electric and ionic conductivity, coulomb efficiency, rate capability, capacity retention and cycle life. To synthesize the NPs, a hydrothermal method is used. This method uses a combination of solvents and heat to control the size and shape of NPs. To assure that the correct product was synthesized, x-ray diffraction (XRD) was used to measure the crystal structure. Since each product has its unique crystal structure, by using a database, the structure of the synthesized compound was compared to the database.

In the synthesis process, many conditions were varied (i.e. pH, temperature, and ratio). It was found that the product that produced an XRD reading closest to the database, only the temperature was varied, pH and the ratios of reactants remained the same. The future plans for this project are to use a layer-by-layer process of coating the LiMPO4 NPs with carbon, so that the NPs can connect electronically and to characterize our product using atomic force microscopy, scanning electron microscopy, and Raman spectroscopy. *[Acknowledgement: This study was supported by funding from the NSF awarded to the CEAS program.]*

Faculty Advisor: Dr. Dianlu Jiang, dianlu_jiang@yahoo.com

COMPUTER SCIENCES & INFORMATION MANAGEMENT

BIOMEDICAL ENGINEERING

128
Interactive User Interface (UI) for the Support of a Virtual Coaching System

Eric Corbett, Savannah State University
Portia Taylor, Jessica Hodgins, and Takeo Kanade, Carnegie Mellon University, PA

In this paper we discuss the development of an interactive user interface (UI) to provide a quick and cost effective method of labeling exercise video data for classification. This tool will be used by physical therapists to give subjective assessments of the quality of the exercises performed by patients. The MATLAB graphical user interface development environment (GUIDE) was used to design and program the interface.

Researchers are developing an intelligent home coaching system that will be able to recognize errors in the exercise performances of patients with knee osteoarthritis (OA). In order for the system to be able to detect these errors, it needs to know examples of the types of errors that may occur. This is accomplished by providing a classifier with exercise data labeled by a physical therapist. However, previous methods of labeling training data involving spreadsheets and manually writing have been expensive and time consuming. The focus of this work is to develop an interactive method to label patient exercise data that will increase the speed and efficiency of the labeling process.

The current version of the UI allows for easy labeling of data. Future work will include experimenting with more interactive methods of labeling and having the UI tested by a physical therapist and feedback will be taken on ways to improve the system. *[Acknowledgement: Funding for this research was provided by the National Science Foundation, Grant 0540866.]*

Faculty Advisor: Portia Taylor, taylor.portia@gmail.com

COMPUTER SCIENCE & INFORMATION SYSTEMS

129
Development Health Disparities Database For Chatham County and Georgia

Tyquan Burney, Savannah State University

The goal of the preset study is to retrieve three measures from the Online Analytical Statistical Information System (OASIS), including morbidity, mortality and Emergency Room Visits. OASIS is a suite of tools used to access the Georgia Department of Public Health standardized health data. The idea is to improve our understanding of health disparity by identifying diseases that qualify as health disparities. Although there are many diseases pertaining to health disparities, this study will only focus on the following 10 diseases: lung cancer, colon cancer, prostate cancer, respiratory disease, obstructive heart disease, major cardiovascular disease, diabetes, HIV, stroke, and high blood pressure. These diseases were chosen based on suggestions made from the Community Advisory Board of RIMI.

To accomplish these goals, the present research will use Excel worksheets and Power Points to organize the data and charts of the diseases listed above by groups of different age, race, and gender. Accordingly, this study will consult the databases of Chatham County and Georgia, from 2002-2008, to identify and document the above health disparities.

Two general conclusions of the present research are that: (1) men are more likely to have a stroke than women, and (2) strokes happen more in white people than compared to black people. Some other findings are that lung cancer is more present in men than in women, and that white people compared to black people are more likely to be diagnosed with lung cancer. Also by comparing groups of different ages, the present research was able to conclude that High Blood Pressure becomes more present as people get older. Future direction of this research will be to analyze other Health Disparities comparing groups of men and women (blacks and whites) of different ages. *[Acknowledgement: National Institutes of Health]*

Faculty Advisor: Dr. Deden Rukmana, rukmanad@savannahstate.edu

130
Self-Regulation in Artificial Agents

Mikhail Creary, Bowie State University, MD

This project describes a self-regulated system that uses metacognition to monitor expectations, notice expectation violations, assess the situation, and guide a response. The test bed for our research is a simple search and rescue robot implemented in the player/stage setting. The environment for the robot includes walls & different models, which based on its color; the robot will either destroy or avoid. The robot collects destroys 'orange' and “red” items that come in the way and avoids 'blue' and “black” items as well as walls. Without metacognitive ability, the robot acts as a simple reflex agent wanderer robot, exploring its environment and collecting or destroying items while avoiding obstacles in its path. The obstacle avoidance algorithm works as follows: when the robot comes within a certain distance of an object, it decides to turn right, turn left, or back away from the object to avoid it. With

metacognition, the robot can monitor expectations and adjust the range of its cameras to avoid obstacles better. *[Acknowledgement: NSF, NASA]*

Faculty Advisor: Darsana Josyula, djosyula@bowiestate.edu

131
Determining a Criteria for Ontology Extraction Techniques for the Evaluation of a Sub-ontology Extraction from the Human Phenotype Ontology

Rhonda Davis, Howard University

There are various competent methodologies existing for the task of creating an ontology, the daunting part is settling on the most efficient technique for the project at hand. We consider the issue of the lack of a gold standard to determine a complete ontology. We generate a benchmark for evaluating an assortment of techniques to extract and modify an ontology, we conclude with the most sound technique based on our metric and purpose. The success of this endeavor might ensure future works on ontology building use the most reliable technique available and have a measure of "completeness". *[Acknowledgement: This study was supported, in part, by a grant from NSF awarded to Dr. Lorraine N. Fleming Ph.D., P.E., Professor of Civil Engineering, Howard University, Washington, DC.]*

Faculty Advisor: Andrei Coronel, acoronel@ateneo.edu

132
Navigation Program for 3D Models

Melissa Greenlee, University of Houston-Downtown

The purpose of this project is to create a program using Microsoft XNA that will allow a user to upload any 3D model and be able to navigate through the model. Model navigation will include collision detection to make movement experience more realistic. This program can be used for familiarization with facilities prior to visitation or as a training implement for personnel in case of emergency situations. In addition, this program would be useful in previewing a facility model and determining functionality and aesthetics before construction.

The main problem is to develop a collision detection algorithm to detect model objects. A camera object was created for navigation and collision detection. Another problem is placing the camera so that it is not placed in the model where it will detect a collision upon loading of the model.

In order for the developed collision detection algorithm to function properly, the 3D models uploaded must be drawn in a specific way. Another issue encountered was how to ensure that models would load without the camera object initially detecting a collision. Due to this issue, another algorithm was created that uses model vertex information to determine initial load position of the camera.

With the algorithms for collision detection and camera loading, the program created was successful with user navigation and collision detection. Several different models were tested, and it appears that any bugs in the program have been resolved. Further testing with more models will bring to light any other program bugs that may need to be addressed.

In the future, we plan to incorporate this program with other another project that uses a VizWall to create a fully interactive virtual environment. *[Acknowledgement: We would like to acknowledge the NSF for funding the Computer Science REU at the University of Houston-Downtown which supported this research. We would also like to acknowledge XNAVideoTutorials.com for their very helpful videos on how to use Microsoft XNA since neither programmers had any prior experience in using XNA.]*

Faculty Advisor: Dr. Ongard Sirisaengtaksin, sirisaengtaksino@uhd.edu

133
SpelBotica: iOS Virtual World Environment for Humanoid Robots

Amelia Henderson, Spelman College

The growing increase in robotics programs and discussions has sparked interest among students throughout the world. While funds are being provided through new initiatives by the United States President and various science foundations for large scale robotics to aid in healthcare, manufacturing, and numerous other areas, there still are very little funds available to assist with middle and high school robotics programs or clubs. This means that students in most schools often have very little experience with actual robots.

One means of addressing this problem is through the use of virtual worlds. Virtual worlds give users the ability to perform tasks that could not be done in the real world because of constraints such as cost or location. An effective and interactive way to provide students with more experience in robotics is by creating an iOS application as well as a virtual world environment that would allow students to control a virtual world and a real world robot to play a game of soccer through an iOS application.

Scripting a soccer game environment in the virtual world of OpenSimulator for use with robotics has proven to be a feasible task. Although there is more scripting left to be done within the environment, the beginning setup has been completed. Users

are able to interact with robots in the virtual world and receive responses from robots contained inside of the virtual world.

Building and scripting the objects and robots inside of the virtual world is just one step of a three-part process. As the commands are executed inside of the virtual world, the same commands need to be sent to the NAO robot in the real world. Once the NAO receives this information, it then needs to execute the commands.

Once all parts of the SpelBotica project are connected, tests will be run to ensure that the virtual world robots' behaviors match that of the real world robots. *[Acknowledgement: National Science Foundation HBCU-UP grant HRD-0714553, ASPIRE, Broadening Participation in Computing grants CNS-1042454, SpelBots, CNS-0742252, ARTSI, Boeing Company, General Motors.]*

Faculty Advisor: Dr. Andrew Williams, Williams@spelman.edu

134
Automatic Ultrasonic Headway Control for a Robotic Car

Chanel Johnson, Spelman College

Intelligent Transportation Systems and supporting technologies have been an active area of research for a while. Human drivers exhibit slower response times and errors can be reduced or eliminated from the driving experience by introducing computer control systems into the automotive arena.

The purpose of this research is to develop a scale model platform for the rapid prototyping and testing of ITS systems and technologies. Specifically, this body of work was concerned with the development of an automatic headway control system that utilized ultrasonic sensors. This control system was intended to automatically maintain headway distance in an effort to create an adaptive cruise control system for this model vehicle. Implementation of such systems could conceivably reduce crashes by removing the burden of maintaining safe following distance from the driver. *[Acknowledgement: This work is supported by the National Science Foundation HBCU-UP grant HRD-0714553, ASPIRE, and Broadening Participation in Computing grants CNS-1042454, SpelBots, and CNS-0742252, ARTSI, along with support from the Boeing Company, and General Motors.]*

Faculty Advisor: Andrew Williams, williams@spelman.edu

135
AutoBot: Android-Based Tablet Control of a Semi-Autonomous Humanoid Robot

Breoshshala Martin, Spelman College
Tyler Davis, Spelman College

Our objective is to develop a mobile application that can be used as a wireless controller for a semi-autonomous humanoid robot. We are working to allow the Android tablet to interoperate with parts of the humanoid Nao robot such as its sensors, motors, and joints. This objective will lead to further exploration of using robots to interact with children who have trouble with motor coordination. We demonstrate the feasibility of our system and describe the benefits of using Android as a platform for controlling robotic systems. *[Acknowledgement: This work is supported by the National Science Foundation HBCU-UP grant HRD-0714553, ASPIRE, and Broadening Participation in Computing grants CNS-1042454, SpelBots, and CNS-0742252, ARTSI, along with support from the Boeing Company, and General Motors.]*

Faculty Advisor: Dr. Andrew Williams, williams@spelman.edu

136
Identifying Uniqueness in High Dimensional Social Science Datasets

Cornelius Myles, Mississippi Valley State University
Asha Saravanamohan, Jackson State University, MS
A. Cheyenne Solomon and Raquel Hill, School of Informatics and Computing, Indiana University

Social scientists at the Kinsey Institute for Research in Sex, Gender and Reproduction gather large amounts of sensitive data from individuals. These datasets are high dimensional, which presents many opportunities to characterize participants in unique ways. The primary purpose of this project is to identify unique characteristics in high dimensional datasets and determine whether uniqueness leads to re-identification. By using data collected from the surveys that the Kinsey Institute supplied, we combined certain answer choices to determine which characteristics make people unique in a dataset. Our results showed that an average of 98.72% of people could be re-identified in the datasets. *[Acknowledgement: This work is funded by NSF grant CNS-101 2081.]*

Faculty Advisor: Dr. Raquel Hill, ralhill@indiana.edu

137
2011 Internship in Educational and Assistive Technology Lab at Auburn University

Cassandra Stephens, Auburn University

During Summer 2011, my internship at Auburn University included various activities. Among these were learning Kodu and Alice, object oriented software programs that are used in Robo Camp – a robotics and game programming camp offered for children in K-12 every semester at Auburn University. I also participated in a teachers' workshop organized by Computer Science and Software Engineering Department in collaboration

with Microsoft Co., and NSF Access Computing Alliance. In addition, I evaluated the accessibility of an Auburn graduate student's master's project website. I also was exposed to many different aspects of Computer Science through interaction with other students from the undergraduate to doctorate level. This internship provided me with an introspective look at Computer Science. *[Acknowledgement: DREU AASD-STEM]*

Faculty Advisor: Daniela Marghitu, MARGHDA@auburn.edu

138
Multi-User Environment in VR for Evacuation Scenarios Using Gaming Metaphor

Michael Tice, Bowie State University
Aaron Boothe, Zachary Springer, and Dr. Sharad Sharma, Bowie State University

Virtual Reality (VR) training has been used for training and education for many years in military and medical fields. Pilots and surgeons have both used VR as a training method in preparation for their respective jobs. Using VR in an evacuation scenario can be useful in industry as it provides users with accurate scaled models of their respective workplaces for a more targeted approach. For example, architects can design buildings with more efficient evacuation routes with the help of VR. Complementing pen and paper evacuation tools such as maps or drawings, adding VR training adds a more visually stimulating experience and can prove more effective than pen and paper alone. We have used game creation as a metaphor in creating an experimental setup to study evacuation behavior. The metaphors related to play could be games, explorations, intrinsic rewards; and rules and how they can be used in learning games. Using tools such as 3DS Max and 3Dvia Virtools, buildings are modeled as accurately as possible in order to produce a more realistic simulation. The human-controlled characters are animated such that they are able to walk, run, and interact with the environment. Other characters in the environment are strictly computer controlled and choose the best path to follow goal behavior. A multi-user environment is implemented to allow multiple users to share the same environment. A reward system is currently under development for choosing the best path or achieving the some goal. The end result of this research is to create an experimental setup to conduct evacuation studies in a Virtual Reality multi-user environment. *[Acknowledgement: This research is funded by the National Science Foundation, Grant HRD-1137541.]*

Faculty Advisor: Sharad Sharma, ssharma@bowiestate.edu

139
The Role of Mobile Devices in Cloud Computing

DeAngelo Williams, Savannah State University
Faheem Muhammad, Savannah State University

The purpose of this research is to make a comparative study of all developing mobile devices keeping in mind their compatibility and usage of cloud computing. Cloud computing refers to the logical computational resources (data, software) accessible via a computer network, rather than from a local computer. Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. The Cloud computing takes away the installation and upgrades hassles and need for higher computing power from users and gives more control to the service providers on administration of the services. Cloud computing utilizes the network as a means to connect the user to resources that are based in the cloud, as opposed to actually possessing them. A wave of new technologies such as cloud computing is shuffling the industry's leaders, elevating the likes of Apple, Amazon and Google while forcing once-dominant companies such as Microsoft and Dell to reinvent themselves to keep up.

Smart phones and tablets have given rise to a new consumer demand for immediate information at our fingertips. With smart phones and tablets on the rise, cloud services have changed to allow access from any device connected to the Internet, allowing mobile workers access on-the-go, as in telecommuting, and extending the reach of business services provided by outsourcing it. App developers are becoming increasingly frustrated with the limited reach and growing cost of launching and maintaining mobile apps. Smartphone apps are typically custom built for particular Smartphone platforms in advanced programming languages, limiting the available pool of developers and driving up costs. Increasingly, the answer to these problems is coming from the cloud in the form of web based driven applications, known as web widgets, that perform one task.

Based on our research in this field we will see:

- The development of tablets and its evolution
- Growing sales in tablets — which tablet is the best buy?
- Emerging of different Operating Systems and its impact on growth of technology
- What kind of mobile devices will be the best and worst markets for widgets?
- Native apps vs. widgets -- how important will widgets be over the next five years?
- Touch screen technology as an intuitive way to navigate our devices

[Acknowledgement: National Science Foundation (NSF)]

Faculty Advisor: Dr. Ijaz Awan, awani@savannahstate.edu

Abstracts

EDUCATION

140
BERT, A Game Approach for Teaching Programming

Christine Boodram, Virginia State University

Games have long been used to facilitate learning of mathematics, logic, reasoning, linguistics and beyond. They offer a hands-on method of instruction that engages and immerses the user through the use of entertainment, strategy and quick thinking. There are currently a variety of video games, such as Light-Bot, to assist with teaching programming concepts. However, wide adoption of video games for educational use presents technical and financial challenges for institutions. Therefore the aim of this project is to develop a board game that will provide an effective means for introducing and teaching computer programming for beginners. We hypothesize that in addition to the low cost and few technical requirements of a board game, the capability to physically manipulate tangible board game elements will be make a board game more accessible to students than the visualization of game elements on a computer screen.

In "A Board Game Education," Jeffery Hinebaugh likens games like Clue and Mastermind to teaching how to think like a lawyer; the aim here is to help players think like computer scientists. The premise of the game is for the user to help BERT the robot regain his memories and repair himself by locating and installing lost parts. As he does, the user is introduced to new programming concepts like flow control, statement blocks, decisions, and loops. In initial testing of the game, elements such as the use of a die were removed; not only was it making play more cumbersome, but the randomization factor detracted from the principles of programming. In order to facilitate use in the classroom, the game is designed in a modular fashion where different boards and their associated pieces can be used in varying combinations to customize the topics being taught.

The initial version of the game is playable as a physical board game. However, in order to facilitate transitioning to programming on a computer, future work includes the development of a hybrid version of the game that utilizes both the board elements and smartphones, as well as a fully networked PC game. In the computer version, the capability to automate the execution of "programs" that the players create to control BERT will allow for more complex programming concepts to be introduced. Future work will also include significant player testing to measure the effectiveness of this approach to teaching computer science concepts.
[Acknowledgement: This research is supported through the WBHRA-LSAMP program funded by NSF.]

Faculty Advisor: Dr. David Walter, dwalter@vsu.edu

SOCIAL SCIENCES/PSYCHOLOGY/ECONOMICS

141
Terrorist Presence in Virtual Worlds: Using Second Life as a Case Study

Darris Taylor Jr., University of the District of Columbia

This beginning research looks at a small sampling of groups formed in the Internet based virtual world, Second Life (Linden Labs, Inc.), in view of developing a group typology for a heuristic classification for further study. It is part of a larger interest to perceive if terrorist activity is occurring. It reviews a sampling of 100 Second Life groups noting their self-definitions, characteristics, membership levels, in view of developing a series of typologies for further study.

There was an inherent challenge of determining how best to construct group searches, considering that there was no way of seeing the total number of groups in Second Life. A arbitrary 1-5 category system was used as a point of departure. On this scale 1 represented groups using the least intense/charged words in their definitions and 5 represented those with the most intense/ charged words. Words and phrases used by the sample groups to define themselves were reviewed using an approach similar to that used by Drs. J.W. Pennebaker and C.K. Chung of the University of Texas, Austin, who conducted a "Computerized Text Analysis of Al-Qaeda Transcripts" by reviewing the types and intensities of words used. Category 1 containing 12% of the sampled groups; Category 2, 27%; Category 3, 33%; Category 4, 19%, and; Category 5, 9%. There were a total of 5,988 members all together. The resultant 5 category typologies derived from this beginning research serves as a marker for the development of a more elaborate review and analysis of groups functioning in Second Life.

Further research needs to be conducted on category development, considering the systemic gap that exists in understanding and categorizing self-defined groupings in Internet based virtual reality sites. How does one measure propaganda generation, distribution, recruitment, training, and staging in such a fluid environment? *[Acknowledgement: This study was supported, in part, by a US Department of Homeland Security STEM grant awarded to Dr. Angelyn Flowers, Ph.D., Professor of Criminal Justice and Homeland Security Graduate Program Director, University of the District of Columbia, Washington, DC.]*

Faculty Advisor: Dr. Sinclair Jeter, sjeter@udc.edu

ECOLOGY, ENVIRONMENTAL & EARTH SCIENCES

AIR

142
Formaldehyde Study on the Nez Perce Reservation: Comparison between 2006 and 2011 Emissions

Etta Axtell, Northwest Indian College
Kayla Warden, Northwest Indian College

In this project formaldehyde and other volatile organic compounds (VOCs) were measured in Lapwai, Idaho to better understand sources of formaldehyde in the region. Formaldehyde is a cancer causing air toxic. In 2006-2007, the Nez Perce Tribe Air Quality Program conducted an air study in the Lewiston and Clarkston Valley of Idaho. In that study, high levels of formaldehyde were detected. The Nez Perce Tribe was concerned about the high levels of formaldehyde and the measurements made in this study are a follow up to that study.

The purpose of this study was to measure the daily variation of formaldehyde, compare levels to the previous study conducted in this region in 2006, compare levels to a set of 24-hr integrated samples co-collected on site every 6 days using the TO-11 methodology, and to document the correlation between formaldehyde and other VOCs that would indicate possible sources, such as primary emissions from a paper mill or secondary sources from biogenic hydrocarbon oxidation.

The study gathered data between June 11, - July 5, 2011. The method utilized to measure formaldehyde and other VOCs was Proton Transfer Reaction-Mass Spectrometry (PTR-MS). This gathered the data in real time resulting in over 20,000 individual measurements. Comparison between PTR-MS formaldehyde data and six samples collected by the TO-11 method revealed that the PTR-MS data typically yielded higher values of formaldehyde. The PTR-MS data was on average a factor of 2 higher with ranges from a factor of 0.12 to a factor of 6.16. The reported TO-11 formaldehyde mixing ratios ranged from 0.32 parts per billion volume (ppbv) to 11.1 ppbv. In general formaldehyde values measured at Lapwai were much lower than values reported in the 2006 study. Formaldehyde displayed a diurnal variation with afternoon maxima and early morning minima. The afternoon maxima were about 1-2 ppbv greater than early morning minimum. Maximum observed one hour average was 4.1 ppbv. Continuing measurement of carcinogenic air pollutants in the Lewiston Clarkston Valley are warranted to further quantify formaldehyde emissions. *[Acknowledgement: This study supported by U.S. Environmental Protection Agency, U.S. Department of Energy, Washington State University Lab for Atmospheric Research and Nez Perce Tribe Air Quality Program.]*

Faculty Advisor: Rochelle Troyano, rtroyano@nwic.edu

143
Perfluorocarbon Tracer Permeation Study on Silicone and Urethane Elastomers

Justin McDowell, Tougaloo College, MS

Perfluorocarbon Tracers (PFTs) are colorless, non-flammable, chemically inert, synthetic liquids that can be detected at extremely low concentrations. PFTs have been utilized to detect oil leaks, follow air movements, trace the flow of pollutants, model the possible effects of terrorist attacks, and measure the effectiveness of ventilation systems as well as other applications. PFTs may be released into an environment by permeation, evaporation, or directly from a gas cylinder. The PFTs used in this research are Perfluoro-iso-propylcyclohexane (i -PPCH) and Perflouro-1,3-Dimethyl Cyclobutane (PDCB). Our project focused on the permeation method, where the PFT permeates from an elastomer encapsulate. PFTs were encapsulated in Dow Corning® Silicone, U.S. Composites ® Polyurethane, and Smooth-On ® Polyurethane systems with the use of a surfactant. The objectives of the project were to determine the maximum amount of PFT that could be encapsulated, and to determine the rate by which the PFTs permeated. Each encapsulation was performed by first mixing Part A (resin) with surfactant and PFT. The mixture was thoroughly stirred before adding Part B (catalyst). After Part B was added, the mixture was stirred once more and allowed to cure. Each sample cured overnight at ambient temperature of 23°C. Sixteen ounce polyethylene mixing cups were used for mixing the reagents. Permeation of the PFTs was determined at 23°C and 50°C over several days. The maximum amount of PFT encapsulated was 35% of total sample weight. The PFTs released from the Silicone at a significantly higher rate than from the Polyurethane systems. In evaluating the release rates, it was observed that the rate PDCB permeated was significantly higher than i-PPCH. *[Acknowledgement: Louis Stokes Alliance for Minority Participation, Brookhaven National Laboratory, Department of Energy, HBCU-UP, Tougaloo College]*

Faculty Advisor: Linden Haynes, lhaynes@tougaloo.edu

144
Comparison of Aerosol Optical Depth (AOD) and Surface Particulate Matter (PM2.5) for New York State

Olivia Reed, New York City College of Technology
Gaffar Gailani, Ph.D, New York City College of Technology, Department of Mechanical Engineering

Aerosols are tiny suspended solid or liquid particles in the air that range in size from a few nanometers, less than the width of the smallest viruses, to several tenths of a micrometer. Most of the aerosols are comprised of sea salt, volcanic ash, dust, pollen, bacteria, spores, viruses, and soot. Around 90% of the aerosols in the air come from natural sources while the rest are man-

made and mostly are contributed by automobiles, incinerators, smelters, and power plants which produce sulfates, nitrates, black carbon, and other particles. They cause tremendous impact on our climate as well as on our health. For instance, volcanoes, which are considered to be natural sources of aerosols, had been recorded to eject large amounts of dust and gas into the air. Aerosols can also have a remarkable impact on human health. With their size, they can cause or enhance respiratory, cardiovascular, infectious and allergic diseases as documented by various researchers and studies. In this study, we gathered data within the span of two months from May 1 to June 30, 2011. We analyzed and compared the data of aerosol optical depth (AOD) and surface particulate matter (PM2.5) for New York State to see patterns, relationships and correlations between the several areas being observed. Six areas within New York State were selected based upon their geographical locations; those areas were Albany, Utica, Newburgh, White Plains, Maspeth and City College of New York (CCNY). These areas were selected to compare the aerosol optical depth (AOD) and surface particulate matter (PM2.5). AOD was measured by Moderate Resolution Imaging Spectroradiometer (MODIS) and GOES (Geostationary Operational Environmental Satellite) Aerosol/Smoke Product (GASP) instruments while surface particulate matter (PM2.5) was measured by Tapered Element Oscillating MicroBalance (TEOM). Overall, the results showed varying degrees of correlation. The R2 of PM2.5 between two areas ranged from a low 0.303 to a moderately strong 0.723.

This result suggested that when PM2.5 between two areas is being compared, the R2 becomes weaker as the distance between the areas increases. However, the R2 of MODIS AOD between two areas ranged from a moderately strong 0.69 to a very strong 0.919 regardless of the distance. It was also found that the correlation (r) between PM2.5 and MODIS AOD in each selected area ranged from a moderately strong 0.64 to a very strong 0.93, with the exception of urban areas CCNY and Maspeth, where (r) was not available. However, the correlation (r) between PM2.5 and GASP AOD in each selected area ranged from a very weak 0.02 to a moderately weak 0.23.

These results show that MODIS AOD and GASP AOD were not consistent in measuring PM2.5. It can be said that TEOM and MODIS AOD posted a moderately strong to a very strong correlation in measuring PM2.5 while GASP AOD did not. For future research, we would extend this study to longer periods of time to see if there will be a difference in the aerosol during different seasons, to ascertain whether we have increased man-made aerosols overtime, and to investigate whether a weak correlation can be attributed to time delay between areas most specifically to those like Albany and Utica. *[Acknowledgement: Louis Stokes Alliance for Minority Participation (LSAMP), New York City College of Technology, City College of New York, and NASA Goddard Space Flight Center]*

Faculty Advisor: Gaffar Gailani, ggailani@citytech.cuny.edu

145
Formaldehyde Study on the Nez Perce Reservation: Effects of Meteorological Conditions

Kayla Warden, Northwest Indian College
Etta Axtell, Northwest Indian College

In this project we measured formaldehyde on the Nez Perce Reservation in the Lapwai Valley during the summer 2011. Formaldehyde and other volatile organic compounds (VOC) were measured by the Proton Transfer Reaction Mass Spectrometer (PTR-MS). Past studies in the Lapwai valley has high levels of formaldehyde during the summer months. Formaldehyde is an air toxic and high measurements during the summer months are a concern to the Nez Perce Tribes Air Quality Department. Formaldehyde mixing ratios went up as high as 5 parts per billion (ppb). The data was analyzed along with meteorological data to determine whether there was a correlation between emissions of formaldehyde and other primary pollutants from the Lewiston paper mill with ambient temperature and other meteorological conditions. During our study we analyzed meteorological data to see whether it was the weather or photochemistry forming the formaldehyde in our atmosphere. We can see when the levels of formaldehyde are high and when they are low by checking the data on how the weather was on a day or hour. Formaldehyde displayed a diurnal variation with afternoon maxima and early morning minima. The afternoon maxima were about 1-2 parts per billion volume (ppbv) greater than early morning minimum. Maximum observed one hour average was 4.1 ppbv. Continuing measurement of carcinogenic air pollutants in the Lewiston Clarkston Valley are warranted to further quantify formaldehyde emissions. *[Acknowledgement: This study supported by U.S. Environmental Protection Agency, U.S. Department of Energy, Washington State University Lab for Atmospheric Research and Nez Perce Tribe Air Quality Program.]*

Faculty Advisor: Rochelle Troyano, rtroyano@nwic.edu

Biomedical Engineering

146
The Effect of Fetal Bovine Serum on Quahog Kidney Cells Exposed to Cadmium

Alania Foxx, University of Massachusetts Boston / Norfolk State University

Cadmium (Cd) is one the major metal pollutants that are stressors to marine animals and their environments. Marine bivalves have been used for more than 25 years to monitor costal pollination. Cd toxicity depends in part upon the uptake/ exposure these animals experience, and it has been found that the bivalve kidney bioconcentrates Cd more than any other organ. We adapted cell culture procedures to investigate the

exposure of cadmium chloride (CdCl2), both in the presence and absence of Fetal Bovine Serum (FBS) in medium, on the kidney cells of the quahog Mercenaria mercenaria L.. Dissociated kidney cells were exposed to concentrations of CdCl2 ranging from 0 to 5000 mM for 24, 48, and 72 hours. Cells were counted using a Coulter Counter (Z1 Dual Cell and Particle Counter) and their viability assessed using Trypan Blue. The aim of this study is to see if FBS is linked to the low toxicity levels of CdCl2 exposure in quahog kidney cells. We conclude that there are differences in the cells that were exposed to FBS/CdCl2 and cells that were just exposed to CdCl2, but there is too much variability to make a final conclusion that the toxic effect was less in either. Further experiments will be done with this comparison exposure and hopefully, this will allow us to conduct comparable exposures with Histidine-rich Glycoprotein, the predominant metal-binding protein in quahog blood. [Acknowledgement: This research was founded by the National Science Foundation.]

Faculty Advisor: Valencia Ingram, vhingram@nsu.edu

Climate Change

147

Validation of Two Algorithms Used in Retrievals of Optical and Size Parameters of Aerosols Utilizing a Multi-Filter Rotating Shadowband Radiometer and Inter-Comparison with a CIMEL Sun Photometer

Antonio Aguirre, New York City College of Technology
Agossa Segla and Viviana Vladutescu, New York City College of Technology, NY
Ernie Lewis and Arthur Sedlacek III, Brookhaven National Lab, NY

Aerosols are liquid or solid particles suspended in the air. The presence of aerosols in the atmosphere contributes to the total optical depth, which is a measure of the transparency of the atmosphere due to the extinction of solar radiation. In particular, aerosol contribution to the transparency of the atmosphere is referred to as aerosol optical depth (AOD), the major contributor to the extinction of solar radiation. Hence, environmental scientists are concerned about the effects of aerosols due to their capacity to warm and/or cool the planet.

The focus here is to calculate optical and size parameters of aerosols by measuring the radiation at the surface (direct irradiance) with respect to time and wavelength using a Multi-Filter Rotating Shadowband Radiometer (MFRSR) and comparing the results with a CIMEL Sun Photometer and an alternative algorithm provided by Dr**.** Mikhail Alexandrov (Columbia University and NASA GISS) for reducing MFRSR data to calculate optical and size parameters of aerosols. Using multiple instruments and retrieval methods to determine the same quantity allows for comparison and aids in determining if the instruments were functioning properly. These results can aide in the overall effort to understand the role of aerosols in regards to the radiation budget of the planet and for climate modeling.

To derive AOD we use Langley plots to find the total optical depth by plotting the natural logarithm of the direct normal radiation as a function of wavelength versus the inverse cosine of the angle between the sun and the vertical. A Langley plot provides a linear regression which is fitted with a best-fit line whose slope is the total optical depth. The AOD is derived from a Langley analysis by means of removing Rayleigh scattering, ozone absorption, and nitrogen dioxide absorption optical depths from the slope. Data retrieval and analysis was conducted daily by a source code written and executed in MATLAB. The code reduced the data producing Langley plots for each wavelength, the AOD of each wavelength, and the Ångström coefficient at the 500/870nm ratio.

Experimentally, we found excellent agreement between the MFRSR, CIMEL Sun Photometer data, and Dr. Alexandrov's algorithmic method. We found by measuring the direct solar irradiance from the sun using an MFRSR, we are able to determine the size of particles that are scattering and absorbing radiation, calculate the AOD for daytime and clear sunny potions of the day, and that AOD is typically inversely proportional to wavelength. The performance of the instruments are based on the inter-comparisons and uncertainties of Rayleigh scattering, ozone and nitrogen dioxide absorption, and uncertainty in the solar intensity at the top of the atmosphere.
Further research criteria includes separation of aerosols into size classes, increased accuracy in determining atmospheric contributions to total optical depth, identifying sources of anomalies in data (i.e. cloud cover, meteorological conditions, pollution transportation). *[Acknowledgement: DOE Office of Educational Programs (BNL) LSAMP]*

Faculty Advisor: Viviana Vladutescu, vvladutescu@CityTech.Cuny.edu

148

Global Water Vapor Distribution from Space-Borne Microwave Instrument SSM/T2

Marsha-Ann Cadougan, New York City College of Technology (CUNY)

Water Vapor is a critical element in the climate system that affects energy and hydrological cycle. The objective of this study is to analyze global water vapor distributions. The spatial distributions of water vapor allow for us to determine the structure and position of clouds. Data sets are collected from the SSM/T-2 Atmospheric Water Vapor Profiler / Sensor and loaded in developed MATLAB code. The data was analyzed for

the months of July and December 1999 and June and December 2000.

The data analyzed showed series of dry regions — less water vapor in the atmosphere and wet regions — more water vapor in the atmosphere on specific areas of the global map and specific distribution trends for specific areas was also noted. To ensure accuracy of resultant image distributions, code will be developed to find Simultaneous Nadir (i.e., two satellites passing the same location) overpass to compare findings.
[Acknowledgement: This study was supported and monitored by the National Science Foundation under the grant AGS-1062934 to the Research Experience for Undergraduates.]

Faculty Advisor: Dr Johnny Luo, luo@sci.ccny.cuny.edu

149
Don't Refrigerate Your Tomatoes; It Just Might Knock Your Socks Off!

Brittany Rucker, Fort Valley State University

Tomatoes are often stored chilled to prolong shelf-life. When this happens, much of the tomatoes' flavor is lost. To understand the basis for the loss of flavor after chilling, we analyzed 24 heirloom and modern tomato varieties before and after chilling. Taste panels were conducted on chilled and non-chilled fruit to determine which varieties lost flavor after chilling. The taste, smell, color, shape, and after-taste of different types of tomatoes were looked at and carefully recorded. The taste of some varieties, such as Maglia Rosa Cherry and Flora-Dade, were less affected by chilling.

We also examined the effect of chilling on several biochemical attributes including sugars, acids, and aroma volatiles. High levels of glucose, fructose and citric acid are important for good flavor, while high levels of malic acid are associated with poor flavor. Loss of glucose, fructose, and citric acid and increases in malic acid in chilled fruit may be responsible for the deterioration of tomato flavor after chilling.

We also observed changes in levels of aroma volatiles after chilling of tomatoes. Increases in undesirable volatiles and decreases in desirable volatiles may also contribute to poorer flavor in chilled tomatoes. These results may help researchers to develop a tomato that tastes better even after chilling.
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Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.ed

ECOLOGY

150
The Effect of Cotton Transformed with D4E1 on Soil Phosphomonoesterase Enzyme Activity.

Marylyn Creer, Lawson State Community College, AL
Lakisha Odom and Ramble Ankumah, Tuskegee University, AL

Cotton-seedling disease is a fungal disease that affects cotton and is responsible for over 2.85 percent of overall cotton crop losses in United States. Cotton plants transformed with an antimicrobial synthetic peptide, D4E1, have been shown in vitro and in planta to have broad spectrum antimicrobial action against many fungi orders, specifically Rhizoctonia Solani and Pythium spp., which are responsible for most of the cotton crop losses.

The overall goal of this study was to determine whether cotton plants genetically modified with D4E1 affect the soil ecology by modifying soil enzyme activity. We hypothesized that the use of cotton genetically modified with D4E1 would successfully control cotton seedling disease while not having any significant effect on soil ecology. Cotton plants were grown in test plots over two consecutive growing seasons, using a completely randomized design. Treatments were a control with GUS reporter gene, a non-transgenic parent variety, or one of 3 isogenic lines of cotton seed transformed with D4E1 (designated 357, 358, and 373). Evidence of the influence of the transgenic plants on soil enzyme was evaluated from soil samples taken at planting (week 0) and at the True Leaf Emergence (TLE) stage. Soil samples were taken from the rhizosphere of the test plots and transported to the laboratory on ice and stored in the refrigerator at 4°C until analysis. Phosphomonoesterase activity was evaluated using the method described by Tabatabi and Bremner. Five-gram air dried samples were incubated with the phosphate substrate and at 37°C for one hour. After incubation samples were extracted with CaCl2, the p-nitrophenol released was determined using Spectronic 20 spectrophotometer at 420nm. pH of the soil samples were also determined using a soil:water (2:1) slurry.

Results revealed no significant difference in phosphomonoesterase activity in soils taken from the transformed cotton plants compared to those obtained from non-transformed cotton. However, a significant difference in enzyme activity was observed between planting and TLE, suggesting that differences in enzyme activity due to physiological activities associated with growth may be important in regulating the phosphatase activity in soils.
[Acknowledgement: This study was supported, in part, by a grant from NSF/REU warded to Dr. Bolden-Tiller, Department of Agricultural and Environmental Sciences, Tuskegee University and USDA/NIFA awarded to Dr. Ramble Ankumah, Soil and Water Quality Laboratory, Department of Agricultural and Environmental Sciences, 2010.]

Faculty Advisor: Ramble Ankumah, rankum@mytu.Tuskegee.ed

151

Determining Restoration Suitability by Examining Microtopography, Plant Functional Traits, and Microclimate Characteristics in a Tropical Dryland

Jennifer Diep, Alaska Pacific University

Hawaii's dryland landscapes are some of the most threatened and degraded ecosystems in the world. Restoration is especially challenging in dry environments where plant growth is extremely water-limited, but recent work has found that microtopographic position can positively affect plant restoration. We examined plant functional traits and microclimate characteristics across topographic areas using a suitability model derived from high resolution 3-D light detecting and ranging data (LiDAR) from the Carnegie Airborne Observatory. We used three requirements (leeward position, descending topography, slope < 10 degrees) to determine suitability classes for restoration. We found that in high suitability sites (areas that met all three requirements) plants were taller ($p = 0.053$), contained more nitrogen ($p < 0.001$) and phosphorus ($p < 0.001$), and soils were deeper ($p = 0.073$). Low suitability sites, (areas that did not meet any requirements) had notably higher percent cover of a native grass species Eragrostis atropiodes (2.5 fold) and an invasive forb, Senecio madagascariensis, (1.3 fold).

These results indicate that plant performance is greater and environmental conditions are more amenable to plant growth at high suitability sites than low suitability sites. To operate more efficiently and economically, this knowledge should be applied to land managing strategies, maximizing restoration potential in these now exceptionally rare, native dryland ecosystems.
[Acknowledgement: Funding was provided by the National Science Foundation and Pacific Internship Programs for Exploring Sciences.]

Faculty Advisor: Roman Dial, roman@alaskapacific.edu

152

Insect Abundance of Golf Course Microhabitats used by Bats on the Delmarva Peninsula

Ileana Garcia Mayes, Delaware State University
Dr. Kevina Vulinec and Megan Wallrichs, Delaware State University

Golf course development has increased in the United States over the last decade. In the US we have more than 16,000 golf courses. Overall courses are one of the fastest growing types of land development in the world. Golf courses are often viewed as an environmental concern, however, these areas have the potential to serve as habitat for a variety of wildlife, including bats. The goal of our project is to determine insect availability on golf courses used by bats as a foraging habitat on the Delmarva Peninsula. We monitored insect activity on four golf courses in Delaware from August to October 2011. Each golf course was divided into five microhabitats: water-hazard, mowed open canopy, natural open canopy, natural cluttered canopy, and open grass. Passive intersect insect traps and light beam surveys were used to monitor insect activity in each habitat type. Insect monitoring results were compared with a concurrent survey of bat activity. Bat presence in golf courses was determined using mist nets and acoustic sampling techniques from June to September 2011.

Analysis of the results suggests insect abundance was higher near water-hazards and open grass, however, bat activity was higher in the water-hazard and natural open canopy. This result suggests the importance of habitat structure as well as prey availability. Results indicate bats prefer to forage on golf courses with canopy cover or adjacent to water.
[Acknowledgement: The study was supported through the Science and Math Initiative for Learning Enrichment (SMILE) grant and in part by a grant from the National Fish and Wildlife Federation, awarded to Dr. Kevina Vulinec, Associate professor, Delaware State University, Dover, DE 19901.]

Faculty Advisor: Dr. Kevina Vulinec, kvulinec@desu.edu

153

Effect of Organic Matter Manipulation in a Pine Plantation 16 Years After Clearcutting

Kimberly Howard, Alabama A&M University
Luben D. Dimov, Natural Resources and Environmental Science, Alabama A&M University
Zakiya H. Leggett and Eric B. Sucre , Southern R&D, Weyerhaeuser Company

Forest treatments, such as thinning, regeneration harvesting, prescribed burning, and other silvicultural activities affect the amount of leaf litter on the forest floor. The influence of these changes in leaf litter, and in turn the buildup of organic matter, on long term stand productivity, and on the cover, richness, diversity, and biomass of the ground layer vegetation (≤1.4 m in height), has not been explored extensively. We studied the impact of organic matter manipulation in a loblolly pine (Pinus taeda L.) plantation in western Alabama. The trees were planted in 1994 after clearcutting. Twelve 0.16 ha plots were established in a randomized complete block design with 3 treatments and 4 replications. The treatments were imposed after harvest and immediately before replanting. They were: 1) removal treatment - all forest floor and slash material were removed, 2) control treatment - the forest floor and slash material were unaltered, and 3) double treatment - all forest floor and slash material coming from treatment #1 (removal) was uniformly added. Tree productivity and forest floor levels were assessed.

We also established 20 ground layer vegetation plots of 1 m 2 each in randomly selected locations within each 0.16 ha plot. We determined the cover of each species by visual estimation. *[Acknowledgement: Weyerhaeuser Company]*

Faculty Advisor: Luben Dimov, luben.dimov@aamu.edu

154

Spatial Variability of Phosphorus Among Different Vegetation Types at Villa Park Wetland

Audra Huffmeyer, University of Minnesota Twin Cities, MN

Wetlands serve a crucial role in maintaining the quality of fresh water sources. Wetlands act as a natural filter and retain excess pollutants and nutrients from runoff. The nutrient of most interest in freshwater sources is phosphorus, (P). Excess P in freshwater causes eutrophication because algal growth is limited by phosphorus. An overabundance of phosphorus will create excess algal blooms that lead to oxygen deficiencies in freshwater and ultimately the death of fish. Previous studies have demonstrated that wetlands sequester phosphorus two ways, integration of P into the biomass of vegetation or P precipitates with aluminum, iron, and calcium in the sediment. Previous studies have also demonstrated that there is a seasonal uptake and release of phosphorus in wetlands by vegetation. Thus, vegetation in wetlands is a major component of P uptake.

This study was done in order to test the hypothesis that vegetation types sequester different amounts of orthophosphate as compared to areas with no vegetation. The vegetation types studied were: emergent, submerged, floating, as well as no vegetation. Water samples were collected at Villa Park Wetland in Roseville, MN, samples were filtered using a 45mm diameter GF/F screen, and then each sample underwent molybdate colorimetric analyses in a spectrometer to find the amount of soluble reactive phosphate (µg/L). An ANOVA analysis of the data yielded a significant p value of .001 and supported the conclusion that different vegetation types sequester different amounts of orthophosphate.

This study also found that submerged vegetation sequesters larger amounts of P than the other vegetation types. If this trend is common researchers can begin to look at which vegetation types should be dominant in a wetland in order to produce an efficient wetland. *[Acknowledgement: This project was funded by the North Star STEM Alliance (LSAMP) and carried out at the REU on Sustainable Land and Water Resources at St. Anthony Falls at the University of Minnesota Twin Cities.]*

Faculty Advisor: Amy Hansen, hanse782@umn.edu

155

Population Genetics and Impact Threat Assessment of Invasive Jackson's Chameleons in Hawaii

Rebekah Klint, University of California, San Diego

Several dozen Jackson's chameleons (Chamaeleo jacksonii xantholopholus) were introduced to Oahu from Africa by a pet importer in 1973. A recent study demonstrated that Jackson's chameleons prey on native invertebrates, including critically endangered tree snails, in pristine Hawaiian forests. The University of Hawaii Tree Snail Conservation Laboratory has begun a series of investigations to determine the level of threat posed by this invasive reptile, including molecular studies to evaluate genetic diversity of chameleon populations in Hawaii. Population genetics theory predicts that introduced species with low genetic diversity will not thrive in novel habitats due to an inability to adapt, however, chameleons are established and thriving on all major islands of Hawaii. We hypothesize that chameleons have done well in the Hawaiian Islands despite low genetic diversity, contrary to theoretical predictions. Current molecular research involves the collection of Jackson's chameleons by hand from native Hawaiian forests and generation of mtDNA sequences (ND4-Leu) via DNA extraction, polymerase chain reaction, gel electrophoresis, and sequencing. In collaboration with researchers in Eastern Africa and Australia, African haplotypes collected from the natural range in Kenya were compared to those of Hawaiian chameleons using phylogenetic trees and haplotype networks. Preliminary data show low genetic variance within Hawaiian chameleons; only four haplotypes were found among 52 Hawaiian chameleons with Kenyan sequences differing by just a few basepairs. Our hypothesis is supported by preliminary results, and sampling is ongoing to continue future research in the direction of the study. Threat assessment and population genetic studies of predators such as Jackson's chameleons contribute to the efforts to and emphasize the importance of the conservation and maintenance of the integrity of Hawaiian forests and associated endemic biodiversity. *[Acknowledgement: University of California San Diego's Minority Access to Research Careers/ University of California San Diego's California Alliance for Minority Participation (LSAMP)/University of Hawaii's Pacific Biosciences Research Center]*

Faculty Advisor: Brenden Holland, bholland@hawaii.edu

156

Carnivore Coexistence and Occupancy Across the Mountain Lake Landscape

Asia Murphy, North Carolina State University

The coyote (Canis latrans) has recently colonized the eastern United States. Its presence in the eastern ecological community could influence native carnivores in either positive or negative

ways. Yet, there has been little research examining how coyotes might interact with other carnivores in the eastern US. Our objectives were to determine how coexisting carnivores are using resource partitioning to ameliorate competition, and we hypothesized that they would use habitat/spatial partitioning to ameliorate competition. Additionally we examined whether coyotes have reached saturation or are continuing to expand their range on Salt Pond Mountain Giles County, VA.

We hypothesized that they were continuing to expand their range. Using camera trapping, we focused on four carnivore species: black bears (Ursus americanus), bobcats (Lynx rufus), gray foxes (Urocyon cinereoargenteus) and coyotes. We surveyed an approximately 30km2 area for nine weeks (May-July 2011) using twenty remote trail camera stations and used historical data from 2004-2010 in our analyses. We examined 1.) habitat selection at the macrohabitat and microhabitat scale; 2.) the potential for habitat, spatial and temporal partitioning; and 3.) and changes in occupancy across the years of 2004 through 2011.We used Student's T-tests to compare mean habitat values at present versus absent sites.

From these results we formulated apriori hypotheses on habitat selection to enter into Program Presence for modeling occupancy via AIC model selection. We also ran single-season and multi-season analyses to estimate occupancy values of all carnivores across the landscape. We found that carnivores are selecting for and against habitat characteristics at both the macrohabitat and microhabitat scale, that there is evidence for habitat partitioning amongst bobcats and coyotes, with coyotes selecting for developed areas and bobcats selecting against developed areas. We also found that Salt Pond Mountain is nearly saturated with bears and that coyote occupancy continues to steadily increase. Based on the results of this study, we believe there is need for more research on the ecology of eastern coyotes and their effects on ecological communities. *[Acknowledgement: NSF REU Grant DBI-0453380]*

Faculty Advisor: Marcella Kelly, makelly2@vt.edu

157

Limu Kohu (Asparagopsis taxiformis) Growth Trial Study: The Influence of Light Penetration and Salinity Levels on Limu Kohu Growth Rates to Determine the Optimum Environment for Limu Kohu Reproduction and Development of Gametophyte

Hoku Pihana, Keaholoa STEM Scholars Program, University of Hawaii at Hilo
Aaron Mickelson, University of Hawaii at Hilo

Limu Kohu (Asparagopsis taxiformis) has been a valuable food commodity for Native Hawaiians and other local populations throughout the Hawaiian Islands. It was and still is a favored food to Hawaii's residence and is an essential source of vitamins and nutrients. Since western contact to presently, the demand for Limu Kohu has greatly increased causing overharvesting and unhealthy harvesting practices, leaving little opportunity for replenishment. This rapid depletion has initiated studies relating to Limu Kohu cultivation in a controlled environment. Since previous cultivation studies have been unsuccessful, this current study was designed to create a baseline for further research. The Limu Kohu (Asparagopsis taxiformis) growth trial study was conducted to determine what type of environmental conditions would be most favorable for Limu Kohu (Asparagopsis taxiformis) growth.

Environmental conditions were observed during each moon phase and tidal fluxes to determine what times were best to collect Limu Kohu samples. Four hundred samples were collected, cleaned, and placed in 500 ml flasks of filtered seawater containing a media of nitrate, phosphate, and other trace solutes. The samples were placed in three different types of light penetration: direct light, moderate light, and indirect light and three different types of salinity levels: 33ppt, 30 ppt., and 27 ppt. They were observed over a twelve month period, with length being measured monthly and nutrient levels adjusted weekly. The twelve month study determined that Limu Kohu growth rates were greater and more consistent in the samples that were exposed to direct light with salinity levels of 33 ppt but, it was discovered that turbidity played a larger role in Limu Kohu growth than assumed in the beginning of the study. This preliminary study established a baseline for the continued research on optimum Limu Kohu growth conditions. Continued research will focus on the effects turbidity, tides, and moon phases have on Limu Kohu growth rates. This research will allow us to understand the optimum conditions for growing Limu Kohu. *[Acknowledgement: Keaholoa STEM Internship Program]*

Faculty Advisor: Pelika Bertelman, pelikaok@hawaii.edu

158

New York's Melting Pot: Forest Fragmentation Events

Rolando Rojas, John Jay College, NY
Dr. Amy Litt, The New York Botanical Garden, NY
Dr. Jim Lewis, Fordham University, NY

As forest fragmentation shrinks natural habitat, it also erodes biotic diversity sustained within these ecological units. For ages, temperate forests have sustained human populations, becoming centers to agricultural and industrial development. As a result, they have experienced some of the most destructive anthropogenic alterations to their structure and composition. We are left with forest fragments or "forest islands", which are only smaller representations of the original forest. These "forest islands" often are isolated, and for many plant species this limits the choices for reproduction and eventually reduces species fitness because of loss of genetic diversity. In New York's Hudson Valley, forest remnants of a once contiguous temperate forest were examined to evaluate the genetic and species

diversity of a fragmented ecosystem. By cross-referencing forest inventories the number of endemic tree species was used as a measure of species diversity testing whether the Theory of Island Biogeography applies to forest fragments. The theory states that larger islands are able to sustain more biota than smaller islands. Using microsatellite analysis, the genetic composition of Quercus rubra within three forest fragments (The New York Botanical Garden, 50 acres; The Louis Calder Center, 113 acres; and Black Rock Forest, 3830 acres) was compared to study the effect(s) habitat fragmentation has on gene flow. As predicted by theory, a higher number of tree species are able to coexist on forest fragments that are larger. The microsatellite analysis reveals a reduction in alleles across all the forest fragments in the younger generation of red oak. This implies that the red oak populations in New York are experiencing a diminution in genetic diversity. Logically a decrease in species fitness will also be observed by the rest of the sessile biota; additional research should be done to evaluate to what degree. In addition to the array of ecosystem services temperate forests provide to nearby population centers, such as food, firewood, freshwater cycling, and cultural resources, recent evidence suggests that temperate forests can store significant quantities of carbon, making them important priorities for conservation and management within the context of global change. *[Acknowledgement: NSF, Fordham University, The New York Botanical Garden]*

Faculty Advisor: Amy Litt, Jim Lewis, alitt@nybg.org, jdlewis@fordham.edu

159
Ground Truthing LIDAR Data Within A Successional Piedmont Forest

Rolanda Sue, Johnson C. Smith University
Megan Talley, Montavia Hawkins, Jamaal Jackson, Michelle Jackson, Camille Grimsley, and Joseph Fail Jr., Johnson C. Smith University, NC
Ryan Emanuel, North Carolina State University

Light Detection and Ranging (LIDAR) is a remote sensing technology that is designed to improve accuracy of large scale ecosystem measurements. In this study, forest data was collected that sought to verify information obtained remotely through LIDAR technologies. Ultimately ground-based sample data was compared to remotely gather electronic data to assess the accuracy of the remote information, and to further the knowledge of the structure and function of forested ecosystems, especially successional trends in forest. To gather and compare data, 20m x 20m plots were set up in varying successional areas determined by LIDAR data to be either young, mid, or old-aged forests of their respective provinces – in this case the Piedmont.

Data was collected on community structure, leaf area, tree age, tree height, and leaf biomass. Electronic leaf area indexes (LAI) were determined by measurements of nine points within each plot and this data was compared to ground-sampled leaf area data of leaf litter on the ground determined by three ¼ m2 plots. The height in age of the tallest tree was sampled in each plot. The data from the two sources of measurements were analyzed and compared to note correlations between the two sets of data.

Through this research it was concluded that: LIDAR estimates of tree height were 76% accurate compared to ground-based hypsometer measurements; LIDAR height data indicated a correct general successional chronosequence set of data for two of three plots measured; Leaf Area Index provided a 78% direct correlation with plant community diversity data; Leaf Area Index provided a 44% inverse correlation with total annual leaf litter biomass estimates; and Leaf Area Index estimated by litter fall is not correlated by leaf area estimated electronically. *[Acknowledgement: Ecological Society of America Strategies for Ecology Education, Diversity and Sustainability at Johnson C. Smith University; NSF-funded Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) at Johnson C. Smith University.]*

Faculty Advisor: Dr. Joseph Fail, mwinters@jcsu.rfi.edu

160
Assessment of Community Lead Efforts to Remove Invasive Algae in Maunalua Bay, Oahu

Devan Tatemichi, Kapiolani Community College
Dr. Wendy Kuntz, Kapiolani Community College, HI

A community-based effort has been underway since 2007 to remove invasive species of algae, mainly targeting Avrainvillea amadelpha, from the Paiko area of Maunalua Bay, a once thriving Lawai'a (fishing village). Community volunteers, directed by Mālama Maunalua and The Nature Conservancy (TNC) began the project which was later expanded as a American Recovery and Reinvestment Act project (ARRA). Kapi'olani Community College (KCC) students in Biology 124 Lab (Ecology and Environment) have participated in algae removal since Fall 2009 and collected data each semester on algal diversity both before and after pulling in removal and control plots, using a point-intercept quadrat monitoring protocol designed by TNC. Total algae removed each semester was also recorded. We examined data collected by KCC students to test the hypothesis that removal efforts are changing the algal community. We analyzed the frequency of native and invasive algae before and after intervention. Results analyzed from Fall 2009 through the Fall 2011 semesters showed a decline in density for the invasive species (A. amadelpha, Gracilaria salicornia and Acanthophora spicifera) within the KCC removal plots. The density of native indigenous algae (Spiridia spp and Padina sp) was higher in the older community and ARRA removal sites in comparison to the KCC control plots. Limited increase in density was seen in native indigenous algae within

the KCC removal plots, which were measured for a shorter period of time. These results support the effectiveness of managed eradication efforts and suggest a longer-term shift towards a native algal community in Maunalua Bay. *[Acknowledgement: Kapiolani Community College STEM Program]*

Faculty Advisor: Wendy Kuntz, wkuntz@hawaii.edu

Environmental Engineering

161
Evaluation of Multi-Sources Cloud-Top Height Estimates

Folashade Alawiye, New York City College of New York, New York

The main objective of this study is to evaluate and compare Cloud Top Height (CTH) estimated from various remotely sensed sources such as MODIS Cloud Top Pressure (CTP) and GOES Cloud Top brightness Temperature (CTTb) products. One very important application of accurate CTH is to improve satellite-based precipitation estimates/forecasts and as the result enhancement of flood forecasting for water resources communities. The project study focuses on: (1) downloading and processing CTP from MODIS; (2) downloading, processing and analyzing CTTb from GOES satellite; (3) converting CTP and CTTb to Cloud Top Height (CTH); and (4) Evaluation of CTH estimates by comparing CTH from the MODIS CTP and GOES CTTb with the truth CTH from CLIPSO satellite (with the assumption that CLIPSO CTH is the true values). This poster presents the first two tasks of this project, which are: (1) describing the CTP and amount algorithm that has evolved through the new collection 5.1 as experience has been gained with in-flight data from NASA Aqua platforms; (2) describing CTTb from band-4 of a geostationary satellite, GOES, and its characteristics; and (3) very briefly about the selected methodologies for estimating CTH. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Shayesteh Mahani, mahani@ce.ccny.cuny.edu

162
The Impact of the Sydney Coordinated Adaptive Traffic Control System on Pollutant Levels on the Heavily Congested Arterial, SE Powell Boulevard, Portland Oregon

Adilene Amaro, Portland State University

Congested traffic corridors in heavy populated areas are an influential factor in the deterioration of air quality and its subsequent effect on the health of people constantly exposed to traffic and its pollutants. For example, one of the heavily congested arterials in Portland, Oregon, especially during peak periods, is SE Powell Boulevard, a primary route to Gresham, a large suburb on the east side of downtown. Not only is this main street filled with automobile traffic, but also with bike commuters and people on public transportation. Two major bus routes, lines 9 and 66, run along this arterial, and their riders face longer than normal waits at the bus stops and are therefore exposed to traffic and the pollution produced.

Portland, Oregon decided to implement an adaptive traffic control system, the Sydney Coordinated Adaptive Traffic System (SCATS), along this arterial at two intersections: 26th and 39th streets. This system calculates cycle length, splits and offsets cycle-by-cycle, and can dynamically change the grouping of signals as traffic changes to alleviate congestion and control pollution.

In order to obtain baseline data prior to implementation of the SCATS system, measurements of the particulate matter, ultrafine particles, carbon monoxide, and carbon dioxide were taken using the following equipment: TSI's Dustrak Aerosol monitor, TSIs P-Trak ultrafine particle counter, Langan Model T15n, and Langan Model L26n.

Once the SCATS system was implemented, these tests were repeated numerous times in different weather conditions to account for potential variance. The present study was conducted to test how efficiently the SCATS system works and to prove the hypothesis: if the SCATS system is implemented, it will reduce traffic queuing and therefore reduce the level of pollution that people are exposed to. Based on promising preliminary results, queuing time has been reduced at both intersections; the Powell side of each intersection has longer green lights and shorter red lights during peak periods. In addition, since implementation of the SCATS system, buses stop more frequently and for shorter periods of time. To be more precise more research can be conducted implementing more SCATS systems on different heavily trafficked arterials in the city of Portland to further observe if it is beneficial to apply this system in all the arterials with heavy traffic. *[Acknowledgement: This study was supported by the city of Portland, Trimet transportation system, and by the Intelligent Transportations System Lab led by Dr. Miguel Figliozzi, Portland State University, Portland, Oregon 2011.]*

Faculty Advisor: Miguel Figliozzi, figliozzi@pdx.edu

163
Spectral Analysis of Soil Moisture Time Series

Amelise Bonhomme, NYC College of Technology- CUNY, NY

This research focuses on soil moisture data. Soil moisture data and observation is helpful to weather and climate, runoff potential and flood control, soil erosion and slope failure, reservoir management, and water quality. The data sets were collected from the International Soil Moisture Network. More

specifically the Illinois Climate Network (ICN). Each of the data sets are collected from each of the ICN sites within the state of Illinois. The data collected is plotted against the date at which it was collected in order to observe how soil moisture has changed or been affected over time. The coherence needs to be calculated in order to observe and/or determine the similarities and differences between the sites. *[Acknowledgement: National Science Foundation Cooperative Remote Sensing Science and Technology Center Research Experiences for Undergraduates (NSF CREST REU). Dr. Nir Krauker, Kibre Tesfagigoris, Dr. Reginald Blake, Dr. Shakila Merchant, Dr. Reza Khanbilvardi, and Chinedu Chukuigwe.]*

Faculty Advisor: Dr. Reginald Blake, rblake@citytech.cuny.edu

164
Flicker Fusion

Adina Gaskins, Fort Valley State University, GA

Flicker fusion is defined as the frequency at which an intermittent light stimulus appears to be completely steady to the observer (Long Evans rats). The Critical Fusion Frequency (CFF) is the frequency at which this phenomenon occurs under set conditions. Operant conditioning is a form of psychological learning where a subject modifies the occurrence and form of its own behavior by relating a behavior with a stimulus. This particular experiment involves rats that are placed in operant chambers, which are the boxes that house the lights and levers necessary for the experiment. The rat must discriminate between a flashing light and a steady light to earn a reinforcer. The object of the experiment is to train the rats in the shortest amount of time with the least amount of correction trials and to get the rats' fixed ratio (how many times the rat hits the lever) as high as 10 at the end of the training phase. The rats are weighed each day before starting their trials and then placed in separate operant chambers. Each trial lasts for 1 hour and 15 minutes; during each trial, the rats have to differentiate between a flickering light and a steady light by pressing the lever associated with that stimulus. After they choose the correct lever, they are reinforced with a sucrose pellet from the dispenser. The goal is for each rat to get a minimum of 80% correct responses during a session. After the trials are over, the rats are fed a specific amount of food that is dependent upon their weight that day. The optimum weight is 250 grams which is the healthiest weight for a Longs Evans rat under one year old. Two of the 10 rats reached a fixed ratio of 10 and 9. Even though 8 out of the 10 rats did not get their fixed ratio high enough, the behavior was learned and became steady over the course of this experiment. Using flicker fusion as a diagnostic tool, this method has been developed as a technique of studying visual problems, caused by toxins and toxicants, over the full lifespan of the rat. The study of eye problems in rats can be used to help diagnose similar problems in humans.
[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA 31030.]

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

165
Numerical Modeling and Mechanism Study of Wind Driven Flow

Rifat Hussain, City College of New York

Understanding of coastal ocean flows is becoming more and more important in the view of various emerging coastal ocean related issues such as climate change and environmental pollutions. This research aims at understanding the mechanism of coastal ocean flows under the action of wind. In particular, we will examine the flow structures inside a long closed cavity under prescribed velocities and shear stresses. Several attempts have been made to study the flow, but discrepancy occurs in the obtained results. In this research, computational fluid dynamics approach is used to simulate the flow inside the cavity and understand the flow mechanism. We have used ANSYS Fluent software to run the flow simulations. This is a long term research. We have run the simulations for standard cavity (cubic box) and long cavity (a water channel) and successfully calibrated our results with previously published results. Currently we are continuing the long cavity flow modeling. We will be investigating the difference of flow profiles under two types of conditions that drive the flow which are velocity and shear stress. The research will produce a deeper understanding and quantity relations of the cavity flow. It is expected that the results will have an impact on understanding coastal ocean flows such as water mixing at surfaces and sediment erosion at bottoms. In the research, we collaborate with another team at Virginia Institute of Marine Science. *[Acknowledgement: NSF CREST-REU]*

Faculty Advisor: Dr. Hangsong Tang, htang@ccny.cuny.edu

GENETICS

166
Sequencing DNA to Detemine Pesticide Resistance in Hyalella Azteca

Sara Nelson-Owens, Norfolk State University, VA

Hyalella azteca are sediment dwelling, primary consuming crustaceans that are commonly used for sediment toxicity testing. Dwelling in the sediment makes them openly accessible to many products of run-off; including pesticides. Pyrethroid pesticide use is increasing in the agricultural market, resulting in increased toxicity to non-target organisms such as Hyalella

azteca at minute concentrations. However, some populations of Hyalella azteca in the central valley of California have remained viable despite pesticide exposure. When explored, this resistance has been attributed to mutations in the gene controlling sodium transporter channels. DNA has been isolated from adult Hyalella azteca, amplified using Polymerase Chain Reaction, and sequenced. We will then isolate, amplify, and sequence DNA from the resistant Hyalella azteca. When compared to non-resistant Hyalella azteca, we expect to see specific point mutations in the sodium transporter gene of the resistant Hyalella azteca. We can then hypothesize that these point mutations provide resistance to pyrethroid pesticides in Hyalella azteca. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Helen Poynton, helen.poynton@umb.ed

Geosciences and Earth Sciences

167
The Study of Organic Matter in the Soil of Arkansas

Cameran Faucette, University of Arkansas at Pine Bluff
Brittany Singleton and Richard Vaught, Natural Resource Conservation Service, Pine Bluff, AR

The Natural Resource Conservation Service (NRCS), formerly known as the Soil Conservation Service, is a federal agency with the United States Department of Agriculture. A goal during this project was to study a baseline inventory of soil organic matter to develop a library of different soil samples that will help crops thrive in different regions across the country. Another goal is to develop and encourage conservation practices that will increase the use of soil organic matter. NRCS was formed about 76 years ago when the nation was rapidly losing topsoil in many areas and the Dust Bowl had formed on the plains. Topsoil has an accumulation of organic matter that is vital to plant production and soil fertility, so the loss of the topsoil and productivity of the land is devastating for farmers. Conserving and improving soil organic matter is good for crop production, pasture production and forests. Information learned from this study will be used to adjust conservation programs and evaluate the effects of conservation practices encouraged by the NRCS and Soil and Water Conservation Districts. The soil analyzed in the study came from farmers' properties mainly in the Southern region of the country. Small central holes were dug in the sand by hand to about 20 inches in depth. Soil samples from Arkansas and surrounding states were collected in bags, weighed with moisture content still inside and processed using a visible and near infrared (VNIR) instrument for organic content. Later samples were air dried, weighed again, ground with a grinder, oven-dried and processed through a VNIR a second time and analyzed further. Four additional very small holes were dug for statistical replication. Once the sampling was complete, the holes were refilled, leveled and restored to the original condition as much as possible. Conclusions from this research project will provide a library of different soil in the areas and their corresponding data to determine which crops will thrive better in particular locations. *[Acknowledgement: This research is supported and funded by the United States Department of Agriculture to Richard Vaught, Natural Resource Conservation Station, Pine Bluff, AR.]*

Faculty Advisor: Richard Vaught, Richard.Vaught@ar.usda.go

168
Biological Activity of Vitus Lake and the Bering Glacier Surge

John A. White, Southern University A&M College

The Bering Glacier field program typically starts in early June and runs through the end of August. The field camp is located near the base of the glacier on Vitus Lake, on a former terminal moraine. The Bering Glacier System is a unique natural laboratory wherein continued investigations will provide many new answers to questions ranging from impacts of glacier dynamics, to ecosystem evolution, to changing climate. Over the past several year, students and faculty from Southern University in collaboration with Michigan Tech Research Institute have been using this field laboratory to investigate the cause and effect relationships of glacier dynamics to the ecosystem. The specific objective of the 2011 voyage was to obtain real time data on Bering Glacier land cover, Bering Glacier terminus characterization; and Vitus Lake turbidity mapping. The specific task for our group was to determine the degree of movement and behavior of the glaciers at Vitus Lake since our last visit in 2008. We have been mapping terminus retreat using remote sensing images and we have determined that the terminus is retreating approximately 0.38 km per year. The data obtain from the 2011 voyage will be used to provide a more precise picture of surging in this region of the Bering Glacier. *[Acknowledgement: This study was supported by "Southern University HBCU-UP ACE Implementation Project," funded by the National Science Foundation.]*

Faculty Advisor: Dr. Wesley Gray, dr1wgray@aol.com

Microbiology/Immunology/Virology

169
The Metabolic Diversity of Blow Bly (Lucilia sericata) Associated Bacteria

Michael Diaz, California State University Monterey Bay
Aparna Sreenivasan, California State University Monterey Bay, Seaside
Mark Eric Benbow, University of Dayton, OH

Larval debridement therapy (LDT) exploits blow fly larvae to treat the wounds of immunocompromised individuals, where antibiotic treatment is ineffective. The link between the larvae

and their bacterial symbionts during this process is poorly understood. Using *Lucilia sericata* larvae, this study explored the effects that tetracycline (TET) had on larval development, larval survival, and the metabolic diversity of larvae associated bacteria. To mimic hospital infections and represent a range of antibiotic concentrations, larvae fed on treatment dishes containing sheep's blood/tryptic soy agar (SBA) with 0ug/ml, 4ug/ml, 8ug/ml, or 16ug/ml of TET (0ug/ml SBA and 0ug/ml liver/tryptic soy agar served as the controls). Larval biomass on treatment dishes, at each stage of development, was used to determine normal growth and survival of larvae. Excretion and secretion swab samples (n=20) were taken from dishes containing 3rd instar larvae (swab samples (n=20) were also taken before treatment as controls). These samples were inoculated onto a 96-well microtiter EcoPlate®, with 31 different carbon sources to reveal bacterial metabolic profiles. Absorbance (A^{600}) readings every 12h for 120h revealed substrate usage by bacteria.

Preliminary data suggests that high TET levels inhibit normal larval growth and exhibit higher larval mortality than other lower level treatments. EcoPlate® analysis is currently being conducted using multivariate statistics. We expect to see a narrower community-level metabolic profile (CLMP) with the increase in TET treatment, corresponding to abnormal larval growth and increased larval mortality. This approach can reveal the potential for antibiotic resistance development in bacteria during LDT based on shifts in CLMPs. Antibiotic resistance development during LDT provides a mechanistic explanation for environment-to-human transmission of resistant bacteria, with blow flies as the vector. *[Acknowledgement: This project was supported by the Dept. of Education under the Ronald E. McNair Postbaccalaureate Achievement Program (Grant Number: P2187A070300).]*

Faculty Advisor: Aparna Sreenivasan, asreenivasan@csumb.edu

170

Investigating the Genotoxicity of Microbial Communities after the British Petroleum Oil-Spill in Impacted Louisiana Shorelines

Nichole Lathan, Dillard University, LA

The Deep-Water Horizon Oil Spill is currently history's largest oil spill leaking over 5.2 million barrels of crude oil into the Gulf of Mexico. With oil leaking for an extended period of time, researchers were not fully aware of the complete effect. Many methods were tried to cleanse the gulf as quickly and effectively as possible, but none have been completely successful.

The first method used to clean the crude oil was Corexit 9500A and 9527. It dissolved the oil, and helped prevent surface oil slicks. The Corexit caused potentially harmful side effects to residents such as eye, skin, kidney, and liver irritation. It contains chemicals that are hazardous to the marine life, and causes the crude oil to become more toxic. Another method used was injecting chemical dispersants near the seafloor close to the wellhead. The crude oil was able to travel to depths of 1,000m below sea level, which caused plumes to form. At great depths oil dispersants are less effective causing microbial communities to diminish oil and gas concentrations at a slower rate. With the ongoing response to this oil spill, studies of ecosystems impacts at the lowest trophic levels may serve as indicators to guide remedial actions. Airborne microbes have not been investigated for its toxic effects in the atmospheric environment near weathering oil spills. The purpose of this research is to collect microbes released into the air because of the deep-water horizon spill, and consider potential toxic effects the abundance of microorganisms have on the ecosystem. To examine the genotoxicity of the microbial communities, impingers were used to take air samples, which were then filtered and examined. As of now, results are being analyzed. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Bernard Singleton, bsingleton@dillard.edu

171

Assessing Biomarkers of Oil Spill Weathering in the Air and Water at Impacted Lousiana Shorelines

Jasmine Scott, Dillard University
Nicole Lathan, Dillard University, LA

We predict that the Deepwater Horizon oil spill will have life long environmental effects on the human and ecological population.This research is important so that early diagnoses for health related problems could be treated.The Deepwater Horizon oil spill is the largest oil disaster in U.S. history. A mixture of 780,000 m3 Sweet Louisiana Crude (SLC) and 205,000mT methane was released into the Gulf of Mexico on 22 April 2010, for 85 days. BP released over a million gallons of Corexit 9500 and 9527 in the gulf to expedite the recovery and clean-up process.

These dispersants solubilize the oil, and help prevent surface oil slicks. The effects of the release of dispersants on the marine environment and ecosystem were initially unknown. Researchers later found that Corexit 9500 and 9527 disrupted the natural process of bioremediation, and killed many of the bacteria communities that fed on the hydrocarbons that were released in the gulf, the most sensitive bacteria to the dispersants were Marinobacte and Acinetobacter. In contrast, the non-hydrocarbon-degrading Vibrio sp. proliferated in the large amount of dispersants. This information suggest that the Corexit inhibit hydrocarbon-degrading bacteria. Investigation of the atmospheric environment near the oil spill has yet to be studied. There are complaints of lung infections and respiratory problems from workers cleaning up the spill and residents living close to the disaster site.

Our research purpose is to collect aerosol, sand and water samples to determine what microorganisms are near the impacted Louisiana shoreline and at Texas shorelines (which will be used as our control), and to consider the health impact of the bacteria that is present, monitor the effects on the microbial communities and other relevant life forms of the ecosystem, and monitor the toxicological effects on the ecosystem. Currently, the results are being processed. Future research can be a follow up of the same experiment, but to find out if the same bacteria is still present at the effected Louisiana shoreline. *[Acknowledgements: The National Science Foundation, Dr. Bernard Singleton, and Lewins Walters.]*

Faculty Advisor: Bernard Singleton, bsingle@dillard.edu

Nanoscience

172
Potential Impacts of Nano Silver Particle Exposure on Lung Physiology

Tierra Poteat, North Carolina Central University

As the use of engineered nanomaterials in the presence of nanotechnologies increases in an exponential rate, the health concerns associated with the exposure to the nanomaterials during their life cycles has risen. In this study, the potential impacts of Nano Ag exposure in infant lung alveolar regions on energy expenditure were evaluated after different size groups of Nano Ag at different concentrations were added to nanopure water. Nano Ag stock solution was first prepared by sonication process as practiced for our previous studies at concentrations between 0.5 and 2.0µg/µl (in nano pure water). Five different size groups of Nano Ag (15nm, 20-30nm, 30-50nm, 50-60nm, and 100nm) were prepared and added to water to see the size effects. The contact angle measurement for the calculation of surface tension was performed by using a goniometer by using triplicates of each sample.

Results showed that, 1) Nano Ag of all size ranges caused surface tension to rise while the Nano Ag at 15nm size induced the highest rise reaching a plateau; 2) Surface tension in nanopure water media rose in all concentration ranges of Nano Ag reaching the highest and plateau between 5 and 10µg/µl concentration. From these results, it is concluded that exposure to any level of Nano Ag powder could be detrimental in respiration process requiring a higher energy expenditure. It is also speculated that children and elderly with compromised lung functions would be affected more than healthy young individuals. Nano Ag powder at 15nm size or smaller, than larger counter parts, can cause less stress in respiration process. *[Acknowledgement: This study was partially supported by LSAMP, NSF_DMR (0959679), NSF_BIO/ROA (DBI-0755219), and equipment support from Center for Environmental Implications of Nanotechnology (CEINT) at Duke University. Dr. Appala Raju Badireddy is also appreciated for his analytical support for this study.]*

Faculty Advisor: Dr. John Bang, jjbang@nccu.edu

Plant Research

173
Selected WRKY- Transcription Factors Analysis in Common Bean (Phaseolus Vulgaris) During Rust Fungal Infection Using Semi Quantitative PCR

Adrianne Brown, Delaware State University
Kalpalatha Melmaiee and Venu Kalavacharla, College of Agriculture and Related Sciences, Delaware State University

Common bean (Phaseolus vulgaris) is an essential crop that sustains an abundance of a culture's nutritional needs. Unfortunately, this annual legume loses up to 50 percent of its yield due to a disease called rust caused by the fungal pathogen Uromyces appendiculatus (race 53). Our goal is to develop solutions to limit the yield loss for this high demand crop by increasing understanding of common beans defense mechanisms against race 53 of the rust pathogen at the molecular level.

In this analysis we are concentrating on expression profiling of four WRKY- Transcription Factors (TFs) WRKY-23, WRKY-27, WRKY-35 and WRKY-54. WRKY-TFs are known to play a role in plant development, and defense responses in other plant species. Currently we are analyzing the expression of these TFs within two common bean genotypes; hypersensitive resistant (HR) Sierra and susceptible (S) Olathe at 0, 12, 24 and 36 hours after inoculation (hai) with rust spores utilizing semi-quantitative real time-polymerase chain (QRT-PCR) reaction. The Olathe 0hai RNA sample was used as control sample and the common bean endogenous gene cons7 was used as a housekeeping gene for calculating gene expression fold changes.

Based on our analysis using default parameters, WRKY-54was found to be up regulated at all of the time points in both the genotypes. The TFs 23 and 27 are down regulated in the susceptible genotype Olathe at 12 hai and WRKY 34 was up regulated in the resistant genotype Sierra. There is no significant difference in the expression of the above TFs at 36hai in both the genotypes. With this information, we aim to identify which specific pathways these proteins are involved in for further analysis. *[Acknowledgement: Sponsored by: NSF grant EPS 0814251, Experimental Program to Stimulate Competitive Research (EPSCoR) at Delaware State University]*

Faculty Advisor: Dr.Venu Kalavacharla, vkalavacharla@desu.ed

174
AtPDR-13 is Involved in Arsenic Sequestration in Arabidopsis

Keisha Cawley, University of Arkansas at Pine Bluff
Sathish K. Ponniah, Anissa Buckner, and M. Manoharan, University of Arkansas at Pine Bluff

Agricultural practices and industrial processes contaminate soil and environment with heavy metals. Among heavy metals, arsenic is an extremely toxic metal which adversely affects plants, animals, and human health. The development of phytoremediation technologies for the plant-based clean-up of arsenic contaminated soils is therefore of significant interest. Arabidopsis contain approximately 130 ATP-binding cassette transport proteins, which includes PDR and MRP subfamilies. Members of the PDR genes are known to play a role in the sequestration of toxic compounds in plants. We have cloned the full length AtPDR13 gene and over-expressed in Arabidopsis to test arsenic sequestration. Wild-type, AtPDR13 over-expression, AtPDR13 RNAi, and AtPDR13 mutant T2 seeds were cultured on half strength MS medium with sodium arsenate (100µM). The shoot fresh weight of AtPDR13 RNAi and mutant lines were higher than AtPDR13 over-expression and wild-type lines in samples treated with sodium arsenate. Mutant lines showed highest root fresh weight. Arsenic was found less in RNAi than over-expression and wild-type lines. The results indicated that AtPDR13 may have a role in arsenic uptake and the over-expression of AtPDR13 may help in phytoremediation. *[Acknowledgement: This study was supported, in part, by a grant from the Arkansas Science & Technology Authority ASSET II NSF 11-EPS2-0007 for Plant Powered Production awarded to Dr. Muthasamy Manoharan, Department of Agriculture, University of Arkansas at Pine Bluff, Pine Bluff, AR.]*

Faculty Advisor: Dr. Muthasamy Manoharan, manoharanm@uapb.edu

175
Biodiesel from Locally Grown Oil Seeds Crops: A Comparative Study of Canola and Camelina

Ja'Nay Currie, Shaw University
Dr. Deva Sharma, Shaw University, NC
TeShima Brennen, North Carolina State University, NC

The quest for alternative fuels started when in 1893 Rudolf Diesel demonstrated an engine running on peanut oil, and won the highest prize at the World's Fair in 1900. In order to reduce the state's dependence on imported fuels, North Carolina has its Strategic Plan with a goal to generate 10% of NC liquid fuels from locally grown biomass by 2017. A significant contribution towards this goal may be realized from oil seed crops currently being grown in North Carolina. At Shaw, we are experimenting with two such crops, namely: canola and Camelina. In this study, we will be reporting the results of Biodiesel generation from canola and Camelina seeds grown by Bertie County farmers for Shaw University's Farm to Fuel Project. In addition to generating Biodiesel from canola and Camelina seeds grown in Bertie County, NC, we will compare other oil-producing seeds, e.g. Jatropha, Pongamia, castor, cottonseed, mustard, soybean, peanut, sunflower, cotton and peanut. Cotton, peanut and soya beans are other major food crops currently grown by farmers in Eastern North Carolina. The report will focus on the results of our pilot project of growing 10 acres of canola and 10 acres of Camelina in Bertie County, their relative yields, cost-benefit-analysis, and other uses of these two non-food crops. *[Acknowledgement: 1.) Minority Science and Engineering Improvement Program, U.S. Department of Education; and 2.) National Science Foundation]*

Faculty Advisor: Dr. Deva Sharma, dsharma@shawu.edu

176
Tardigrades Asociated with Bryophytes in the Pacific Northwest

Rosa Hunter, Northwest Indian College, Bellingham, WA

The purpose of this research project was to first find out if there are Tardigrades in the Pacific Northwest, specifically in Whatcom County, Washington and second to find out what bryophytes they are associated with. Eighteen bryophyte species were collected and documented and identified using standard methods including the use of a GPS unit to obtain locality data. The collection of bryophytes is a common method to obtain tardigrades. There are two standard methods for isolating tardigrades from collected materials. The first is to soak bryophyte specimens in water to release the tardigrades and the second method involves the use of a Berlese-Tullgren funnel. Materials obtained were transferred using micropipettes to glass slides to examine microscopically using bright field and phase contrast methods. Isolated tardigrades were identified using standard identification keys and nomenclature sources. Some ecological considerations are that some studies have included identifications of the research and demonstrated some patterns of bryophyte-tardigrade associations, notably the presence of tardigrades with five moss species (Bryum argenteum, Clapodium crispifolium, Dicranoweisia cirrata, Dicranum tauricum, and Rhytidiadelphus squarrosus). The most tardigrades were found in association with R. squarrosus, possibly because of its association with moist growing conditions that may favor the higher abundance of tardigrada populations. This project is the first to address bryophytes and their associated micro-invertebrates at NWIC. This initial exploratory project has yielded results that may be explored further as the focus of a baccalaureate program of study at NWIC to contribute to knowledge of Tardigrades in western Washington. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: brian compton, bcompton@nwic.edu

177

GFP Chloroplast Transformation to Study Functional Genes in Tobacco

Kiara Little, Fort Valley State University, GA

Chloroplasts are organelles found in plants that conduct photosynthesis and other biologically important processes. Plants can be genetically modified through a process known as chloroplast transformation which involves homologous recombination of foreign genes into the chloroplast. Our hypothesis is that we can use tobacco chloroplast transformation for functional validation of chloroplast targeted proteins from other plants preventing any complications of chloroplast import. Usually green fluorescent protein (GFP) is used in conjunction with chloroplast transformation because GFP retains fluorescence when fused to another protein on both the N- and C- terminal making it an attractive tag to monitor subcellular activities such as gene expression, protein-protein interactions, and protein trafficking and localization. Tobacco chloroplasts were first transformed with GFP to ensure that chloroplast transformation is occurring efficiently. We were able to observe chloroplast-derived expression of GFP in the resulting transgenic plants thereby leading us to the conclusion that chloroplast transformation is feasible in tobacco. Further studies will focus on studying the function of apple chloroplast targeted proteins with unknown functions utilizing chloroplast transformation in tobacco. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

178

Evaluation of Organically and Conventionally-Grown Cowpeas and Sweet Corn

Shetelia Melton, Fort Valley State University

Organic foods are widely perceived to be more nutritious and healthier than conventionally-grown products, and the production process is perceived to be more environmentally-friendly. The United States is the only developed country producing large amounts of cowpeas. Sweet corn is a source of many nutrients such as the B-complex vitamins and carotenoids. The overall aim of this project was to evaluate the compositional contents of organically and conventionally-grown cowpeas and sweet corn. Specifically, protein, starch, ash, fat, fiber, sugar contents, amylose:amylopectin ratio and color of conventionally and organically grown cowpeas and sweet corn were evaluated. Two treatments (organically and conventionally-grown) of cowpeas and corn were evaluated in triplicate. Protein and starch were determined using the Bradford and Amyloglucosidase/a-Amylase methods, respectively. Ash was measured with the muffler furnace at 550ºC. The Soxhlet apparatus and ANKOM2000 Fiber Analyzer were used to measure fat and fiber contents, respectively. The Sucrose, D-Fructose and D-Glucose Assay procedure was used to determine the sugar and amylose:amylopectin ratio was measured by the Iodocolorimetric method. Color was determined with a hand held Minolta Chromometer. The mean protein contents of the conventional and organic cowpeas were (11.8±1.8% and 10.8±0.8%, respectively). For the sweet corn, protein contents were 3.3±0.4 and 3.6±0.5%, respectively, for those grown organically and conventionally. The starch content of the organic sweet corn (34.9±1.8) was higher than that of the conventionally-grown (29.7±0.9%). For both the organic and conventional cowpeas and corn, there were no differences in ash and fat contents. The organic cowpeas had higher fiber content than those conventionally-grown (7.4±0.7 vs. 5.2±0.1%). In the conventionally-grown sweet corn, glucose, fructose and sucrose contents were higher than the organic sweet corn. All the cowpeas had negligible amounts of glucose and fructose; however the conventional cowpeas had slightly higher sucrose. The conventional cowpeas had slightly higher L* values (66.5±0.42 vs. 63.5±0.5) than the organic, indication of a lighter color. Overall, the organic sweet corn had higher starch but lower sugar contents than those grown conventionally. The color and fiber differed for the organic cowpeas. Consumers will be able to use the information to make healthier and more informed food choices. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

179

Effect of Organic Mulches on Phosphorus Availability under Organic Production System

Belther Monono, Alabama A&M University

This work aimed to evaluate the impact of mulching on soil pH and phosphorus (P) concentration under organic system at the Winfred Thomas Agricultural Research Station (WTARS) in Alabama. Mulching include spent mushroom compost (SMC), Sudan sorghum hybrid (SS), and a combination of spent mushroom compost and Sudan sorghum hybrid (SS+SMC), laid on the soil surface. The Soil samples were collected in 0-10 and 10-20 cm depth after crop harvesting. Phosphorus extraction procedure was performed using a double acid extraction develop by Melhich (Melhich 1). The soil pH was measured using glass electrode at 1:2 soil to water ratio after 30 min of equilibration. The results of the experiment showed that P concentrations were dominant at 0-10 cm depth as compared to 10-20 cm and varied within treatments. At the lower depth the

pH levels of the soil were slightly acid and ranged from 5.7 to 6.6. The use of SMC or SS+SMC improved P availability and could be considered as one way to control weed and improve soil nutrients. *[Acknowledgement: Regine Mankolo]*

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

180
Expression of PvLea3 Gene in Phaseolus vulgaris during Drought Stress

Maryam Muhammad, Fort Valley State University, GA

Late Embryogenesis Abundant (LEAs) are low molecular weight proteins formed during the late period of seed development. They are involved in protecting the plant structures from damage caused by environmental stress like dehydration or drought. With time, plants have developed these survival strategies for continued changes in the environment. Drought is one of the main reasons for yield loss around the globe. Drought happens so slowly, we can only see the effects like poor crop quality. Phaseolus vulgaris or common bean is an important crop world wide making it the first choice for LEA protein research. Common beans are also the cheapest source of proteins making them very important to our diet. Our hypothesis is to determine the induction expression of the LEA protein, PvLea3 gene, as it is associated with drought tolerant plants. This gene belongs to Group 3 of the LEA proteins and is responsible for enriching ions during the dehydration of higher plants. The objective is to understand how drought stress affects the expression of the PvLea3 gene. It is also important to identify when the gene is expressed meaning at what point in time during drought is the gene expressing its self. To conduct the experiments, plant seedlings from two different Phaseolus cultivars, SEA5 and TARS283, were stressed by providing no water for 10 days. To understand the gene expression, RNA was isolated from seedlings at different durations of stress (from 24 hours to 10 days). Reverse transcription to complementary DNA (cDNA) using reverse transcriptase is the second step. Finally, REAL TIME-PCR was conducted to identify how and when the genes are expressed.

Results indicated that PvLea3 gene expression was induced by keeping the plants in stress for 96 hours and a high level of gene expression was observed even at 10 days after stress in both cultivars. The drought tolerant Phaseolus can be used in the breeding program to cross the Phaseolus high yielding varieties with less or no stress tolerance. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD HBCU-UP awarded to Sarwan Dhir, Ph.D., Director of the Center for Biotechnology, HBCU-UP and REU-Site Programs, Fort Valley State University, Fort Valley, GA.]*

Faculty Advisor: Sarwan Dhir, dhirs0@fvsu.edu

181
Extraction of Panicum virgatum (Switchgrass) Hemicellulose

Ashley Rich, University of Arkansas of Pine Bluff
Kris Bunnell, Danielle Julie Carrier, and Chuck West, University of Arkansas, AR

Biofuels have been a heavily researched topic over the last decade. According to Nuffield Council on Bioethics, the rush to find an efficient alternative fuel is driven by "energy security, economic development, and the mitigation of climate change." Because of America's fluctuating gas prices, dependence on other countries for oil, and oil's limited availability, the search to find an alternative biofuel has become more urgent. Hypothesis: Bioenergy crops such as switchgrass are being studied as a source for second generation biofuels because it grows in diverse climates, requires low inputs, and produces high yields of biomass. Hemicellulose has to be removed from the switchgrass to make cellulose more accessible to enzymes during enzymatic hydrolysis. Pretreatment breaks hemicellulose down to fermentable monomeric sugars, but can also degrade to potent inhibitory compounds.

The material used was Alamo Switchgrass, grown at the University of Arkansas Agricultural Research and Extension Center in Fayetteville, AR on a Captina silt loam soil. Two different samples were taken: both planted on July 3, 2008. The first sample was harvested on July 4, 2009 and the other on February 18, 2010 and the hemicellulose went through an extraction process. The dried, ground switchgrass was water-washed then Soxhlet extracted using chloroform:methanol (2:1, v:v). Samples were then delignified using sodium chlorite. Cellulose was then separated using potassium hydroxide followed by filtering. The hemicellulose was precipitated using four volumes of ethanol before being dialyzed and lyophilized. The sugar monomers analysis was conducted by using a Waters HPLC 2695 separations module equipped with a Shodex SP-G guard column and SP0810 column followed by a Waters 2414 refractive index detector.

Results: Compositional analyses were taken and structural carbohydrates were determined using a two stage acid hydrolysis modified from NREL's LAP Determination of Structural Carbohydrates and Lignin in Biomass. Switchgrass hemicellulose was extracted from two harvest dates and its composition was determined. About 28% was recovered from the February samples and 24% from the July samples. The glucose contents from the February and July samples were statistically different, while the xylose and arabinose contents showed no significant difference. Conclusion: These results suggest that the plant maturity of switchgrass affects its hemicellulose composition. *[Acknowledgement: This study was supported, in part, by a grant from the National Science Foundation to the Arkansas Science & Technology Authority ASSET II for Plant Powered Production to Dr. Julie Carrier, University of Arkansas, Fayetteville, AR.]*

Faculty Advisor: Dr. Julie Carrier, carrier@uark.edu

182
The Effects of Mycorrhizal Fungi on Sex-Specific Competition in Distichlis Spicata Seedlings

Allie Simpson, Portland State University

Population sex ratios are generally thought to be 1:1, but can vary in many species. Determining why populations' sex ratios vary has been an important goal for evolutionary biologists, as it will allow us to understand a major mechanism governing population structure. Many hypotheses have been put forward to explain skewed sex ratios. One such hypothesis suggests that males and females compete differentially against each other.

Here, using the dioecious, saltmarsh grass Distichlis spicata, which exhibits extremely skewed sex ratios as well as spatial segregation of the sexes, we tested the hypothesis that females would be more competitive than males due to females of this species having a higher rate of infection by mycorrhizal fungi. In the greenhouse, we grew D. spicata seedlings in competition and alone to determine the effects of competition. Additionally, in a fully crossed design, we added treatments with and without mycorrhizal fungi, a potential third player in intersexual competition in this species. Initially, we sterilized the seeds and let them grow in a sterile culture, in order to remove fungi, before planting. Once planted, we allowed the seedlings to grow in treatments for three weeks, until, we believed, the plants in the competition treatments began to interact. We determined the sex of each seedling by using the previously found RAPD-PCR marker for the female sex specific gene and determined the males by the absence of the female marker. We, then, measured the dry weight of individual plants, chlorophyll fluorescence, mycorrhizal infection rates and calculated root:shoot ratios.

Our results indicate that little size difference exists between male and female D. spicata despite the finding that females exhibit higher mycorrhizal infection rates. However, our results help explain the extremely skewed ratio found in D. spicata, and we place our results in the context of skewed population sex ratios in general. For the future, we plan to extend this greenhouse study to field studies to determine whether similar effects are found across multiple populations.
[Acknowledgement: This study was supported, in part, by a grant from NSF awarded to Dr. Sarah Eppley, Center for Life in Extreme Environments, Department of Biology, Portland State University, Portland, Oregon.]

Faculty Advisor: Sarah Eppley, eppley@pdx.edu

POLLUTION/TOXIC SUBSTANCES/WASTE

183
Investigation of Sources of Metal Contamination on the Turtle Mountain Chippewa Reservation

Elizabeth Bluestone, Fort Berthold Community College, ND
Audrey LaVallie, Faculty of Turtle Mountain Community College / Fort Berthold Community College

Tribal college students from Turtle Mountain Community College and Fort Berthold Community College investigated metal contamination sources on the Turtle Mountain Chippewa Reservation. The sources of possible contamination included two separate media- open soil and wetland sediments. Open soil sites had been previously tested in a 2009 CDC study and further samples were sought for corroborative purposes. These sites included the landfill and adjacent sites, two former dumps, a destroyed public housing site, an illegal dump and a local manufacturing plant; the latter location had previously shown high nickel and iron quantities. Wetland sediments were tested primarily for lead contamination when Dr. Debra Hunter, a leech research project investigator at TMCC, found that extensive leeching with leech traps weighted with lead weights had been ongoing for years in numerous sloughs on the reservation.

Students recorded all sample locations (latitude and longitude) with Garmin eTrex Legend HCx GPS units and later plotted the sites on GIS maps. Samples were crushed mildly if needed, and baked at 110°C for 30 minutes for thorough drying. Samples were digested first by acid and peroxide treatment in the hood and then further digested in an Ethos Milestone microwave by ramping to 180°C over 5.5 minutes and maintained at this temperature for another 4.4 minutes. Samples were diluted to a specified volume by 5% HNO3 with a small percentage of lanthanum suppressants present. Standards curves for Pb, Ni, Cr, Ag, Cd and Fe were calculated for a Buck 200A atomic absorption spectrometer, and field samples were then evaluated for these metals.

Results showed that Pb, Ag, and Cd were not high (above limit of detection) in any open soil samples, according to EPA soil screening generic levels for ingestion. Several Cd and Cr samples were over the EPA generic soil screening levels for groundwater; however, absolute comparison could not be done without doing a soil evaluation. Slough sediment lead levels were determined to be under the EPA generic soil screening limit of 400 ppm in all samples, although lead was elevated in some sloughs compared to others, suggesting some additions to various bodies of water by some source, possibly leeching.
[Acknowledgement: Funded by NSF undergraduate research grant (REU)]

Faculty Advisor: Kerry Hartman, khartm@fortbertholdcc.edu

184
Establishing a Baseline of Water Quality along the Coast of Northeastern North Carolina in Response to the Deepwater Horizon Oil Spill

TeAirra Brown, Elizabeth City State University / Norfolk State University

Deepwater Horizon was an ultra-deepwater, semi-submersible, offshore drilling oil rig used for oil exploration and production purposes. The oil rig was owned by Transocean and was under contract to British Petroleum (BP). On April 20, 2010, the Deepwater Horizon had a wellhead blowout which caused an oil spill in the Gulf of Mexico. This incident caused a total of eleven deaths and injured seventeen of the workers. The Deepwater Horizon blowout is the largest oil spill in U. S. history.
The Deepwater Horizon was located north of the Gulf Stream Loop Current which is a warm ocean current that begins its path within the Gulf of Mexico. The Loop Current flows northward between Cuba and the Yucatan Peninsula, eventually curving east and south along Florida's coast and exiting through the Straits of Florida. The Gulf Stream then follows the coastlines of the United States and Newfoundland before crossing the Atlantic Ocean. These currents have the potential to bring oil from this spill to the Outer Banks of North Carolina.

This project sought to establish a baseline on a range of data correlating to water composition along the Outer Banks of North Carolina from Ocracoke Inlet to Corolla with concentrated sampling from Ocracoke Inlet to Cape Hatteras. The spectral fluorescence data was the main indicator for the presence of crude oil. The data obtained predates any appearance of oil from the Deepwater Horizon oil spill on the outer banks of North Carolina. The compilation of data will allow researchers to analyze variations between the baseline and future data collected. *[Acknowledgement: Center for Remote Sensing of Ice Sheets, Center of Excellence in Remote Sensing Education and Research, Office of Navy Research, National Science Foundation.]*

Faculty Advisor: Jeff Wood, t.m.brown13849@spartans.nsu.edu

185
Investigating the Presence of the Ozone Weekend Effect in Davidson, North Carolina

Alexandra Buckley, Johnson C. Smith University
Juliana Porter and Dr. Cindy DeForest Hauser, Davidson College, NC

The Ozone "Weekend Effect" is the theory that Ozone Concentrations are lower on the Weekdays than the Weekend. Ozone formation is considered to be limited either by the ambient concentration of volatile organic compounds (VOCs) or nitrogen oxides (NOx). The Weekend Effect is observed in regions that are VOC-sensitive. The southeastern US has traditionally been NOx sensitive due to the increase in biogenic VOC emissions during the summer months when ozone production is at its peak. The presence of the Weekend Effect in Davidson, NC would have implications for emissions reduction strategies as VOC reduction would take precedence over NOx reduction. It is also worth noting that the Weekend Effect is typically observed in more Urban Centers and not observed in less polluted regions where ozone concentrations increase with NOx concentrations. To evaluate this phenomena in the Town of Davidson, Ozone and NOx concentrations were monitored using passive samplers over a seven week period at two locations.

NOx concentrations were consistently higher at the Concord and Main intersection than on South St., as would be expected for a site with more traffic. NOx concentrations were higher during the week and lower on the weekend at the high traffic site. If ozone production were NOx sensitive, we would expect to see a similar trend in ozone concentrations. Ozone concentrations showed little variation between the two sites. This is not surprising as ozone is a secondary pollutant. Ozone concentrations correlate with temperature. Ozone concentrations were consistently higher on the weekends than during the week at both sampling sites. The Ozone Weekend Effect was observed in the Town of Davidson during the Summer 2011 sampling event indicating that air quality in the Town of Davidson is resembling urban environments rather than the expected semi-rural trend. *[Acknowledgement: Davidson Research Initiative]*

Faculty Advisor: Dr. Cindy DeForest Hauser, mwinters@jcsu.edu

186
A Threat to Our Reefs: Sedimentation

Jewel Cumberbatch, University of Virgin Islands, St. Thomas
Bernard Castillo II, Ph.D. and Kynoch Reale-Munroe, University of Virgin Islands

Impacts on near-shore coastal habitats, resulting from sediment laden runoff, continues to be one of the main nonpoint sources of pollution contaminating surrounding waters in US Virgin Islands. Land use changes that decrease vegetation cover, increase the potential for soil erosion and therefore, sedimentation into coastal marine environments. Increased development, unpaved roads and a lack of effective erosion control practices have massively contributed to increased sediment loading rates in the territory. This study was designed to quantify and compare sediment production rates from natural and anthropogenic sources of sediment within the subtropical environment of the East End and Boiler Bay watersheds on St. Croix. Sediment production rates are being measured from undisturbed, vegetated hillslopes, and disturbed areas, represented by old unpaved roads that are currently used as foot trails. The main objectives of this project are: 1) to

compare erosion rates between the two types of surfaces (i.e., trail vs hillslope); and 2) to quantify the particulate organic material composition of the collected sediment samples from both source types. Monitoring sites have been established throughout the watersheds by the installation of 21 sediment traps that collect material from trails, hillslopes and cliff surfaces. Material collected from each of the sediment traps during the 2010 study period were analyzed and correlated with rainfall data, slope and vegetation cover. Subsamples taken from the material collected from the sediment traps were analyzed for organic content, using the Loss on Ignition (LOI) method. Preliminary results illustrate that erosion rates on trail surfaces are higher than undisturbed hillslopes. In addition, the ranges of particulate organic material present in the soil samples are showing that samples taken from trail surfaces are generally lower than those taken from undisturbed hillslopes. *[Acknowledgement: USGS through WRRI at UVI (Project: 2010VI170B) NSF HBCU-UP through ECS at UVI (Grant: HRD 0506096).]*

Faculty Advisor: Bernard Castillo II, Ph.D., bcastil@uvi.edu

187
Biodiesel Fuel from Sewer Grease

Destiny Gray, Fisk University / Tennessee State University
Christina Lee and Cierra Parker, Fisk University, TN
Samantha Levy, College of Agriculture, Human and Natural Sciences, Tennessee State University

Brown grease refers to lower quality oils and greases, generally containing large amounts of free fatty acids (FFA) and suspended water. Because of the technical difficulties of making bio-diesel from that source of oil, it has received much less attention than virgin or used vegetable oils. Depending on the quality, the use of brown grease requires an acid catalyzed or two-step acid, then base, catalyzed procedure. In spite of those difficulties, we believe the brown grease route is worth pursuing because of its potentially plentiful supply and lower cost. Because oil from sewer grease mostly FFA, an acid catalyzed process was used. For each preparation, 25 mL of oil was mixed with 20 ml of methanol and a sulfuric acid catalyst (100ul-150ul), and the mixture was refluxed for up to 24 hours. Cooled reaction mixture poured into separatory funnel containing 40 mL water, shaken, and lower aqueous layer was discarded. 1 g K2CO3 dissolved in 40 mL water and added to crude Biodiesel fuel (BDF). This process was repeated twice. Emulsion allowed was to break overnight, followed by centrifugation. Oil layer (BDF) was collected and centrifuged to remove residual H2O and sediment. BDF was collected and weighed. The 150 microliter acid catalyzed samples generated higher yields than the 100 microliter samples. This is in contrast to our previous studies on biodiesel preparation of oil extracted from garbage. The 100 microliters of catalyst was the optimum amount. The garbage oil contained both triglycerides and FFA, while the sewer greases seemed to be mostly FFA by IR analysis. There was considerable variation in the amount of sediment from sample to sample. This affected the consistency of the reaction yields. For future investigation, we plan to degum the sewer grease by hot water to remove the residual bottom sludge and other solid impurities. *[Acknowledgement: This study was supported in part by the grants from NSF, HBCU-UP ID 0927876.]*

Faculty Advisor: Larry Pratt, lpratt@fisk.edu

188
The Effect of Dairy Manure Applications on Nitrogen Fixation by Alfalfa under Mediterranean Climate Conditions

Bridget Guiza, University of California, Davis / University of California, San Diego

Alfalfa (Medicago sativa L.) is a legume with a perennial growth habit and deep root system. It is thought to protect surface and groundwater quality by taking up residual soil nitrogen in fields that have received excessive rates of manure and nitrogen fertilizers. This has not been documented under irrigated Mediterranean climate conditions such as California. We used a natural abundance stable isotope method to estimate biological nitrogen fixation (BNF) by alfalfa growing in fields having a history of dairy manure applications. This approach exploits the 15N content of manure (and soils receiving manure), which typically is elevated at a small but measurable amount above that of the atmosphere. This small enrichment in 15N is primarily due to selective loss of 14N from the manure during ammonia volatilization following excretion. We measured the 15N /14N content (atom %) of alfalfa and non-legume reference plant (weed) samples collected in the Central Valley of California from commercial farm fields having a history of manure (and one wastewater) applications and others with no history of manure applications. Reference plants and alfalfa were collected in triplicate in each field and within a few meters of each other. Nitrogen content was determined on all samples by combustion and 15N /14N was determined by isotope ratio mass spectrometry (IRMS). We used these data to estimate the proportion of alfalfa N derived from the atmosphere (%Ndfa) from soil in both manured/wastewater and non manured fields. Alfalfa from fields with a history of manure/wastewater applications have an elevated 15N content ranging from 1 to 5%. The %Ndfa was lower in manured/wastewater fields ranging from 20 to 75%, while in the nonmanured fields the %Ndfa was significantly higher at about 95%. This suggests that alfalfa grown in the Central Valley of California in fields with a history of manure applications does obtain a significant portion of its nitrogen from soil residual N and may decrease nitrate leaching and groundwater contamination. The method used in this study requires that reference plant and alfalfa N rooting patterns be similar, and future studies should focus on this aspect. *[Acknowledgement: Dr. Stuart Pettygrove, University of California, Davis]*

Faculty Advisor: Dr. Stuart Pettygrove,
gspettygrove@ucdavis.edu

189
Effects of Household Laundry Bleach, Detergents, and Fabric Softeners on the Development of Xenopus laevis

Courtney Hines, Oakwood University
Dr. Londa L. Schmidt, Oakwood University, AL

Pollutants found in waterways and ponds are believed to be the cause of the decline in amphibian populations. Household laundry detergents and fabric softeners are among the pollutants found in the water. Chemicals found within these detergents, specifically surfactants, are believed to cause negative effects on the growth and development of amphibians. Xenopus laevis, the African clawed frog, was the amphibian of choice for the study. Fertilized eggs from a pair of laboratory frogs and from Carolina Biological Supply Co. were distributed among various dilutions of the selected detergents and fabric softeners (collectively referred to as "detergents") and control groups. The bought fertilized eggs and the in house ones were kept in separate aquaria. Eggs placed in the higher dilutions had a higher survival rate and, therefore were able to advance to tadpole stage and on to adulthood. The same was true for the control group. The tadpoles contained in the dilutions began to exhibit possible signs of deformities and malformations. There were differences in the rate of growth observed in the aquaria that initially had bought fertilized eggs as compared to those obtained from the in house pair. Observations suggested that once tadpoles reached adulthood, macroscopic and microscopic abnormalities could be a factor, thus proving the negative affects of household laundry detergents on the growth and development of amphibians. *[Acknowledgement: This study was supported, in part, by a grant from NSF-HBCU-UP Program Grant 0811507 awarded to Kenneth Laihing Ph.D., Program Manager for S.T.E.M.E.R. HBCU-UP, Oakwood University, Huntsville, AL.]*

Faculty Advisor: Dr. Londa Schmidt, lschmidt@oakwood.edu

190
Quantification and Identification of Environmental Contaminants in Native Insect Pollinators

Yoshira Ornelas, University of Arizona
Jen Sepulveda, Monique Adequi, and Ashley Hale, University of Arizona

Over the past few years pollinating animals have declined tremendously in the environment. This is a critical issue that has the potential to affect agriculture and thus affect food sources that humans depend on. Colony collapse disorder (CCD) is currently an issue of concern for honeybees in North America and Europe, and it is thought to be caused by environmental stressors. Pesticides have been suggested as the factor contributing to CCD. The aim of this proposal is to investigate how pesticides affect pollinators. Current pesticides used in agriculture are required to not kill pollinators, but they might still have sublethal effects. It is recognized that sublethal effects may interfere with orientation, learning capacity, foraging, and brood care with out causing death *(Thompson and Maus, 2007)*. The primary focus of this investigation is to analyze insect extracts by mass spectroscopy, and analyze contaminant levels using LC-and GC-mass spectrometry methods.

Pesticide standards of 15 known concentrations were created in organic solvent to determine limits of detection and create calibration curves for quantification. The pesticides used to create the calibration curve were; Acephate, Glyphosate, Prometryn, Pendimethalin, Chlospyrifos, Diuron, Oxamyl, Thidiazuron, Methyl Parathion, Esfenvalerate, Imidacloprid, and Acetamiprid.

Samples consisting of individual bees from southern Arizona were extracted in order to identify environmental contaminants. Honeybees, carpenter bees, cavity-nesting leaf-cutter bees, bumblebees, and alfalfa leaf-cutter bees (Total equals79) were collected for extraction. The average mass of the honeybees used was 0.0667 grams, the average mass for the other types of insects were 0.261 grams. Extracts were created from 49 honeybees and 30 native bees. Insects were homogenized and blended with acetonitrile, sodium acetate, and magnesium sulfate, followed by centrifugation according to QuEChERS method (Anastassiades, et al., 2003). Extracts are being analyzed by GC- and LC-MSMS analysis. LC- and GC-Tandem mass spectrometry analyses are being conducted using multiple reaction monitoring methods optimized for each pesticide target analyte. Analysis of single insect bodies is challenging due to the small amount of biological material available for extraction. Nonetheless we intend to survey all extracts for as many pesticide target analytes as possible over the next months. *[Acknowledgement: Sponsor award 1101728 WAESO]*

Faculty Advisor: Leif Abrell, abrell@email.arizona.edu

191
Environmental Microbiology and Oceanography

Veola F. Thomas, Johnson C. Smith University
Dr. Joseph Fail, Dr. Baldeo Chopra, and Dr. Sunil Gupta, Johnson C. Smith University, NC

Using organisms to detoxify or eliminate toxic materials is known as bioremediation. Oceans play a major role in the shaping of the weather and climate over the entire earth. Waves, tides, currents, salinity, temperature, pressure and light intensity can largely determine the makeup of biological communities. Environmental disasters, such as oil spills, could

have a tremendous impact amongst natural bacterium environments. The question of whether bacterium can sustain life in their natural environments and recover from pollutants such as oil is of great concern. Identification of bacterium that are capable of consuming oil and surviving will enable conservation of natural resources and the endangered species populating the ocean floor.

The purpose of this research was to determine a bacterium that can be utilized to consume oil and survive various conditions. Microbial soil was collected from various plots in Ribbon Walk, North Carolina. An agar solution was prepared in order to isolate bacterium to be grown under normal conditions. Surviving microbes were then diluted with various concentrations of motor oil, water or sucrose. Microbes surviving preliminary trials were further researched to determine genome and cellular functions.

Microbes diluted with a water solution survived. Microbes diluted with the oil solution also survived. Although it was hypothesized that sucrose would aid in the survival of microbes, exposure to sucrose destroyed the cultures. Additionally, soil microbiology did not facilitate testing of pure microbial cultures. The presence of numerous varieties of microbes in the soil samples yielded inconclusive results. Future research will include a variety of uncontaminated cultures of a single microbe. *[Acknowledgement: Ecological Society of America Strategies for Ecology Education, Diversity and Sustainability (ESA-SEEDS) at Johnson C. Smith University]*

Faculty Advisor: Dr. Joseph Fail, mwinters@jcsu.edu

192
Comparison of Hexavalent Chromium Reduction by Bacillus Sphaericus in Fine Sand and Soil Columns.

Priyanka Yarlagadda, Paine College
Brittney Fontenot, Dr. C. R. Nair, Dr. Bibekananda Mohanty, and Dr. C.P. Abubucker, Department of Mathematics, Sciences and Technology, School of Arts & Sciences, Paine College, GA

An International Agency for Research on Cancer (IARC) report indicates that hexavalent chromium is known as human carcinogen. The trivalent (Cr-III) and hexavalent (Cr-VI) forms of chromium are two important oxidation states of chromium. Cr-VI is water soluble, highly toxic and is known to be both carcinogenic and mutagenic to living organisms and Cr-III is non-toxic, non-mobile micronutrient and used by the biological system.

The present study was undertaken to examine the potential of Bacillus sphaericus (a soil bacteria) in the reduction of hexavalent chromium in fine sand and soil columns. B. sphaericus 2362 cells were grown successfully in a liquid fermentation medium containing sodium acetate, yeast extract, magnesium chloride, and calcium chloride. The fermentation medium was inoculated with B. sphaericus followed by addition of 3000 µg of Cr-VI and the culture was grown for 48 hours. During this period the growth of the cells was not inhibited compared to control (no Cr-VI) and the chromium was completely reduced in the 12 hours of growth. It was hypothesized that the bacteria would have enhanced ability to reduce chromium in sand and soil columns using molasses as the source of carbon for cell growth. Fine sand from a local store and soil from a depth of 50 to 60 cm at Paine College campus were collected, sterilized and used in the study. The control column has 3000 µg of Cr-VI, as well as the columns with molasses and molasses plus bacteria.

The results of this study indicated that sand columns treated with molasses and bacteria reduced 65 % of the Cr-VI as compared to control in 8 days. The results of the soil column study indicated that the treatment with molasses and bacteria reduced 75% of the Cr-VI as compared to control in 2 days. Thus, it appears that B.sphaericus can be used for bioremediation of Cr-VI in soil columns with molasses more efficiently as the source of carbon for cell growth. *[Acknowledgement: This study was supported by a grant from D.O.E awarded to Paine College, Augusta, GA for bioremediation research on chromium.]*

Faculty Advisor: Dr.C.R.Nair, cnair@paine.edu

WATER

193
Population Estimate and Tracking of Astyanax anes by Means of Electroshocking to Capture Sample: Use of Elastomer Implants To Code Collection Sites

Sunshine Claymore, Sitting Bull College, ND

The banded tetra (*Astyanax aeneus)* has inhabited the anthropogenic water systems throughout Costa Rica. Previous studies have indicated that *Astyanax aeneus* has become the dominant fish species in many of the canal systems that were built to provide water for irrigation of rice and sugar cane fields. The purpose of the study was to determine population estimates, as well as the level of fish movement, of *Astyanax aeneus* in the canal systems. Because of the remote nature of these anthropogenic water systems, the ability to capture large amounts of fish to determine population estimates, as well as the fish movement, within these systems can be difficult. Through electro-shocking methods, 357 *Astyanax aeneus* were captured for inclusion into the study.

Upon collection of the fish, an elastomer implant was injected into each *Astyanax aeneus* caught. Each implant was color coded according to the sample site from where the fish was caught, in order to determine the level of fish movement throughout the study period. After elastomer implantation of the fish, each fish was released on-site and allowed to

reacclimatize back into its original habitat for three days before a second sampling of the area was conducted in an attempt to recapture the marked fish. During the recapture sampling process, a total of 735 Astyanax were caught. Six of the recaptured fish carried the elastomer marking from the original sampling period.

Mathematical calculations of these data indicate that population estimates of *Astyanax aeneus* are large throughout the anthropogenic water systems. In addition to the population estimate determination, the study found that the movement of fish appears to vary depending on on-site specific environmental factors. Therefore, future research is needed to obtain environmental data, such as dissolved oxygen concentrations, water temperature, and flow rates to determine which factors contribute most to the movement and population density of *Astyanax aeneus*. *[Acknowledgement: This study was funded in part by the National Science Foundation (NSF) Tribal Colleges and University Programs (TCUP) grant and by Sitting Bull College]*

Faculty Advisor: Linda Different Cloud, lindaj@sbci.ed

194
An Evaluation of Indicator Bacteria Levels at Green Lake Park Swimming Beaches

T'Shane Williams, University of Washington
Nicola Beck M.S. and J. Scott Meschke Ph.D., University of Washington

Green Lake Park, located in the center of an urbanized neighborhood, is one of the most frequently visited parks in Seattle, Washington. The park is valued for its sizeable fresh water lake (259 acres), which is very popular for swimming. Two swimming beaches at the lake: East Beach and West Beach are visited regularly by a diverse cross section of the city's population. The purpose of this study was to identify and compare the levels of indicator bacteria in the two beach waters and to evaluate whether the swimming beach waters met the State and EPA criteria for fresh water. The indicators examined in this study were Escherichia coli, Enterococcus sp., and fecal coliforms. Sampling occurred twice weekly for 5 weeks during the months of July and August 2011. Three evenly distributed samples were collected at knee-high water level within the swimming areas at each beach.

Each sample was analyzed in duplicates for each of the three indicators of interest by membrane filtration and the colony forming units (CFU) per 100 ml were calculated. While a small number of individual samples exceeded the recommended criteria, the geometric means of the CFUs for each of the three indicators examined were below the State and EPA water quality standard, indicating that the beaches were safe for swimming. The Geometric means of the indicator organisms for all sampling dates and locations at East Beach were 43 CFU/100mL for Fecal coliforms, 43 CFU/100mL for Enterococcus sp., and 20 CFU/100mL for Escherichia coli. For West Beach the results were 28 CFU/100mL for Fecal coliforms, 6 CFU/100mL for Enterococcus sp., and 29 CFU/100mL for Escherichia coli.

When the results for both beaches were compared, it showed that the levels of the geometric means for all the indicator organisms were higher at East Beach which could be related to the higher number of people and ducks sited in the water at each sampling. *[Acknowledgement: This study was supported by the Award R25ES016150 from the National Institute of Environmental Health Sciences. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.]*

Faculty Advisor: Dr. J. Scott Meschke, jmeschke@uw.edu

MATHEMATICS & STATISTICS

CANCER RESEARCH

195
Data Envelopment Analysis Models to Identify Potential Cancer Biomarkers Genes: Cervix Cancer

Jorlys I. Alvarado-Morales, University of Puerto Rico at Mayaguez
Jaileene Pérez-Morales, Paloma Díaz-Candelas, Matilde Sánchez-Peña, and Clara E. Isaza, Mauricio Cabrera-Ríos, University of Puerto Rico at Mayagüez

In the identification of potential cancer biomarkers lies a significant contribution to characterize, detect and understand the illness. In our research group, a novel method based on multiple criteria optimization has been proposed to detect potential cancer biomarker genes through the analysis of microarray data. More precisely, the multiple criteria optimization problem is approached through a technique called Data Envelopment Analysis (DEA). DEA is a nonparametric technique capable to identify an envelope of a set of solutions. This envelope is found following the desirable directions (minimization or maximization) on each of the multiple criteria characterizing each solution. The prerogative in this method is that, if genes (solutions) can be characterized through multiple criteria (say, p_values) to be optimized (minimized in the case of the p_values), then finding the genes in the envelope of the set of genes (formally known as efficient frontier), would detect genes with high probability of having biomarking properties. There are several DEA formulations, formally called DEA models. In this research six models are compared on their capability to detect cervix biomarker genes. Essentially, they are compared

using the total number of genes that they detect and the fraction of these genes that present biomarking properties.

The cervix cancer database used in this study consists of 10,693 genes characterizing eight healthy tissues and twenty-five carcinogenic tissues [Wong YF, Selvanayagam ZE, Wei N, Porter J, Vittal R, Hu R, et al. Expression Genomics of Cervical Cancer. Clinical Cancer Research. 2003;9(15):5486-5492]. Using the Mann-Whitney test, two p_values are obtained for each gene. The Mann-Whitney is a nonparametric test on the difference of the medians of two populations. One of the p-values is left the same while the other one is transformed, this with the idea to provide a performance measure to be minimized (the original p_value) and another to be maximized (the transformed p_value). Ten frontiers are generated from each model recording those genes that are deemed efficient by the corresponding model. The resulting genes are compared to a list of 28 genes that have been shown that are related to cancer.

The preliminary results show that one of the models, called the Free Disposal Hull Model (FDH), detected 25 of 28 cervix cancer biomarkers. This result can be compared with the Increasing Return to Scale (IRS) model and the Banker-Charne. *[Acknowledgement: NSF-REU; Lockheed Martin Corp.]*

Faculty Advisor: Dr. Mauricio Cabrera-Rios, mauricio.cabrera@gmail.com

Materials Science

196
Spatial Spread of Wolbachia-Infected Mosquitoes

Chassidy Bozeman, North Carolina State University / Clark Atlanta University

Dengue Fever is a disease transmitted by the mosquito species Aedes aegypti. Currently, strategies for controlling dengue rely upon reducing the mosquito population. An alternative method involves releasing mosquitoes infected with Wolbachia, a vertically transmitted bacterium that reduces adult mosquitoes' lifespan and reduced the mosquitoes' ability to acquire and transmit dengue virus. The spread of Wolbachia is made possible by cytoplasmic incompatibility, which reduces the hatch rate of eggs laid by uninfected females that mate with infected males. We developed a discrete time metapopulation model to study the spread of Wolbachia.

Using numerical simulations, we studied different release strategies and the effects of fitness costs and movement rates on the speed and the spread at which Wolbachia spreads through populations (wave speed). In addition, we studied the effects of heterogeneous populations by varying subpopulation size. We found that simultaneously releasing Wolbachia into multiple, neighboring subpopulations increases the ability of Wolbachia to spread for a wider range of fitness and migration rates. When we allowed for heterogeneity in subpopulation size, the wave speed decreased and was more sensitive to fitness costs and movement rates. We found that under a variety of conditions, Wolbachia can spread through multiple subpopulations and Wolbachia-Infected mosquitoes can replace an existing population. *[Acknowledgement: NSF NSA]*

Faculty Advisor: Alun Lloyd, alun_lloyd@ncsu.edu

Mathematics and Statistics

197
Finger Motion Modeling for Bionic Fingers

Myrielle Allen-Prince, Bennett College, NC
Jay R. Walton, Ph.D., Texas A&M University

The use of bionic hands is becoming a reality for those who have suffered amputation. Mathematical models are necessary to calculate the forces needed on each tendon to mimic the motion of human fingers. We modeled the motion of the human finger and thumb as it bends in and out using Newton's second law of motion. A system of partial differential equations was developed to describe the relationship of the forces needed to move the finger to a specified position, incorporating a feedback mechanism. Our work shows that this type of model can be used to accurately control the motion of a human finger. Our model successfully calculates the movements due to the forces on the phalanges. One benefit of our approach was that it is simpler. This project can be extended by finding a way to move the finger and thumb in space at any time, also by selecting a point in space and moving the finger to that point at a given time. *[Acknowledgement: This project is funded by the National Science Foundation.]*

Faculty Advisor: Margaret W. Curtis, Ph.D., mcurtis@bennett.edu

198
Analysis of Various Schemes for the Estimation of Atmospheric Stability Classification.

Helen Bagnato, Suffolk County Community College, NY
John Heiser and Terry Sullivan, Brookhaven National Laboratory, NY

Atmospheric stability class shows if the air is stable or unstable in a certain area. This is particularly important to Brookhaven National Laboratory's (BNL) Emergency Response if a hazardous chemical has been released. There are many methods to calculate stability class but none of the methods are applicable under all conditions. The goal of this project was to calculate stability class from the given data by using seven different

methods and then comparing them to each other to see why each method gives different results and which method is more appropriate to use. The seven different methods are: Pasquill, Modified Pasquill, Temperature Gradient, Standard Deviation, Businger Formulation, Businger-Hick Formulation, and Bulk Richardson Number Formulation. The meteorology data at BNL were used to calculate the stability classes for each minute of the year from 1996-2002 and 2006-2011. These data were analyzed to find the percentage for each of the stability classes and then the methods were compared to see which one was more appropriate. So far the results showed that Standard Deviation Method is more appropriate because the percentages between years 2006 through 2011 were very close to each other. Thomas Watson is continuing the research with this data. *[Acknowledgement: NSF-STEM.]*

Faculty Advisor: Dr. Candice Foley, foleyc@sunysuffolk.edu

199
A Sinusoidal Temperature Model for Major Cities in Georgia

Jessica Foster, Savannah State University
Megan Bridges, Savannah State University

One of the periodic natural phenomena in life is temperature patterns. Given the significant positive and negative impacts of temperature patterns on lives and livestock throughout Georgia, there is a need to formulate a mathematical model that would describe maximum and minimum temperature through a yearly cycle of the major cities in Georgia. A mathematical model based on periodicity called a sinusoidal temperature model has been formulated to describe and estimate the maximum and minimum temperature characteristics for the major cities in Georgia. Since weather temperature is a complex phenomena that is periodic in nature, we base our model on the periodic functions of sine. A sinusoidal function is a function which can be expressed in the form: $y= D + A\sin(Bx + C)$ where the parameters A, B, C and D are constants. The four parameters in the sinusoidal temperature model that are used to predict or estimate temperature patterns are based on a thirty-year monthly means of the maximum and minimum temperature of cities in Georgia obtained from weather.com and almanac.com/weather/history/GA. The basis for the calculation of the parameters for the model is the thirty-year monthly means of maximum and minimum temperatures of each of the major cities included in the study. We believe that the thirty-year means will provide us with the necessary sample size to obtain a historical base for comparison of a given year's temperatures, and the model parameters for each city will provide a quantitative way of comparing temperature patterns among the cities. A scatter plot of the data for each of the cities clearly revealed a sinusoidal pattern. The model shows a high level of accuracy in predicting maximum and minimum temperatures for major cities in Georgia. Furthermore, the data indicate that the major cities in Georgia have (almost) identical temperature patterns. The standard deviation (which is used as a measure of accuracy of the temperature model) for the maximum temperatures and the minimum temperatures, ranged from 11.59 to 13.05 degrees Fahrenheit, and 13.50 to 14.94 degrees Fahrenheit respectively. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Samuel Dolo, dolos@savannahstate.edu

200
Mathematical Analysis of Solitons and Tsunamis

Adriana Gracia, The University of Texas - Pan American

On March 11, 2011, an earthquake recorded as 9.0 on the Richter scale, struck the coast of Japan that triggered a devastating 30-60ft. tsunami that swept over cities and farmlands in the northern part of the country. The Japan Meteorological Agency issued warnings on March 11 that recorded the tsunami as the most serious on its warning scale. Predictions were made that the tsunami would be of at least 3 m (9.8 ft) high. However, the tsunami that struck the coast of Japan was much larger than scientists predicted and cost over 1,000 people their lives. For this reason we are interested in researching the mechanism of tsunami evolution.

Tsunamis can be modeled by solitons; a self-reinforcing solitary wave that maintains its shape while it travels at a constant speed. Solitons are known to interact with other solitons, and emerge from the collision unchanged. A solitary wave is also described as a solution of the Korteweg-de Vries (KdV) equation. The KdV equation describes one-dimensional waves on shallow water surfaces and can be solved by the inverse scattering transform method. The Kadomtsev-Petviashvili (KP) equation describes a 2-dimensional dispersive wave on shallow water surfaces. This equation can be derived from the Benney-Luke equation, when we assume quasi 2-dimensionality. We will then use these equations to investigate the mechanism of tsunami evolution by means of creating a numerical simulation code for shallow water waves. In this project we develop a new efficient numerical method to simulate shallow water waves. Using our numerical scheme, we study the amplification of amplitude when two tsunamis interact.

We trust that our understanding gained by this research will allow us to comprehend how these shallow water waves behave, thus allowing us to better understand the mechanism of tsunamis. As future problems, we will update our numerical code and investigate more details of the interaction between tsunamis. Our research is intended to gain sufficient knowledge to help us become aware and prepared for future tsunamis. *(References: Y. Kodama, KP solitons in shallow water, J. Phys. A: Math. Theor. 43 (2010) 434004.) [Acknowledgement: We thank the NSF-LSAMP for funding our research project, and Dr.*

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Faculty Advisor: Dr. Kenichi Maruno, kmaruno@utpa.edu

201
Asian Carp Invasion of the Upper Mississippi River System

Dawn Howell, Bennett College
Kyriah Shannon and Hyunju Oh, Ph.D., Bennett College, NC

In our research we created two models, a model of competing species and a model of predator-prey in the Upper Mississippi River System. In order to construct our research we used data from the Upper Midwest Environmental Science Center and then used numerical methods with Maple, to solve the system of differential equations which cannot be solved exactly. First, we selected two fish species of silver carp and gizzard shad in the Open River, and from the pool in the Upper Mississippi River System, to create a competition model. We found a mixed equilibrium solution from the competition model and the solution point was a saddle point. That means silver carp will eventually overwhelm gizzard shad and drive it to extinction. Secondly, we selected two fish species of largemouth bass and gizzard shad in the Open River by setting largemouth bass species as a predator and gizzard shad species as a prey. We created a predator-prey model for dynamic of populations of largemouth bass and gizzard shad species. The silver carp is not a direct predator of largemouth bass or other species, but it becomes an indirect predator for other native fish species and eventually destructs the ecosystem. We will create more models in other pools which do not have silver carp yet in the Upper Mississippi River System and compare the pattern of oscillating graph of predator-prey models. Therefore we can see the indirect predator Asian carp's behavior in the Upper Mississippi System. *[Acknowledgement: This research project is funded by the HBCU-UP Computational Science Project at Bennett College, which is supported by the National Science Foundation, Award 0506155.]*

Faculty Advisor: Dr. Hyunju Oh, hoh@bennett.edu

202
The Calculus Alive Project: Engaging Students to Become 21st Century Scholars

Ashley Moore, Johnson C. Smith University
Dr. Dawn McNair, Johnson C. Smith University, NC

Studies have shown that one reason for the loss of students early in the Science, Technology, Engineering, and Mathematics (STEM) pipeline is dissatisfaction of students with an emphasis of factual recall (Seymour & Hewitt, 1997) and a perceived lack of applicability of STEM disciplines improving the lives of people in the community (Ibarra, 1999). The Calculus Alive Project (CAP) creates a platform where students are engaged in an inquiry-based workshop to create mathematical models to answer questions about the world around them. Our research compares the impact on academic performance and attitudes of CAP students versus the broader population of calculus students. This presentation will discuss CAP design and implementation as well as CAP formative data.

A two-tailed t-test was used to analyze (CAP and non-CAP) students' understanding of core calculus topics. Surveys were used to capture qualitative data. Findings indicate that the project had a statistically significant impact on student performance and that students had a more favorable attitude towards mathematics. Noting these successes, CAP serves as a catalyst for change in the way educators approach the teaching of undergraduate mathematics through high-level engagement and innovative pedagogical practices. *[Acknowledgement: NSF-funded Historically Black Colleges and Universities Undergraduate Program (HBCU-UP) at Johnson C. Smith University]*

Faculty Advisor: Dr. Dawn B. McNair, dmcnair@jcsu.edu

203
Development of Funny Flash Math Games: Evaluation of Trigonometric Functions at the Special Angles

Ashley Morris, Savannah State University

The nation-wide FWD (Fail-Withdrawal-D grades) rates were marked inordinately high showing up in the 40-60 percent range. It has been stated on numerous occasions that this deficit is due to students' insufficient high school preparation, lack of reflection of students' needs, change of students' attitude, and other environmental, social, or mental factors. The most serious problem is students' lack of interest in the traditional learning environment. On the other hand, students show great interests in new games, and they grasp their concepts rather quickly. With this reasoning this project contributes to the development of new learning tools which attract the students' interest through the creation of a Math Online Flash Games. The use of the advantages present within web-based modern computer technology will allow a funny flash game and mathematics concepts to co-exist. In particular, the project primarily focuses on the evaluation of trigonometric functions at special angles which is one of most difficult topics that students are always confused on. It consists of three building blocks: an explanation of a formula through the flash movie that can be used to evaluate the trigonometric functions at the special angles, a matching card game with function-and-value cards, and a speed game to confirm the students' evaluation skills. The games keep their unique, fun nature, but stimulate students to become involved in pre-studying or practice. Although these learning materials are not currently examined in some classes, one expects that they help students enhance their math knowledge

and so to be successful methodologies. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Hyounkyun Oh, hoh@savannahstate.edu

204
The ∞ pairs of (m, n) when σ(m + n) = σ(m) + σ(n)

Dwayne Richardson, University of the Virgin Islands

Let N be the set of natural numbers. We define the arithmetic function σ: $\mathbb{N} \rightarrow \mathbb{N}$ by σ(n) = ∑_(d|n) d, where ∑_(d|n)d is the summation of all the positive divisors d, of n. This operation is known as the sum-of-divisors function. Suppose m is another element in N. Given the case σ(mn) where (m, n) = 1 (which is to say that m, and n are relatively prime), it is clear that σ is a multiplicative function, i.e., σ(mn) = σ(m) σ(n). We ask ourselves: are there infinitely many solutions (m, n) for which σ (m+n) =σ(m)+σ (n) ? (1) Some specific cases have been found, where (1) holds for infinitely many pairs (m, n). However, we need to understand why only certain pairs of (m, n) work. Determining these causes may lead to a new dimension of number properties that could affect all branches of mathematic and scientific study. This is why we seek only for primitive solutions (m, n). A solution is known as primitive, if the greatest common unitary divisor of m, n, and m +n is 1. Upon investigating pairs (m, n) that solve (1), it was found that each m, n and m + n would be multiples of primes. Using odd primes p, q, and r, along with natural numbers a, b, and c, where p ł a, q ł b, and r ł c, a system of linear equations was developed, as seen here:

$$ap + bq = cr \quad \sigma(ap) + \sigma(bq) = \sigma(cr)$$

Through applying Linear Algebra and Number Theory, an algorithm was developed which provided some solutions (m, n). This method shows that it is simple, but not trivial to provide several pairs (m, n) which satisfy (1). This strengthens the conjecture that there are infinitely many primitive solutions satisfying σ(m+n) =σ(m) + σ(n). *[Acknowledgement: This work is supported by NSF HBCU-UP HRD-0506096.]*

Faculty Advisor: Douglas Iannucci PhD, diannuc@uvi.edu

205
Tau Factorizations Over Z

Aqeeb Sabree, Texas Southern University
Nathan Bishop, St. Olaf College
Mary Bohlke, Loras College
Alex Sistko, Bradley University

Our research was done in the abstract algebra area of commutative rings. In our research we apply the theory of τ relations to Z. This research is based on the work by Dr. Dan Anderson who has laid the foundation for much of the τ relation. The question we asked was, for what values of n ∈ N is Z τn -Atomic? In the paper written by Dr. Anderson (On A General Theory of Factorization In Integral Domains), it explains how the notion of factorization of an element of an integral domain plays a central role in algebra. Our results were that Z is a τn -Atomic Domain for n ∈ {0, 1, . . . , 6, 8, 10} and is not a τn -Atomic Domain for all other n ∈ N. We had many future research questions, and we began answering some. We asked the question, is Z a τn -HFD for n ∈ N? This question we worked on and concluded that Z is a τn -HFD for n ∈ {0, 1, . . . , 6, 8, 10}. We then posit conjectures for the remaining values of n, as future work. *[Acknowledgement: National Science Foundation National Alliance for Doctorial Studies in Mathematics]*

Faculty Advisor: Michelle Tolbert, tolbert_ym@tsu.edu

206
Properties of Bit-String Arc Diagrams

Kenneth Shim, Delaware State University
Dr. Darin Johnson and Dr. Janko Milutinovic, Delaware State University

The bit string arc diagram was introduced by David Callan in American Mathematical Monthly. It shows an intriguing way to present an undirected graph with binary labeling. The vertices of this graph are assumed to be in ascending order from right to left using integer values and each vertex is labeled with a binary digit, 0 or 1. The edges (or arcs) can occur only between vertices when they have opposite binary values and a vertex cannot form more than one edge with vertices on its right side. Finding the relationships between properties of the bit string arc diagram and some other known mathematical objects was the primary objective of this research. Integer sequences were generated based on various properties of the bit string arc diagram of length n and compared with other known sequences in OEIS, The On-Line Encyclopedia of Integer Sequences. The integer sequences were primarily generated by the following methods.

First, a computer program was developed by utilizing a JAVA programming environment and the JGRAPHT package. Second, recurrence relations were constructed with given initial condition. The integer sequences generated by these methods were found to have some significant relationships to other known and well studied integer sequences. First, the number of bit string arc diagram of length n with k connected components, denoted by Cn,k, was shown to be 2k * Sn,k where Sn,k is the unsigned Stirling numbers of first kind. Second, the number of bit string arc diagram of length n with k zeros, denoted by Zn,k, is identical to the Eulerian numbers of length n+1.

These are perhaps the most well studied sequences in the study of permutations. The integer sequences generated by the number of bit string arc diagram on length n with k number of edges, denoted by En,k was found to be anti-symmetric to the integer sequences generated by Cn,k. A great many other sequences were also found. Algorithms were also developed to convert bit string arc diagrams to permutation cycles to demonstrate the relationship between the arc diagrams of length n and permutations of length n+1. Currently, the relationship between Zn,k and the Eulerian numbers and other integer sequences are being researched. *[Acknowledgement: This study is joint work of Dr. Darin Johnson and Dr. Janko Milutinovic, supported by a grant from the DSU Smile Project NSF with subaward to Dr. Darin Johnson, Department of Mathematical Science, Delaware State University, Dover, DE 19901.]*

Faculty Advisor: Janko Milutinovic, jmilutinovic@desu.edu

NANOSCIENCE

BIOMEDICAL ENGINEERING

207
Toward Backpacking Bacteria for Biomedical Applications via Antibody-Based Surface Attachment and Triggered Release

Mary C. Zuniga, Northern Arizona University
Rohan Fernandes and David H. Gracias, Johns Hopkins University, MD

We describe the fabrication of backpacking bacteria – bacteria attached to micro and nanoscale cargo for biomedical applications. Bacteria offer numerous attractive behaviors such as motility; the ability to respond to diverse stimuli and to grow naturally in niches within the body. Recent advances in micro/ nanotechnologies have enabled the fabrication of micro/nano scale cargo of controlled sizes, shapes, and geometries with tunable optic, electric, and magnetic properties. Backpacking bacteria combine the advantages of bacteria with those of the cargo they are attached to.

In this study we have developed a two antibody-based, surface attachment and triggered release method to fabricate backpacking bacteria. We attach motile Escherichia coli to sub-micron polystyrene beads. We hypothesize that our methodology enables both specific bacteria-bead attachment and on-demand release.

First, we fabricated 80μm x 80μm square gold (Au) patterns on silicon (Si) substrates, using conventional photolithography. The Au micro-patterns were functionalized with nitrilotriacetic acid (NTA) thiol to enable subsequent binding of his-tag proteins via nickel ions (Ni2+) chelation. Ni2+ attachment was obtained by immersion in an aqueous nickel sulfate solution. Next, the substrates were exposed to an aqueous his-tag protein G solution to selectively bind the tag to the Ni2+–NTA complex. We used two antibodies with complementary binding sites to achieve selective binding between the bacteria and beads on the Au patterns on the Si substrate. Goat anti-rabbit IgG was used to attach the beads to the Au patterns. The beads were in turn coated with rabbit anti-E. coli enabling attachment of bacteria to the beads. Bacteria–bead conjugates were released from the Au patterns using either imidazole or EDTA. Attachment and release were monitored using fluorescence and scanning electron microscopy. Control experiments, lacking any of the molecular functionalization steps, showed that if any of the steps was skipped, beads and bacteria did not bind specifically to each other or to the Au patterns. In conclusion, we have demonstrated a methodology for selective attachment and triggered release of motile cargo-carrying bacteria from patterned substrates. We envision the use of backpacking bacteria in intracellular or extracellular delivery of diagnostic or therapeutic cargo. *[Acknowledgement: This study was partially supported by NSF's REU program at Johns Hopkins University Institute of NanoBioTechnology.]*

Faculty Advisor: David H. Gracias, dgracias@jhu.edu

CIVIL/MECHANICAL/MANUFACTURING ENGINEERING

208
Variational Analysis of Nanoproperties – Preliminary Results

Nicole A. Blanco Vicens, University of Puerto Rico-Mayaguez

Cobalt Zinc Ferrite is an accessible magnetic material that, when doped with a rare earth element, becomes an attractive candidate for magneto caloric applications. One application that is deemed attractive is a magneto-caloric pump for refrigeration systems. The fact that this pump would not require mechanical parts would imply a reduction in maintenance costs. In this work a statistical experimental design was used to study the effect of the contents of Gadolinium (Gd) and Sodium Hydroxide (NaOH) on different physical properties of Cobalt-Zinc Ferrite nanoparticles. In particular, the objectives were a low demagnetization temperature, a high magnetization level, a low coercivity value and a high pyromagnetic coefficient. The experimental results indicated that only coercivity could be manipulated with the variation of NaOH and Gd, which in turn meant that this property could be minimized without statistically affecting the rest of the properties. Such optimization tasks will be carried out in the next stage of this project.

Along with the results of the previously mentioned experiment, the analyses of a series of presumed scenarios involving conflict between the different objectives are presented here. A conflict between objectives would imply, for example, that varying Gd in

a certain direction would decrease coercivity (a desired effect) but at the same time it would increase the demagnetization temperature (an undesired effect). Considering multiple objectives in conflict entails a special type of optimization procedure called multiple criteria optimization. Having the capability to deal with this kind of situations will enhance the decision-making associated with future experiments that involve tailoring multiple nanoproperties already planned within our research group. *[Acknowledgement: This material is based upon work supported by the National Science Foundation under Grant HRD 0833112. I will also like to thank Prof. Mauricio Cabrera-Rios for giving me his support throughout my research and his availability throughout the entire process.]*

Faculty Advisor: Dr. Mauricio Cabrera Rios, mauricio.cabrera@gmail.com

Materials Science

209
Characterization of 2-300nm Al2O3 films deposited via ALD

Malena Agyemang, Georgia Institute of Technology / Norfolk State University
Dr. Rosario Gerhardt, Georgia Institute of Technology

Thin films are used widely across the engineering field, as electrical semiconductors, optical coatings, in drug delivery systems and in solar cells. Alumina thin films are the most ideal type of films due to their properties. They are hard and stiff, have good chemical and thermal stability, firm adhesion to many surfaces, a high dielectric constant as well as excellent insulating properties. However, even though these thin films are used frequently, the properties of the thinnest films are assumed to behave the same way as thicker films.

The objective of this research is to characterize alumina thin films to give accurate measurements of the electrical properties at the nano-scale. Alumina thin films were deposited on silicon wafers via Atomic Layer Deposition at thicknesses ranging from 2-300nm and ellipsometry was used to determine the films thickness. Then, electrodes of various diameters were deposited on the films and impedance measurements were carried out at different frequencies. From these measurements, resistance and capacitance values were derived as a function of film thickness and electrode size and compared to expected electrical properties.

Results are found to depend heavily on the geometric parameters. Future works consists of a more extensive look at the thin films by depositing more electrodes of various sizes on different film thicknesses and taking more measurements, and also, by viewing them under an Atomic Force Microscope to get a better look at the structure.

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Faculty Advisor: Ms. Zenora Spellman, zespellman@nsu.edu

210
Preparation and Identification of Polyimide-CNT Composite Films

Johan Von Behr, Southern University
Barry Hester, Ph.D., Southern University at Shreveport, LA
Naidu Seetala, Ph.D. and Cassandra R. Hendon, Grambling State University, LA

Thermosetting polyimides are known for their chemical resistance, excellent mechanical properties, light weight and thermal stability and therefore an ideal choice as a material used in the aerospace industry. By incorporating Carbon Nano-Tubes (CNTs), strength and flexure becomes an enhancement of the mechanical properties. We prepared polyimide composites with 0 and 1 wt% of three varieties of carbon nanotubules (CNTs): Single Wall - functionalized, Double Wall - functionalized, and Double Wall - non-functionalized CNTs. The fictionalization is performed by oxidation in acid followed by purification. Polyimides were prepared using Bisphenol-A-dianhydride (BPADA), 2,2-Bis[4-(4-aminophenozy)phenyl] propane (BAPP), and refluxing in anhydrous N-Methyl-2-pyrrolidone (NMP) followed by precipitation, cleaning, dissolving and dispersing CNT in NMP, and curing in a vacuum oven. High quality films of polyimides with and without CNTs were characterized using FT-IR, TGA, DSC, and Positron lifetime spectroscopy (PLS). The FT-IR spectra for all the samples showed the characteristic peaks of polyimide such as C=O asymmetric/ symmetric stretching and bending of imide, C-O-C between two aromatic rings, (CO)2-NC of imides, aromatic ring vibration, etc. This confirms the completion of polymerization to form polyimide in all the films. TGA curves showed weight loss with temperature in two stages.

The first stage 180 - 300°C showed a weight loss of ~ 15%, that may be associated with the trapped (NMP) release. The second stage 500 - 750°C with a drastic weight loss is associated with decomposition. The residual weight is ~ 40% at 750°C in pure polyimide and functionalized single or double wall CNT dispersed polyimides. The non-functionalizes CNT dispersed polyimide showed similar two-step behavior, but the weight loss is remarkably less and about 80% weight remained at 750°C. DSC curves of all polyimide samples showed two distinguishable endothermic peaks at around 90°C and 200°C. The first peak may be correlated with the onset of NMP release, while 200 °C

for structural change. We used PLS to study the micro-porosity of CNT incorporated polyimide composites. The third lifetime component provided the information on pore size (lifetimes) and concentration of pores (intensities) using a simple model, and the values were compared between the films with and without CNT. *[Acknowledgement: NASA and NSF]*

Faculty Advisor: Dr. Barry Hester, bhester@susla.edu

Nanoscience

211
Single-Walled Carbon Nanotubes in Aqueous Lysozyme (SWNT-LSZ)

Kathryn Tracy-Parrilla, Florida International University / Auburn University
Daniel W. Horn and Virginia A. Davis, Auburn University, AL

The objective of this research was to increase the relative concentration of single-walled carbon nanotubes (SWNT) in aqueous lysozyme (LSZ). Films and fibers produced from these dispersions have been shown to have antibacterial activity against gram positive bacteria such as Staphylococcus aureus. However, in order to maximize mechanical properties, it is desirable to increase the relative concentration of individual SWNT.

In this research, two methodologies for trying to increase the supernatant concentration of SWNT were studied: carboxylation of SWNT and introduction of a surfactant, trimethyl tetradecylammonium bromide (TTAB). Carboxylation increases the solubility of SWNT in water through the introduction of hydrophilic, carboxylic acid groups to the SWNT ends. However, based on UV-vis spectroscopy data, carboxylation of the SWNT decreased the concentration of SWNT in the supernatant. This suggests that the hydrophobic interaction between SWNT and LSZ is a key determinant of dispersion stability. Introduction of various ratios of TTAB enabled an increase in the relative concentration of SWNT in the supernatant.

The results of this work can be applied to future studies of SWNT-LSZ dispersion and processing into films and fibers. *[Acknowledgement: NSF REU]*

Faculty Advisor: Dr. Virginia A Davis, davisva@auburn.ed

Physics

Astronomy and Astrophysics

212
Observing SNe Ia Progenitors with LISA

Frank Ceballos, University of Texas at Brownsville

The Galactic population of close white dwarf binaries is expected to provide the largest number of gravitational wave sources for low frequency detectors such as the Laser Interferometer Space Antenna (LISA). Progenitors systems of Type Ia supernovae are a subset of this population. We investigate whether LISA will be able to identify these progenitors. With this in mind we used a population synthesis model of the Galactic white dwarf binaries and a LISA data analysis algorithm using Mock LISA Data Challenge tools. We report on the results of a study of the properties of resolved binaries. Current data analysis techniques have demonstrated the capability of resolving on the order of 10^4 white dwarf binaries from a 2 year observation. The resolved binaries are either at high frequencies or large amplitudes or both. Such systems are more likely to be high-mass binaries, a subset of which will be progenitors of Type Ia supernovae in the double degenerate scenario. *[Acknowledgement: This work was supported by the NSF through the CREST and PAARE programs, and NASA through the URC program.]*

Faculty Advisor: Matthew Benacquista, benacquista@phys.utb.edu

213
Recent Acceleration and Observational Evidences of Black Hole Universe

Clayton Frederick, Alabama A&M University

Recently, Zhang has proposed an alternative cosmological model called black hole universe. According to this model, the universe originated from a hot star-like black hole with several solar masses, and gradually grew up through a supermassive black hole with a billion solar masses to the present state with hundred billion-trillion solar masses by accreting ambient materials and merging with other black holes. The entire space is structured with an infinite number of layers hierarchically. The innermost three layers are the universe that we live, the outside space called mother universe, and the inside star-like and supermassive black holes called child universes. The outermost layer has an infinite radius and limits to zero for both the mass density and absolute temperature. All layers or universes are governed by the same physics, the Einstein general theory of relativity with the Robertson-Walker metric of space-time, and tend to expand outward physically. The evolution of the space

structure is iterative. When one universe expands out, a new similar universe grows up from its inside. In this study, we analyze the acceleration expansion and matter accretion for the black hole universe. We also demonstrate observational evidences of the black hole universe and compare the black hole universe with the big bang cosmology. *[Acknowledgement: Alabama NASA EPSCoR NSF AAMU HBCU-UP]*

Faculty Advisor: T. X. Zhang, PhD.; M. Dokhanian, PhD, tianxi.zhang@aamu.edu: mdokhanian@gmail.com

214

Age Determination for the Open Cluster NGC 6939 from the Eclipsing Binary V12

Chantal Gonzalez, San Diego State University

Measuring precise ages in astronomy is a very difficult task, but star clusters often provide the best opportunities to make age determinations. A star cluster generally contains stars of the same age, and among these stars eclipsing binary systems can lead to high-precision measurements of the masses and radii of the two orbiting stars. If an eclipsing binary contains a star that is rapidly changing in size because it is running out of hydrogen fuel at its center, then these measurements can lead to a precise age. We performed a study of the eclipsing binary star V12 in the (~1.0-1.6 Gyr) open star cluster NGC 6939 by monitoring its brightness during eclipses with the Mount Laguna Observatory 1 meter telescope and the radial velocities of the stars using the 9-meter Hobby-Eberly Telescope. We have analyzed photometry and radial velocity data for binary star V12 to derive precise masses and radii, and will present a new determination of the age of the cluster *[Acknowledgement: National Science Foundation under grant AST-0908536 E.G. through grant AST-0850564 as part of the CSUURE Research Experiences for Undergraduates Program at San Diego State University. National Science Foundation under grant 0802628.]*

Faculty Advisor: Eric Sandquist, erics@aethon.sdsu.ed

215

Optical Monitoring of High Mass X-Ray Binary System BD+53 2262

Nathaly R. Zurita, Brigham Young University, UT

High Mass X-ray binary systems (HMXB) are usually composed of a B spectral type star and a neutron star. These systems have been primarily observed in the X-ray regime and as such their optical properties have not been thoroughly studied. We hypothesize that variability/periodicity in the optical brightness should be present and correlate with variability at other wavelengths. For the last five summers, optical observations of HMXB system BD+53 2262 have been gathered on the David Derrick 16'' telescope located at Brigham Young University.

To probe for long-term and short term variability, observations were taken in quick succession in one filter over the course of a night and also shorter observations through multiple filters spaced over many nights. The observations are primarily in the Johnson V filter, with B and I added in 2010, and R in 2011. We present optical light curves for five years of observations of the system BD+53 2262. There is a definite decrease in magnitude in the past five years and small monthly variations in three of the four years.

These indicate a long term periodicity on the range of years and some shorter term periodicity in the range of months, consistent with what was expected. Period analysis has been done on our data and preliminary results will be presented. We will keep observing this system to see if there is further evidence of long term periodicity and to see if the monthly variations continue. *[Acknowledgement: We acknowledge and are extremely grateful for the support from the WAESO LSAMP program for funding this research and a BYU MEG grant which was used to start this project.]*

Faculty Advisor: Dr. J Ward Moody, jmoody@physics.byu.edu

Biomedical Engineering

216

Hypoxic Investigations of Therapeutic Temperature-Responsive Poly(N-vinyl carpolactam) based Hydrogels for Cartilage Tissue Engineering

Omari Baruti, Cornell University / Morehouse College

Injury and diseases that affect articular cartilage present a daunting challenge in orthopedic medicine. During the onset of injury or disease, low oxygen environments decrease healthy cartilage cell growth making it harder for scaffolds to work in the defective joint. We have developed a therapeutic injectable composite hydrogel system that contains poly(N-vinylcaprolactam) [PVCL], hyaluronic acid (HA), and a synthetic for of vitamin E (a-tocopherol) [PVCL-graft-HA-graft-a-tocopherol (JD4)]. PVCL is a biocompatible temperature responsive polymer that forms a gel due to the lower critical solution temperature (LCST). Articular cartilage cells (chondrocytes) were harvested and seeded on various formulations of PVCL-graft-HA [PVCL-g-HA] and a-tocopherol hydrogels under normal (normoxic) (21%) oxygen and hypoxic (1%) low oxygen conditions at 37°C. Extracellular matrix (ECM) synthesis and biochemical assays were evaluated after 1, 2 and 3 weeks of incubation. Chondrocytes remained viable for up to 10 days at 20% and 1% O_2 levels in PVCL, PVCL-g-HA, and JD hydrogels. Under hypoxic conditions, PVCL polymers had higher

chondrocyte viability than HA and JD4 polymers. JD4 hydrogels had the highest ECM production between 7 and 10 days, with no difference in hypoxia and normoxic. Hence, PVCL and the composite system of PVCL-g-HA promote a protection of cells against hypoxic environments via the vitamin E component. Future studies consist of determining how the chemical structure of PVCL protects cells under hypoxic conditions. *[Acknowledgement: Dr. Larry Bonassar.]*

Faculty Advisor: Dr. Juana Mendenhall, jmendenhall@morehouse.edu

Computer Science & Information Systems

217
Toward Using Mobile Robots to Create Abstract Art

Christina Sparks, Spelman College

Enabling robots to create works of art based on music or other audio inputs aims to bridge the gap between the arts and sciences. A better understanding of the technical and creative aspects of both areas of study and exploration may create a larger understanding of the unity between the two. Research began on the medium of sound to determine its viability as an input, continued into studying the audio interpretation abilities of a robot and is now in the beginning stages of studying patterns and trends in music the robot may be able to recognize and use for the purpose of interpretation. The goal of this research is to create a working input system that will allow a robot to receive, analyze, and respond to certain patterns in music. *[Acknowledgement: This work is supported by the National Science Foundation HBCU-UP grant HRD-0714553, ASPIRE, and Broadening Participation in Computing grants CNS-1042454, SpelBots, and CNS-0742252, ARTSI, along with support from the Boeing Company, and General Motors.]*

Faculty Advisor: Dr. Andrew Williams, Williams@spelman.edu

Materials Science

218
Plasma Polymerization Deposition Rate Study within an Atmospheric Pressure Cold Plasma Reactor

Roderick Gray, Alabama Agricultural & Mechanical University

The protocol for effectively mixing wood and thermoplastics has been extensively studied throughout the scientific community. It is duly noted that wood and thermoplastics are not compatible for mixing: wood is hydrophilic (attracts water) and thermoplastics are hydrophobic (repels water). Plasma polymerization can be used to alter the surface chemistry of the wood, potentially improving the interaction between wood and thermoplastics. In this experiment we attempt to interpret and model how mass deposition occurs within our atmospheric pressure cold plasma (APCP) reactor. Deposition rates are determined utilizing a microbalance while atomic force microscopy (AFM) and scanning electron microscopy (SEM) will be utilized to identify changes in surface topography. In order to analyze mass deposition as a function of placement within the reactor, the substrates were varied by r (radial distances) and z (depth) throughout the reactor. Substrates include mica, which is ultra flat and the ideal use for AFM surface characterization, and filter paper, comprised primarily of cellulose, which is a major constituent of wood. For the study of z (depth) we select four positions away from the grounded mesh, r (radial distance) points are arbitrarily chosen. We combine acetylene (precursor gas) (C2H2) and argon (carrier gas) simultaneously inside an atmospheric plasma reactor. A voltage is then applied to generate an artificial plasma. The results show a trend for mica, as depth increases so does mass deposition. Whereas for filter paper the mass deposition varies throughout the z (depth) position. Future work involves testing the reproducibility of these results as well as analyzing the data to conclude an acceptable region for continued testing. We will then view that specific z (depth) position as a control position so that we can evaluate the r (radial distance) using previous methods in order to confirm the most critical position that produces the most mass deposition. The goal is to plasma polymerize a surface onto wood particles to create improved compatibility with thermoplastic resin matrix. This potentially will improve the composite performance. *[Acknowledgement: HBCU-UP Project]*

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

219
Anomalous Magnetization of Rare-Earth Metals

Kafayat Olayinka, University of the District of Columbia
H. M. Seyoum, University of the District of Columbia

Rare earth metals have a wide range of applications. Gadolilium (Gd), for example, is used as a benchmark for magnetocaloric effect studies. Their magnetization has been studied for several decades. Their magnetic properties present a formidable challenge to both theoreticians and experimentalists. Gd, for example, show magnetization anomalies at four temperatures: one at 130 K, another one at the spin reorientation temperature of 230 K and two more at close to its Curie temperature, Tc= 293 K. Applying an external magnetic field, the magnetization vs temperature shows complex behavior. The magnetization vs temperature will be discussed. *[Acknowledgement: STEM HBCU -UP]*

Faculty Advisor: Hailemichael Seyoum, hseyoum@udc.edu

220
Pulsed Laser Deposition of Epitaxial BaFeO3 Thin Films

Michael Sagapolutele, Dillard University
Abdalla Darwish and Simeon Wilson, Dillard University, LA
Brent Koplitz, Tulane University, LA

The importance of Barium Ferrite ($BaFeO_3$) in magnetic recording media has been emphasized by many papers, including Y. K. Hong et. al. [J. Appl. Phys. 61, 3872 (1987)] and has been known to be suitable for perpendicular magnetic recording because of its high coercive force (Hc) and a large remnant magnetization, as well as a hexagonal plate-like particle shape. In 2010, Fujifilm broke the record for areal density on linear magnetic tape with 29.5 billion bits per square inch.

This study was undertaken to test the hypothesis that the magnetic parameters of fine-powder $BaFeO_3$ would translate to thin films made using the PLD technique. The magnetic parameters of an epitaxial $BaFeO_3$:Mn thin film, fabricated and doped using the double pulsed laser deposition (DPLD) technique onto a Si substrate, were determined and compared that to the magnetic parameters of six fine-powder $BaFeO_3$ samples. The first anisotropic constant K_1 was deduced by estimating the effect of particle shape using saturation magnetization, measured by means of a vibrating sample magnetometer. The values of K_1 were found to change sign between the high and low temperature ranges, generally between 50^{o}C and 225^{o}C. Large positive signs for K_1 imply spontaneous magnetization perpendicular to the hexagonal plane, facilitating perpendicular recording. Sample 2 showed a relatively high K_1 at 35 erg/cc and a T_t of 100C, making it the best choice for use in perpendicular magnetic recording and for use in the thin film. The ferromagnetic resonance (FMR) measurements of the thin film were found to be close to the parameters associated with the fine-powder samples. An Atomic Force Microscope was used to examine the surface morphology of the thin films at different temperatures. The derivative FMR line width of the thin film was measured to be 70 Oe at 60 GHz and 50 Oe at 90 GHz.

In conclusion, many of the magnetic parameters did translate to the thin film, verifying the feasibility of PLD in translating magnetic parameters to thin films. The translation was not perfect however, and further research can be undertaken to improve the PLD technique's ability to translate the characteristics of its target materials. *[Acknowledgement: The support of the DOD-AFOSR grant numbers FA 9550-08-1-0363, FA 9550-10-1-0199, FA 9550-10-1-0198, and NSF/LA BOR DUE LSAMP grants awarded to Dr. Abdalla Darwish.]*

Faculty Advisor: Dr. Singleton, bsingleton@dillard.edu

221
The Model of Sensing Mechanism of Toxic Vapor Sensors

Mychal C. Thomas, Alabama A&M University

The metal oxides chemical sensors operate on the principle of change in conductance due to chemisorption of vapor molecules on their surfaces. In the Materials Science laboratory, the research is being conducted to develop binary oxides based sensors for toxic volatile organic compounds (VOCs). The thick-film toxic vapor sensors are based on wide-band semiconductors such as tin oxide, arsenic oxide, zinc oxide, indium (III) oxide; etc. As part of undergraduate research, a model for the sensing mechanism of thick-film has been explored via change in conductance as a function of the concentration of vapors and the operating temperature. The change in conductance has been derived by utilizing one dimensional Poisson equation for transport. To predict the response, the equation has been solved by MATLAB code. The result of the modeling will be compared with experimental data obtained for the isopropanol and rocket fuels detection. *[Acknowledgement: The project is funded by NSF-RISE grant 0927644]*

Faculty Advisor: Mostafa Dokhanian, mdokhanian@gmail.com

222
NIR-to-Visible Upconversion Fluorescence of NaYF4: Tm3+, Yb3+ Nanocrystals and Colloids with Potential Use as a New Laser Filling Media

Donald M. Wright, III, Oakwood University
Dr. Sergey Sarkisov, SSS Optical Technologies LLC
Dr. Darayas N. Patel, Oakwood University, Michael Jumper, Janeen Morgan, and Brandon Robinson, Oakwood University, AL

Nanocolloids and nanocrystals doped with ions of rare-earth elements have recently attracted a lot of attention from the scientific community due to unique physical, chemical and optical properties attributed to nanometer size of the particles. They have great potential of being used in applications spanning from new types of lasers, especially blue and UV, phosphorous display monitors, optical communication, and fluorescence imaging.

Here we present the results of synthesis and optical spectroscopy of hexagonal-phase NaYF4: Tm3+, Yb3+ nanocrystals with significant NIR-to-visible upconversion fluorescence. The nanocrystals can be potentially used as a new laser filling medium in photonic crystal fibers. The nanocrystals were synthesized using a simple co-precipitation procedure in the presence of ethylenediaminetetraacetic acid (EDTA). The size of the nanoparticles in the colloid was measured using the atomic force microscope. The freshly prepared nanophosphor,

being pumped with a 980-nm laser, exhibited very weak up-conversion fluorescence. However, after annealing at a temperature of 600°C, the nanophosphor produced blue upconversion fluorescence visible by the naked eye at room light. The optical fluorescence spectroscopy indicated that the upconversion fluorescence had spectral peaks at 376 nm, 476 nm, 646 nm, 696 nm and 803 nm. The obtained nanocolloids were incorporated into the HC19-1550-01 micro-structured photonic crystal fiber, and their properties as a filling laser media were investigated. *[Acknowledgement: This study was supported in part, by a grant from the NSF HBCU-UP, 0811507, awarded to Kenneth LaiHing, Ph. D., Professor/Chair Office of the Chemistry Department, and DoD grant awarded to Darayas Patel, Ph.D., Associate Professor, Department of Mathematics and Computer Science, Oakwood University, Huntsville AL]*

Faculty Advisor: Dr. Darayas N. Patel, dpatel@oakwood.edu

NANOSCIENCE

223
Green Synthesis of Silver Nanoparticles, Their Characterization and Application for Antibacterial Activity.

Anita Johnson, Alabama A&M University
Tatiana Kukhtareva, Florence Okafor, and Afef Janen, Mostafa Dokhanian, Alabama A&M University

Synthesis of noble metal nanoparticles for applications, such as catalysis, electronics, optics, environmental, and biotechnology is an area of constant interest. Gold and silver have been used mostly for the synthesis of stable dispersions of nanoparticles, which are useful in areas such as photography, catalysis, biological labeling, photonics, optoelectronics and surface-enhanced Raman scattering (SERS) detection.

Our recent research intentions were focused on development materials and their characterizations, which can find application in medical research and are responsible for environmental cleaning. We are working on developmenting the environmentally friendly way to produce nanomaterials using extracellular biosynthesis. In this paper we present the results of producing noble nanoparticles using live plants as reducing agent.

In our study we have used *Magnolia grandiflora*, *Geranium, Aloe 'Tingtinkie' leaves broth, Actaea racemosa (Black Cohosh)* extracts for noble metal nanoparticles production. The reaction process verified with UV-Visible Spectroscopy. We observed the appearance of Surface Plasmon Resonance (SPR) Peak, which corresponded to the silver nanoparticles – 417-425 nm and in several minutes. The nano-silver colloid was characterized by various physical methods including UV-Visible Spectroscopy, Atom Force Microscopy (AFM) and dynamic light scattering technique (DLS).

According to DLS and AFM, the size of silver nanoparticles was in the range of 10–15 nm. We have studied antibacterial activity using BioScreen C device. We treated *e-coli*, by 10 µL, 20µL nanoparticles solution with the various concentration of silver nanosolution (2ppm – 15ppm). The antibacterial effect of silver nanoparticles used in this study was found to be far more potent than that described in the earlier reports. However, further studies must be conducted to verify if the bacteria develop resistance towards the nanoparticles and to examine cytotoxicity of nanoparticles towards human cells before proposing their therapeutic use. *[Acknowledgement: HBCU-UP]*

Faculty Advisor: Tatiana Kukhtareva, tkukhtareva@yahoo.com

224
Photoluminescence of Surface Modified Silicon Carbide Nanowires

Polite Stewart, Jr., Texas Christian University / Southern University A&M College
Ryan Rich and Dr. T. W. Zerda, Texas Christian University

SiC nanowires were produced from carbon nanotubes and nanosize silicon powder in a tube furnace at temperatures between 1100°C and 1350°C. SiC nanowires had average diameter of 30 nm and very narrow size distribution. The surface of the SiC nanowires is covered by an amorphous layer composed of amorphous SiC and various carbon and silicon compounds. The objective of the research was to modify the surface structure of the SiC nanowires, a step necessary for future surface functionalization. The acid etched nanowires were analyzed using FTIR, TEM, x-ray diffraction, and thermoluminescence The concentration of Si-Ox groups in untreated specimens was estimated to account for 1% of the total mass of a 2 nm thick amorphous layer wrapping around all structures. After treatment in HF this concentration was negligibly small. TEM images show that after treatment the amorphous layer was removed, but the diameter of the core remained unchanged. The surface was roughened and multiple pits formed on that surface. X-ray line broadening analysis indicates a significant contribution due to stress caused by dislocations and planar faults. After acid etching, line narrowing was observed and attributed to stress reduction and elimination of the smallest wires. The photoluminescence signal from received samples was very weak but increased greatly after acid treatment, indicating that the signal is related to surface defects. Measurements at low temperatures, 8 K, showed peaks due to point and planar defects. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. T.W.Zerda, t.zerda@tcu.edu

PHYSICS (NOT NANOSCIENCE)

225
The Jerk Vector in Motion of Charged Particles Under Electric and Magnetic Fields

Brittany Bazzle, Alabama A&M University

Most physical laws are represented by second-order differential equations containing the second and/or first derivatives. The first derivative gives the slope of the Variable. The second derivative is a measure of the curvature of the variable. While the third derivative exists, it is normally overlooked and seldom discussed. In mechanics, the first two derivatives of the position vector with respect to time, are the velocity and acceleration vectors. The existence of the third derivative, called the second acceleration or jerk (cf. Campbell, 1920), has been known for a long time. It is in simple harmonic motion (Schot, 1978), Uniform circular motion (Sandin, 1990) and Keplerian motion (Schot, 1978; Tan 1992).

In this study, the existence of second acceleration/jerk is explored in the M=motion of charged particles under the influence of electric and magnetic fields. The existence of the jerk vector (or second acceleration) is explored in the motion of a charged particle under the action of electric and magnetic fields. Four examples are considered: (1) Charged particle in a uniform electric field; (2) Charged particle in a uniform magnetic field; (3) Charged particle in uniform electric and magnetic fields parallel with one another; and (4) Charged particle in uniform electric and magnetic fields perpendicular to one another. It is found that: (1) A uniform electric field does not produce jerk on a charged particle (Example 1); (2) A uniform magnetic field produces jerk vector which executes uniform circular motion (Example 2); and (3) The superposition of a uniform electric field on a uniform magnetic field alters the dynamical vectors such as velocity and acceleration but not jerk (Examples 3 and 4). *[Acknowledgement: NSF, Alabama A&M University, HBCU-UP]*

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

226
Development of Energy Harvesting Smart Materials

Alayna Fields, Alabama A&M University

Electric power harvesting or scavenging is the technique of extracting useful electrical energy from ambient low grade energy sources such as solar energy, mechanical energy and thermal energy using smart functional materials such as transducers.

This work aims at dual (thermal and mechanical) electrical energy converters based on ferroelectric materials for energy harvesting, and examines its possibility in powering low power devices. Recently, we have theoretically predicted the energy harvesting capacity of pyroelectric samples fabricated in our laboratory and commercially available pyroelectric elements/ transducers by capturing thermal energy of pavements. The single- and poly-crystalline elements: triglycine selenate, lithium tantalate, modified lead zirconate titanate, modified lead titanate, modified lead metaniobate, and pyroelectric polymer nano-composites such as Portland cement, nano-carbon fibers, polymer-lithium tantalate embedded with silver nano-particles, were characterized for applicable performance parameters. To further investigate their mechanical performance, piezoelectric and mechanical properties are being investigated utilizing facilities available. The results obtained will be presented along with possible future work in the arena of Hybrid Energy Harvesters. *[Acknowledgement: NSF-AAMU HBCU-UP]*

Faculty Advisor: Ashok Batra, ashok.batra@aamu.edu

227
Photoemission Spectra and Spin-state Transitions of LaCoO3

Brenda Minjares, University of California, Santa Cruz

Transition metal compounds have been an interest in solid state physics in the past several decades. Many of them are known to undergo a metal-insulator transition or a magnetic transition, making them useful for applications in modern devices. Lanthanum cobaltite is an example that has attracted much attention recently. In this study, our goal is to study the spin state of the 3d shell of Co through the 3s core level photoemission spectroscopy. In the literature, there are two competing models of the spin state of Co in LaCoO3. In one model[1], as the temperature rises beyond 100 K, some low spin (S=0) Co ions are converted to high spin (S=2) Co ions. In another model[2], the low spin Co ions are converted to intermediate spin (S=1) Co ions. As these spin states are intimately related to the structural and electronic properties, the resolution of this debate continues to be a hot topic.

Our goal is to help settle the debate between the competing theories by probing the spin state directly using the 3s core level photoemission. The reason why this is a direct probe is because the 3s spin directly couples to the 3d spin, giving information on the spin state of Co. I will show how this experiment works, and how the temperature dependent 3s core level photoemission can shed light on this issue.

As the ambiguity of the Co spin state is the reflection of the competition between the exchange interaction and the covalency, it is important that we treat these two physical effects on equal footing. Thiswork, using line shape fit procedures based on a many-body interaction model, does just that, for the first time. Another important aspect of this work is the investigation of the temperature dependence, which is

crucial since the Co 3s core level spectrum of LaCoO3 happens to overlap with the La 4d core level spectrum.
[Acknowledgement: Funding for this project was provided by the California Alliance for Minority Participation in research program.]

[1]E.g., see Haverkort 2006. [2]E.g., see Zobel et al., PRB 66, 020402(R) (2002).

Faculty Advisor: Gey-Hong Gweon, gweon@ucsc.edu

228
Positron Lifetime Studies of Porous Silica

Godwin St. Luce, Grambling State University
Damilola S. Fasheru and Naidu V. Seetala, Grambling State University, LA

Porous silica has been used as support for nano-catalysts, where metal nanoparticles can be trapped on the pore surface and increase the active surface area which yields higher catalytic reaction products in converting renewable and heavy fossil resources into useful energy sources. Positron lifetime spectroscopy (PLS) is very sensitive to the nano-porous structure in the silica supports[1].

Here, we try to use PLS to evaluate the effect of pressure deformation on the porous structure of silica. A Positron Lifetime System with 22Na source was used and POSFIT computer program analyzed the spectra into three lifetime components. The third lifetime component, related to positronium formation in free spaces, provides the information on pore size (proportional to positronium lifetime) and concentration of pores (proportional to the intensity of the positronium component). The third lifetime component in porous silica showed ~ 4 ns lifetime with 5% intensity, while these values after 20,000 PSI pressure deformed were ~ 2.7 ns with 13.5% intensity. This shows that the larger size pores are collapsed to smaller size pores with ~4 times increase in concentration.

We plan to use the PLS technique to study the pore structure changes in silica supported nano-catalysts as the preparation methods are changed and before and after catalytic study.
[Acknowledgement: Work is partly supported by a DOE-EFRC and LA-SiGMA grants.]

[1] M. Koshimizu, et al., J. Phys. Chem. C112 (2008) 877.

Faculty Advisor: Dr. Naidu V. Seetala, naidusv@gram.edu

SCIENCE & MATHEMATICS EDUCATION

PHYSIOLOGY AND HEALTH

229
Retrospective Analysis of the Potential Risk Factors for Airway Stenosis and Therapeutic Interventions in Postoperative Lung Transplant Patients

Andrea N. Haynes, Johns Hopkins University / Tougaloo College
David Feller-Kopman MD FCCP and Lonny Yarmus DO FCCP, Johns Hopkins University

The most common causes for lung transplant are emphysema, idiopathic pulmonary fibrosis, cystic fibrosis, and pulmonary arterial hypertension. Complications postoperative are believed to be caused by such factors as ischemia, immunosuppression, rejection, and surgical techniques. Airway stenosis, a postoperative complication, is typically seen in patients 2- 9 months after transplant. Discovery of stenosis can be found during surveillance bronchoscopy or detected by patients' dyspnea, cough, or recurring pneumonia. Transplant related stenosis is often treated by balloon bronchoplasty and stenting.

Two of the main objectives of this study was to determine the cause of airway stenosis in post lung transplant patients and investigate the effect of airway narrowing in lung transplant patients. Retrospective data was collected from a total of 122 patients who had lung transplant procedures at Johns Hopkins Hospital in Baltimore, Maryland from August 2005 until May 2011. A single lung transplant surgeon performed all of the transplantation procedures. In patients who experienced airway stenosis, it was managed with a variety of interventions including rigid bronchoscopy, mechanical debridement, tissue destruction, balloon dilation, and stent placement.

The data indicates that airway stenosis occurred in 46 out of 122 lung transplant patients or (37%). Some of the main causes of stenosis in this study were postoperative pneumonia, postoperative gastroesophageal disease (GERD), and Tobramycin use. The average number of pulmonology interventions was 6.8. There was a high prevalence of postoperative GERD; however, only 45% of the patients developed stenosis. Airway stenosis post lung transplantation can be successfully managed with a variety of airway interventions such as balloon dilation and stent placement. Further studies are needed to determine the etiology of airway stenosis. *[Acknowledgement: This project was supported by the NIH/NHLBI grant R25 HL084762. This research from the Jackson Heart Study is supported by NIH contracts N01-HC-95170, N01-HC-95171, and N01-HC-95172 provided by the National Heart, Lung, and Blood Institute and the National Center for Minority Health and Health Disparities.]*

Faculty Advisor: Dr. Wendy White, wwhite@tougaloo.edu

SOCIAL & BEHAVIORAL SCIENCES

SOCIAL SCIENCES/PSYCHOLOGY/ECONOMICS

230
Food Insecurity and Chronic Kidney Disease: The Healthy Aging in Neighborhoods of Diversity Across the LifeSpan (HANDLS) Study

Alexandria L. Broadnax, Dillard University
Deidra C. Crews, MD, ScM, Johns Hopkins University
Marie Fanelli Kuczmarski, PhD, RD, University of Delaware
Neil R. Powe, MD, MPH, MBA, San Francisco General Hospital and University of California at San Francisco
Michele K. Evans, MD5 and Alan B. Zonderman, PhD, National Institute on Aging, National Institutes of Health

Food insecurity is defined as the inability to afford nutritionally adequate and safe foods. It has been shown to be associated with several chronic diseases including diabetes, heart disease, hypertension and obesity. Little is known about the association between food insecurity and chronic kidney disease (CKD); therefore we examined this association in the Healthy Aging in Neighborhoods of Diversity Across the LifeSpan (HANDLS) Study. Cross-sectional study. 2,193 community-dwelling adults aged 30 -64 years residing within 12 neighborhoods were selected for both socioeconomic and racial diversity in Baltimore City, Maryland.

Food insecurity is defined as three or more affirmative responses to a 17-item food insecurity questionnaire. CKD is defined as estimated glomerular filtration rate <60mL/ min/1.73m2. Descriptive statistics and logistic regression were used to estimate the relationship between food insecurity and CKD. 1,567(71.5%) participants were food secure and 626 (28.6%) were food insecure. Food secure and insecure participants were of similar age (48.1 and 47.4 years, respectively); however the food insecure participants were more likely to be of black race, female, uninsured, unemployed, and with less than 12th grade education (P<.05 for all).Compared to the food secure, food insecure participants were more likely to have hypertension (48.4% vs. 42.5%) and diabetes (21.4% vs. 16.8%), P<.05 for both. The overall prevalence of CKD was 5.0%. Food insecurity was not associated with CKD (odds ratio 0.83; 95% CI 0.54-1.30, comparing food insecure to secure). In an urban population, food insecurity is associated with diabetes and hypertension, but not with CKD. *[Acknowledgement: This study was spported by the NSF/LSAMP Program Awarded to Abdalla Darwish, Ph.D., Coordinator/ Campus Director at Dillard University, New Orleans, LA]*

Faculty Advisor: Dr. Bernard Singleton, bsingleton@Dillard.edu

231
Sex, Stress, and Inflammation in a Murine Model of Ulcerative Colitis

Derell N. Hampton, Tuskegee University
Ira Tigner, Destina Campbell, Jonathan McNeilly, Kara Cromwell, Darielle Freeman, Tim Purdie Jr., DeJuana Grant, Frank Chestnut, and Oresea Mitchell, Tuskegee University

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. IL-10 knock-out (KO) mice are unable to cope with stressors, are hypersensitive to inflammation and may exhibit altered responses to sex-related stressors. Six week (young) to 6 month-old (old) male and female 129 SvEv wild-type mice were reared in shoebox cages. Half of the animals had previously been used in mating pairs (experienced) and the other half were naive (virgin) mice. We then introduced the singly housed mice to singly-housed mice of the opposite sex.

The experimental design included mice that were confined so that the other mouse of the opposite sex could see, smell and touch but not copulate with the mouse and included cage pairs that were freely able to mate (wild-type controls). After the introduction, the mating pairs were observed for one hour. Data collected included number of attempts at mating, number of copulations, and behavioral and physical changes, comparing confined mice to wild-type controls.

In Experiment 2, 4 IL-10 KO female mice and 4 WT female mice were chosen of the same age (11mnths). In separate cages, they were placed in the presence of one single male mouse to synchronize their estrus cycles. Each female IL-10 KO and WT mice were matched with male mice of the same age and strain. They were observed for an hour every 48 hours over a 21 day period to cover at least 3 weeks of the females' estrus cycle. Mice were calm and resting before being introduced to the mouse of the opposite sex. The old experienced male mice were more aggressive than the young male mice. In Experiment 2, we conducted that the WT mice showed more responses to the stressor than the IL-10 KO mice. *[Acknowledgement: The project described was supported by grants from: NSF (HBCU-UP HRD-0938273*
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Faculty Advisor: Dr. A. Deloris Alexander, dalexander@mytu.tuskegee.edu

232

Knowledge, Attitudes and Beliefs about Water Pipe (Hookah) Smoking among Somali and Oromo Young Adults: Results from Listening Circles

Abdi Jibril, University of Minnesota Twin Cities
Janet Thomas PhD, LP, Moustapha Omar, Ahmed Mohamed, and Rachel Adams MPH, University of Minnesota
Brian Primack MD, Ed.M, University of Pittsburgh
Sirad Osman PhD, New America Community Services

Waterpipe Smoking (WPS) is a centuries-old traditional method of tobacco use. WPS contains many of the same toxicants as cigarettes, including those that cause cardiovascular disease, lung disease, and cancer. WPS has been associated with features of nicotine dependence (e.g., drug-seeking behavior, inability to quit despite repeated attempts, abstinence-induced withdrawal). Somali and Oromo immigrants in Minnesota are increasingly using WPS during social gatherings as an approved method of tobacco use. Reasons for this increasing phenomenon and community awareness of the health risk associated with WPS are not known. Acculturation and unique cultural barriers may affect tobacco prevalence in immigrant populations and has not been fully studied in the Somali/Oromo immigrants. The primary aim of this qualitative research was to increase our understanding of the knowledge, attitudes and beliefs about WPS among the Twin Cities Somali/Oromo communities. We conducted a series of "listening circles" to ultimately inform the development of a culturally appropriate intervention to decrease waterpipe smoking among this underserved community of new immigrants. Preliminary results indicate that WPS has become a norm, ubiquitous in most social gatherings in homes with both family (including community elders) and friends; there is limited knowledge about the health effects of WPS and an absence of awareness about exposure risks to nonsmokers, and that among Somali/Oromo youth WPS in hookah bars is "the latest fad", associated with social popularity ("cool"). Results support the need for culturally-sensitive prevention and cessation efforts to address this emerging trend in tobacco use. *[Acknowledgement: This study is supported by faculty award from Center for Unbar and Regional Affairs to Dr. Janet Thomas, University of Minnesota Medical school, Department of Medicine.]*

Faculty Advisor: Dr. Janet Thomas, jthomas@umn.edu

233

Contrasting Effects of Lesions to the Orbitofrontal Cortex and Basolateral Amygdala on Visual Discrimination Reversal Learning in Rats

Nicolas Manos, California State University, Los Angeles
Chelsi Darling, California State University, Los Angeles

The neural circuitry that subserves flexible choice making is of interest to the study of addiction and neuropsychiatric diseases such as obsessive-compulsive disorder, impulse control disorder, and anxiety disorders. Lesion experiments in animals have contributed heavily to our knowledge of this circuitry. For example, lesions to the orbitofrontal cortex (OFC) across many species including humans produce well-known impairments on adaptive choices when reward consequences change, whether the change is in the qualitative reward value domain (i.e. from desirable to less desirable reward) or the quantitative reward contingency domain (i.e. from reward to no reward). More recent reports in both rats and monkeys show that the basolateral nucleus of the amygdala (BLA), though highly interconnected with OFC, may be differentially involved in updating responses to changing reward value and reward contingency. Specifically, there are data to suggest that BLA may be relatively uninvolved in adaptive choices when a behavior results in a change in reward contingency (Izquierdo and Murray, 2007).

In this study, we compared the effects of BLA and OFC lesions on visual discrimination reversal learning in rats wherein reward contingency was shifted. Twenty-five rats received neurotoxic ibotenic acid lesions of either BLA (n=8) or OFC (n=7), or were given SHAM (n=10) surgeries before being trained on an operant visual discrimination task and subsequently tested on reversal learning. Through a series of pretraining phases, the rats were trained to nosepoke one of two visual stimuli on a touchscreen upon self-initiating a trial. A sucrose pellet reward was dispensed when the correct stimulus (S+) was nosepoked. Alternatively, nosepoking the incorrect stimulus (S-) resulted in a 5 second delay during which the rat could not initiate a new trial. Our primary measure of learning rate was the number of sessions to reach criterion. All rats learned the initial visual discrimination problem at equivalent rates. Not surprisingly, OFC rats were significantly slower on reversal learning than were SHAM rats ($p < .03$). BLA rats, however, displayed faster reversal learning than the OFC group ($p < .01$) but not significantly different than SHAM rats ($p > .05$). This finding adds to mounting evidence that BLA and OFC are differentially involved in updating information about reward contingency in both rats (Stalnaker et al. 2007) and monkeys (Izquierdo and Murray, 2005). *[Acknowledgement: Supported by the NIH MBRS RISE program at CSULA and SC2MH087974 (Izquierdo).]*

Faculty Advisor: Dr. Alicia Izquierdo, aizquie@exchange.calstatela.edu

234

Assessment of SAMHSA's Indicators and Measures for Drug Abuse Treatment Programs for Women and their Children

Felicia Swafford, University of the District of Columbia

The Substance Abuse and Mental Health Services Administration (SAMHSA) has funded drug abuse treatment programs for women and their children since the early 1990s through the

Residential Treatment for Pregnant and Post-partum Women Program (RTP). These programs, operated by non-governmental, non-profit organizations across the country, provide a wide range of services to these vulnerable women and their children. Since the beginning of the program, SAMHSA has collected evaluation data. With the new set of grantees, funded in late September 2011, SAMHSA is instituting new, extensive requirements for reporting outcomes.

The problem addressed in this research was that the Request for Proposals (RFP) to which the grantees responded specified multiple reporting requirements. The methods used to carry out the research included: identifying each of the individual indicators required in the RFP; arraying these indicators by key program domain (e.g., drug abuse treatment) and requirement source (e.g., Government Performance and Results Act); conducting a cross-walk to identify duplication and gaps in the indicators; and identifying specific measures required in the RFP and/or those deemed by the researchers to be relevant and feasible.

The results of this qualitative research, which are being used by SAMHSA to plan for the ongoing evaluation of new as well as existing grantees that provide services to women and their children, include: 1) duplication of indicators; 2) lack of specificity and clarity in requirements for application of the indicators; 3) lack of specificity with respect to the measures for each of the indicators and data collection instruments that can be used by the programs for these measures; and 4) lack of information regarding practical approaches to collecting the data. Discussion. All participants in SAMHSA's RTP grant program should share a common understanding of the program's evaluation requirements and the data collected need to be consistent and comparable across the grantees in order to provide meaningful data and information for the individual programs and for SAMHSA.

Future research needs to identify the measures proposed by the grantees in their response to the SAMHSA RFP, and the data collection instruments and measures that they propose to use. These will then be compared with the instruments identified by the researchers as appropriate and feasible for use by these community-based programs. *[Acknowledgement: MARC U*STAR Honors Program]*

Faculty Advisor: Dr. Jillson, iaj@georgetown.edu

235
Infant Mortality and The Life Course Perspective

Britani Vann, Langston University, OK
Kathryn Cardarelli and Marcy Paul, University of North Texas Health Science Center, TX

Infant mortality is defined as the death of an infant before his or her first birthday. The rates of infant mortality in Texas are 6.1 per 1000 live births (LB), 7.2 per 1000 LB in Tarrant County, and 7.7 per 1000 LB in Fort Worth, TX. The goals of the Healthy Moms-Healthy Babies-Health Community Initiative are (1) to establish collaboration building on existing and new stakeholders who are committed to a coordinated approach to reducing infant mortality rates using the Life Course Perspective, (2) assess the awareness and understanding of the extent of infant mortality among community residents in targeted areas in Fort Worth having the highest infant mortality rates, and (3) to establish sustainable methods of communication with the residents, establish a strategic plan and a work plan as the foundation for identifying, creating, and implementing steps that will reduce infant mortality rates in the areas of Fort Worth zip codes 76105, 76112, 76119, and 76120. The present survey study was undertaken to help establish some of the leading factors impacting infant mortality. It was commonly believed that stress is a leading factor. We implemented eight focus groups with diverse organizations and stakeholders. We asked questions to assess their knowledge, attitudes, and beliefs regarding infant mortality. Once we reviewed the transcriptions of the surveys and performed a literature review on stress and infant mortality, we determined that there were similar qualities, and that stress was a leading factor in the lives of these women. We utilized the program NVIVO to analyze our survey findings. We are now organizing a community forum to share focus groups findings and garner community input in developing the strategic plan. It is planned to research how stress is related to the life course perspective and infant mortality. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: John Coleman, jkcoleman@lunet.edu

TECHNOLOGY & ENGINEERING

BIOMEDICAL ENGINEERING

236
Induction of Hydrocephalus in Rats and a Novel Treatment Method

Bhargav Desai, University of Illinois at Chicago
Dr. Sukhraaj Basati, Dr. Ali Alaraj, and Dr. Andreas Linninger, University of Illinois at Chicago

Hydrocephalus, a medical condition affecting approximately 1 out of every 500 births, is an abnormal accumulation of cerebrospinal fluid (CSF) that occurs in the ventricles of the brain. This results in increased intracranial pressure (ICP), progressive enlargement of the head of infants, convulsions, tunnel vision, mental disability, and in extreme cases, death. Existing CSF shunting procedures have been deemed inadequate because they withdraw CSF solely based on ICP measurements. This often leads to dangerous over- and under-shunting, because ICP can vary due to posture, routine daily activity,

altitude, and even atmospheric pressure. Our laboratory has postulated that direct volume monitoring and feedback control is a promising strategy to improve the treatment of hydrocephalus. This novel treatment method involves using a volume sensor to aid pressure measurements to more accurately drain CSF in hydrocephalic patients. Electrodes on the sensor generate an electric field, which measure volume through changes in impedance.

Our recent experiments focus on the induction of hydrocephalus in animals with an assessment of sensor performance through post-implantation sensor testing by injection/withdrawal of CSF. We studied the juvenile onset hydrocephalus following kaolin injection in 15 rats, acquiring a 40% induction rate. The key goals of this study were to induce hydrocephalus and obtain data while testing the sensor. Calibration of the sensor was completed via dynamic bench-top testing inside a silicone balloon model in which 100 uL of fluid was injected/withdrawn. Following calibration, testing of the sensor was done in a hydrocephalic rat model in which voltage changes were found to successfully correspond to the injection/withdrawal protocol. Controlled CSF shunting in-vivo with hydrocephalic rats resulted in precise and accurate sensor measurements (R^2=0.98). A maximum error of 17.3% was found between measured volume and actual volume as assessed by a Bland-Altman plot. Ventricular enlargement consistent with successful hydrocephalus induction was confirmed via imaging as well as post-mortem analysis of brain tissue.

We conclude that the intracranial volume sensor is a viable technique to measure intracranial ventricular volume change as evidenced by both successful bench-top testing and animal validation. *[Acknowledgement: This study was funded, in part, by an NSF grant, REU-EEC0754590, awarded to Andreas Linninger, Ph.D.]*

Faculty Advisor: Dr. Andreas Linninger, linninge@uic.edu

Cancer Research

237

Meta-analysis: The Search for Potential Cancer Biomarkers in Common Between Multiple Microarray Experiments

Jaileene Perez-Morales, University of Puerto Rico-Mayaguez

The identification of cancer biomarkers is critical to characterize, detect and understand the illness. Meta-analysis entails the joint study of different databases or studies to obtain conclusions that apply across them. Meta-analysis can be attempted to identify potential cancer biomarkers that are significantly expressed on several microarray experiments simultaneously. This is done by using a multiple criteria optimization approach, as previously proposed by our research group. The proposed approach does not require the adjustment of parameters by the users, thereby preserving the objectivity and consistency of the analysis. The starting point includes the analysis -with multple criteria optimization- of two publicly available microarray databases separately: one related to cervix cancer and the other related to colon cancer. The resulting potential biomarker genes for cervix cancer are: AA488645, H22826, AI553969, T71316, AA243749, AA460827, AA454831, AA913864, AA487237, AA446565, H23187, AA282537, N93686, R91078, R44822, AI334914, R93394, AA621155, R52794, W74657, AI017398, AA282537, AA705112, H69876, and H55909. and for colon cancer: M22382, R87126, H08393, R36977, J05032, M26383, X63629, H40095 Z50753, M63391, J02854, X12671, U09564, H43887, M76378, M36634, T86473 H06524, R84411, X14958, T92451, M26697, T71025, X86693, T47377, U30825, D31885. The joint study proposed in this work will shed light on the genes that show persistent potential cancer biomarking behavior. If successful, this study will open the door to make meta-analysis more effective and more efficient. *[Acknowledgement: NSF/REU awarded to Viviana Cesani, Ph.D.,Director of Industrial Engineering Department, University of Puerto Rico-Mayaguez, Mayaguez, PR (EEC0851879) Bio SEI Project 220103080301 (PI: M. Cabrera-Rios)]*

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

Civil/Mechanical/Manufacturing Engineering

238

Application of Galerkin Method for Heat Transfer Analysis of a Fin with Uniform Cross-Section

Gerald Andrews, Virginia State University
Nasser Ghariban, PhD, Virginia State University

A fin is a surface that extends from an object to increase the rate of heat transfer to or from the environment by increasing surface area. This poster presents an analysis of heat flow by convection from a fin of uniform conductivity and cross-sectional area, fixed in one end to hot surface and extended in a cooler fluid. An analytical Galerkin based method is used to find local temperature distribution and heat transfer rate at the base with a simple programming in MathLab. The numerical value is compared with exact solution for validation of the method. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Nasser Ghariban, PhD, nghariban@vsu.edu

239

Improving the Jump Efficiency of Millirobots through Modeling and Testing of Prototyped Jumping Devices

Carlos Casarez, University of Maryland, College Park
Sarah Bergbreiter, University of Maryland, College Park

Jumping is an advantageous form of robot mobility because it allows robots to overcome large obstacles and achieve powerful jumps by rapidly releasing energy stored in a spring that has

been slowly stretched by a low-force actuator. However, jumping robots lose some of their stored energy because not all of it is converted to gravitational potential energy. Energy loss depends on the spring material, geometry of the spring elements, mass distribution in the robot and many other parameters. The hypothesis of this research is that modeling and experimental methods for analyzing jumping dynamics can be used to identify sources of energy loss that can be reduced by carefully selecting jumping robot design parameters. In turn, the efficiency of jumping robots can be improved so that they jump higher for a given energy input.

A laser cutter was used to fabricate jumping devices with elastomer springs. Elastomers are robust spring materials that can achieve large recoverable strains and survive repeated stress cycles. The dynamics of the jumping devices were modeled using a differential equation solver in MATLAB. The modeled forces are the restoring force of the spring, the damping force of the spring, drag and gravity. The solver outputs the time dependent position and velocity of the device's leg and body, which were used along with measured spring and mass parameters to determine jump efficiency for the model of the device. The dynamics of the jumping devices were measured using image processing in MATLAB to track the position of the leg and the body in high-speed video. The video data were used to calculate an experimental value of jump efficiency.

When the natural frequency of the jumping device is held constant and the body to leg mass ratio is increased, the jump efficiency increases in both the model and tests. However, there is a large difference between the model and test efficiencies, which had ranges of 55-75% and 5-25% respectively. The drop in efficiency in the tests can be explained by inaccurate measurements of spring energy storage and unmodeled sources of energy loss. A force sensor will be used to measure spring energy storage in future tests, and the test data will be analyzed for indications of unmodeled energy loss. Future research includes determining the effect of spring material and spring geometry on jump efficiency and implementing a jumping mechanism with improved efficiency on an autonomous jumping millirobot. *[Acknowledgement: This research was supported by the Louis Stokes' Alliance for Minority Participation Undergraduate Research Program at the University of Maryland.]*

Faculty Advisor: Sarah Bergbreiter, sarahb@umd.edu

240
CATS: Cryogenic Acquisition and Transfer System

Roberto Dextre, Binghamton University

My project deals with the design and construction of the Cryogenic Acquisition &Transfer System (CATS) test article, for use in future experiments. This is a unique test article, and it widens the testing capabilities for ER24. The purpose of CATS is to develop an automated procedure for filling, storing, and transferring cryogenic propellant in orbit. I designed and helped manufacture the frame, structural attachments, and the waist bands on the tanks. I also developed the piping schematic, the CAD drawings, and specified what instrumentation (i.e. valves, pressure gauges, and thermocouples) was needed for the test article. With proper utilization of CATS, we can collect valuable data through various testing on a small-scale basis; and then apply it to the design for future spacecraft. *[Acknowledgement: Andrew Schnell]*

Faculty Advisor: Shanise Kent, skent@binghamton.edu

241
A Medial Condyle Surface Replacement Scaffold Utilizing Biomimetic Trabeculated Pegs to Accelerate Bone Ingrowth

Nicklaus Diggins, University of Arizona College of Medicine
Javier Rojas and John A Szivek Ph.D, University of Arizona College of Medicine

Problem Statement: Osteoarthritis (OA) results from cartilage damage and leads to pain and debilitation. OA affects nearly 27 million US adults and 14% of adults over 24 (CDC). Focal cartilage defects have been treated using cartilage regeneration strategies that utilize cell-based therapies. This approach could be extended to the treatment of patients with early stage OA and large defects. In order to support large areas of cartilage growth, a scaffold is necessary. Successful creation of cylindrical scaffolds prepared using a Rapid Prototyping (RP) technique has led to the development of a complete surface replacement scaffold to resurface an entire medial condylar surface.

We hypothesize that the surface replacement scaffold will sustain physiological loads, the biomimetic support pegs will enhance bone ingrowth, and when used in combination with adult stem cells will promote cartilage regeneration on the joint interfacing surface.

A medial condyle surface replacement scaffold was designed in Solidworks. Pegs designed to anchor the surface were built using an image data set collected from a microCT scan of a trabecular bone core. Scaffolds were built using polybutylene terephthalate using a Stratasys Fused Deposition Modeler 1650. A strain gauge rosette was attached in the space between the two anchoring pegs on the bone-interfacing surface of the scaffold. Measurements collected from this sensor could be utilized to facilitate the development of rehabilitation protocols following surgery. A finite element model (FEM) was created using Abaqus. The scaffold was modeled as an isotropic linear elastic material. Scaffolds were loaded using a servo-hydraulic material testing system to physiological loads. Results: The FEM demonstrated that stresses would be below yield stresses during physiological loading. Preliminary mechanical testing

results confirmed the FEM results. Conclusions: Preliminary testing indicates that this scaffold design will support physiological loads in vivo.

The scaffold will be implanted for evaluation in vivo to examine the rate of bone ingrowth and cartilage regeneration on the scaffold. This will allow testing of the sensor system to provide loading information during cartilage formation and preliminary information about new regeneration strategies. *[Acknowledgement: We thank NSF for funding through grant CMMI-0855493 and through a student support grant, Western Alliance to Expand Student Opportunities.]*

Faculty Advisor: Dr. John A. Szivek, szivek@email.arizona.edu

242
Protein Transport Through Metal Affinity Hydrogel Membrane and Metalloprotein Characterization

Veniece Kirksey, Prairie View A&M University
Audie Thompson and Felecia M. Nave, Prairie View A&M University

A principal advantage of using membranes in separation processes is the ability to control permeation of different species. Additionally, effective separation of a mixture of chemical components involves the use of a polymer membrane that possesses high permeance and selectivity for the species being separated.

In this study, membrane material design, development and characterization for bioengineering and nanotechnology applications will be pursued. The polymer used for this study is Poly Vinyl Alcohol (PVA) for the purification and characterization of metalloproteins. To improve the properties of polymer membranes, Immobilized metal affinity (IMA) groups have been incorporated on the polymer backbone and used as fixed site carriers to purify proteins with surface exposed histidine residues. The IMA group used in this study consist of a spacing element (1,4-butanediol diglycidal ether (1,4-BDE), chelating ligand (nitrilotriacetic acid (NTA) and a divalent ion (Ni2+). Chicken egg white lysozyme (CEWL) and cytochrome c oxidase assembly protein (HMHMp) will be used as the solutes to characterize the solubility and rate of mass transport in control (membranes without metal attached) and affinity membranes (membranes with metal attached). We have created a soluble HMHMp with a 6x-histidine tag and is expressed in E. coli.

We will elucidate the extent to which a pure protein is produced and information about the copper stoichiometry of a copper chaperone. Previous experiments have demonstrated how important purity and yield are to the examination of a metalloprotein. Our goal is to determine the solubility of a recombinatorial expressed protein in a membrane and the copper binding stoichiometry. *[Acknowledgement: NSF]*

Faculty Advisor: Dr. Felecia Nave, fmnave@pvamu.edu

243
Optimization of Mixed Design for Permeable Concrete

Daisy Manivong, California State University, Fresno
Jameson Schwab and Dr. Jesus Larralde, PhD California State University, Fresno

The problem of rainwater runoff has been a main issue in areas that are heavily dependent on rain. Not too long ago permeable concrete was introduced and was found to be quite unique, eco-friendly, and effective in reducing rainwater runoff. In comparison to normal concrete, permeable concrete contains voids that allow water to flow freely, percolating through the concrete instead of collecting on the top. The characteristics of this concrete paves ways for possibilities of addressing environmental issues such as storm drainage systems, water pollution, runoffs, island heat effect, and many others, while supporting green and sustainable growth. However, not much research has been conducted to determine the strength of the concrete and its permeability.

Five different mix designs were created with the same type of aggregates and different admixtures, including: fly ash, super plasticizers, and accelerator. The maximum size of the aggregate was 3/8". A mixer was used to first produce a homogeneous water-cement paste and then aggregates were added manually to the water-cement paste to prepare four specimens for each mix. The mix design was created based on a 1:4 water-cement ratio. After the specimens were prepared, two were placed in a curing room where they remain at constant temperature of 70°F ± 12 while the other two were placed outside and covered with a plastic sheet. The specimens were left to cure for four weeks. After curing was done, the specimens' permeability was determined using a constant head permeability procedure. Then the specimens were tested to determine their compressive strength.

After testing, the results revealed that the mix with super plasticizers in a controlled curing room with temperature of 70°F ±12 had the strongest strength value of an average of 618.71psi while also maintaining its permeability rate. In conclusion, the specimen that proved to be the strongest had a lower water to cement ratio with the addition of super plasticizers. With this result, future work is needed to improve the strength by improving the mix design and perhaps adding reinforcing fibers. *[Acknowledgement: This study was supported, in part, by a grant from NSF HRD-0802628-515291 awarded to Louis Stokes Alliance for Minority Participation Program for STEM students doing research, California State University, Fresno 2011.]*

Faculty Advisor: Dr. Jesus Larralde, jesuslm@csufresno.edu

244
Computer Aided Fixture Design for Manufacturing and Assembly of Go-Kart Chassis

Major McNair, Virginia State University
Jahangir Ansari, PhD, Virginia State University

Go-Kart chassis is a frame made of pieces of steel pipes welded together to support the engine, driver weights, and other external static and dynamic forces. CAD/CAM is the integration of design and manufacturing activities using the computer systems. This study is concentrated on implementation of CAD/CAM technology to design fixtures and tooling required for manufacturing and assembly of the kart chassis. A CNC milling machine is used to prepare the ends of the pipes' cuts and CNC plasma welding to pre-assemble the frame. This study is a part of a long-term undergraduate research project for design and manufacturing of an electric Go-Kart. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Jahangir Ansari, PhD, jansari@vsu.edu

245
Friction Stir-Welding of Aluminum 6061 Alloy

Elliott Reed, Virginia State University
Lipika Ghosh, Virginia State University

Friction Stir-welding is the process of welding without using a filler material, but instead using friction to weld the material together making it one solid piece and seamless. This process should make the material more solid and strong if it was welded using the conventional way of welding. The material that we used was the alloy, aluminum 6061. We cut down the materials to the dimension four inches by six inches and place them in a fixture in a way that we call a butt weld, which is side by side. We put in the information to the computer of the machine and let it run. We did it multiple times just using the aluminum alloy. We then cut the material into one by seven inch strips of aluminum and placed them into the Instron machine. Instron is the tensile testing apparatus by which the stress and strain of a material are measured by stretching or elongating the material until the point of failure. The data indicates that the point of the weld that we created is stronger than the actually material itself. In other words, the material always fractured above or below the weld without showing sign of failure in the actual weld. If we apply this mechanism for the welding of materials into commercial use, could we make buildings structurally sound, and possibly last longer? Could with this new technology make buildings earthquake proof without spending any extra funds? Through the conventional welding verse friction stir welding, the data indicates that by making the material one solid whole piece of material instead of using filler material to weld the material together makes the material stronger than if it was welded by hand. *[Acknowledgement: Virginia State University Research Funds]*

Faculty Advisor: Lipika Ghosh, Ph. D., lghosh@vsu.edu

246
Approximation of Material Behavior in Polymer Processing

Cesar A. Rivera, University of Puerto Rico at Mayagüez
María Angélica Salazar Aguilar, CIRRELT, Canada
José M. Castro, Ohio State University
Mauricio Cabrera Ríos, UPRM

The objective of this work is to apply empirical models to approximate material behavior in polymers. Many of the models that are used to represent polymer-processing behavior are physics-based or chemistry-based when complexity allows, or simulation-based when complexity is large. There is a need, however, for models that are simple and quick to predict different aspects of polymer behavior in the industry with moderate to large complexity. With this in mind, this work attempts the approximation of thermal evolution in sheet molding compound and of flow distance in injection molding with simple artificial neural networks. The first results, pertaining to sheet molding compound, point to the feasibility of this approach, as well as its convenience. *[Acknowledgement: National Science Foundation under Grant HRD 0833112.]*

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

247
Energy Harvesting Performance Investigation of Pyroelectrics

Meseret Sima, Alabama A&M University

Power harvesting is the process of extracting useful electrical energy from ambient low grade energy sources, such as solar, thermal, and mechanical energy, using smart materials as transducers. These materials have the ability to convert one form of energy into another. The present work aims at thermal-electrical energy converters based on pyroelectric effect for energy harvesting and examines its possible use in ultra-low power devices. Recently, we have theoretically predicted the energy harvesting capacity of pyroelectric samples fabricated in our laboratory and commercially available pyroelectric elements/transducers by capturing thermal energy of pavements. The single- and poly-crystalline elements: triglycine selenate, lithium tantalate, modified lead zirconate titanate, modified lead titanate, modified lead metaniobate, and pyroelectric polymer nano-composites such as: Portland cement, nano-carbon fibers, polymer-lithium tantalate embedded with silver nano-particles; and others were characterized for applicable performance parameters. To investigate and validate the analysis of a single electric-energy

harvesting unit, few important pyroelectric devices were embedded in various types of soils and sand. Their performance is investigated via simulating thermal conditions of pavement in the laboratory. The results obtained were presented along with possible future work and concepts of developing promising multi-domain energy harvesters or hybrid harvesters. *[Acknowledgement: AAMU/NSF HBCU-UP]*

Faculty Advisor: Dr. Ashok Batra, ashok.batra@aamu.edu

248
Development of Highly Flexible Thermal Strap for Portable Remote Imaging Spectrometer

Cristal Vasquez, Jet Propulsion Laboratory / California Polytechnic State University, San Luis Obispo

PRISM is an airborne sensor intended for on-demand monitoring of coastal areas. Sensors for ocean science must be able read very sensitive wavelengths because the reflectivity of water is low compared to that of land topography. Thus PRISM integrates an imaging spectrometer covering the visible and near-infrared range, and a short-wave infrared spot radiometer. These devices are housed in a vacuum enclosure, which is held to a stringent stability requirement of 0.1nm, which is driven by the desire to maintain spectral calibration knowledge throughout operation. The infrared cameras require a highly flexible direct cooling system due to the mechanically sensitive focal planes. A thermal electric cooler is often used together with a thermal strap as a means to transport the thermal energy removed from the infrared detector. While effective, these traditional thermal straps are only truly flexible in one direction. These requirements created the need for a new design of the focal plane thermal strap. This solution must be highly conductive, lightweight, able to operate within a vacuum, and highly flexible in all axes (to accommodate adjustment of the focal plane's six degrees of freedom). The new design must also meet space requirements of 2.5in by 6in, all while meeting a minimum conductance requirement of 0.2W/K.

After developing conceptual designs, a two-armed thermal strap was selected. It consists of a twisted section, which offers enhanced elastic movement, significantly beyond the motion permitted by existing thermal straps. This design innovation allows for large elastic displacements in two planes and moderate elasticity in the third plane. The configuration reduces the bending moment of inertia for a given conductance. By increasing length and decreasing thickness you are able to maintain the same cross sectional area for thermal conduction. This reduction in the thickness has a significant effect on the flexibility since there is a cubic relationship between the thickness and the rigidity. Comprehensive design drawings were created from which a fully functional prototype assembly was manufactured. We chose to use "swedging" as a material bonding process because it breaks the oxide layer of the material and produces pure Al to pure Al contact, which gives us better thermal contact.

Testing of the conductance was then performed in a vacuum chamber over a wide temperature range, including cryogenic temperatures. Our results were within 86% of our theoretical calculations, Gtheoretical = 0.356W/K. Based on previously tested thermal straps, we were able to project a conductance value of Gprojected = 0.306 W/K which was within 1% of the actual value. This development is a significant contribution to the thermal cooling of optical focal planes due to their highly sensitive alignment requirements and mechanical sensitivity. *[Acknowledgement: NASA MUST, Jet Propulsion Laboratory, National Science Foundation (Grant 0802628), and LSAMP]*

Faculty Advisor: Mary Whiteford, mwhitefo@calpoly.edu

249
Micro-contact Printing and Electrical Actuation of Thrombin-Apatamer Molecule

Therin Young, Savannah State University

The purpose of my research was to use micro-contact printing to print thrombin-aptamer complexes onto a gold surface and actuate the complexes with specified potentials using a potentiostat. What scientists know is that by introducing a negative or positive charge to a DNA inhibited system, the DNA molecules will either stand up in the event of a negative potential being applied or lie down in the event of a positive potential being applied. My motivation for this experiment is the fact that it can be of great use in the medical fields. Every day, patients are diagnosed with illnesses that occur because of biological problems, and advances are being made to ultimately find a cure for these illnesses. Our experimenting introduces a potential method for controlling the amount of fibrin that is produced in the human blood stream. Fibrin is the substance that causes blood clots if too much of it is present in the blood, and thrombin protein is the catalyst that helps to produce it. By applying specified potentials of -300mV, +300mV, and open-circuit voltage to the micro-contact printed thrombin-aptamer complexes, we hope to be able to control the binding and breaking of this complex. Because we used height changes for our data analysis, expensive evaluation methods such as fluorescent labeling was not required. Minimal results were obtained only for the sample that received the -300mV potential because of inconsistent voltage applications. Currently, better methods for applying the voltages are being considered. The results we obtained from our experimenting are still big steps towards building a respected experimental practice for actuating molecules. *[Acknowledgement: I would like to thank Iowa State University's MoSAIc REU Program and the National Science Foundation for the funding of our experiments.]*

Faculty Advisor: Dr. Pranav Shrotriya, shrotriy@iastate.edu

COMPUTER ENGINEERING

250
Virtual and Remote Laboratories (VR-Labs)

Osman Ahmed, Texas Southern University
Daniel Osakue and Chenyu Wang, Texas Southern University

Since the earliest days of engineering education, hands-on laboratories have been essential to undergraduate engineering programs. Concepts taught through lectures are often reinforced by such laboratory experiments. Hands-on activities allow students to conduct experiments, observe dynamic phenomena, test hypotheses, learn from their mistakes, and reach their own conclusions. Information technology has had a great impact on education, by providing additional teaching strategies such as online learning. To provide such online courses, remote access and control laboratory equipment are inevitably necessary, especially for the engineering education.

Currently, our framework uses a server and web-pages coded and configured to eliminate the need for browser plug-ins or third party software in order to operate. The workstations that host VR-Labs via web-services are made available through an experiment scheduler to eliminate resource conflicts. To allow rapid development, National Instruments(NI) software and hardware is used for the programing, data acquisition, and interaction with remote devices. The programing of virtual labs is primarily done with NI LabVIEW v8.6 as well as Java. Currently we are developing Digital Signal Processing (DSP) remote labs, and creating cross-browser compatible web-page interfaces with HTML and JavaScript to eliminate their required client-side plug-in. The primary obstacles have been accomplishing cross-browser compatibility while ensuring proper interaction between the web-page, server and web-service.

Currently, multiple virtual labs for Data Communications, AC/DC circuits, and DSP subjects are available for experimentation and coursework integration. Our Smart Vibration Platform remote lab interactively presents students with key dynamics of active structural control and Smart Martial Alloys. Eventually all our VR -Labs will require only a web browser, making them highly accessible, and combined with traditional physical laboratories will improve the efficiency of their host institutions. In the future the main focus will be on implementing this system in schools and judging its effectiveness. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Xuemin Chen, chenxm@tsu.edu

251
Modeling Facility Location Decisions for Supply Chain Management using Geographical Information Systems

Eric Glover, Virginia State University
Frank Pinto, Kamar Hooligan, and Ali Ansari, PhD, Virginia State University

The objective of this project is to analyze existing census, transportation, and geographic data to explore options for new grocery stores in Richmond, Virginia. As with any type of commercial venture, location is critical to the success of any facility regardless of the service provided. Location criteria used to establish where a facility might be successful may vary considerably depending on its service, its location and its specialization. Successful businesses use GIS software. Organizations can go beyond standard data analysis by using GIS tools to integrate, view, and analyze data using geography. These applications can be used across an entire organization, in the field, and on the internet. The beauty and power of GIS is that it allows companies to consider many possibilities, understand potential, review the impact of different investments, store and produce configurations, and analyze changing trends in the retail landscape. No other software technology has such a far reaching potential.

Grocery stores were chosen due to the variety of services and types of grocery stores available to consumers, especially within the Richmond/Petersburg area due to the economic uncertainty of the military installments, existing road network and the sustainment. The Richmond area will benefit from this expansion by population increases, additional visitors from out of state, revenue growth. More grocery stores and places for families to shop will be needed. This project will attempt to assist many planners and engineers in determining the most feasible locations to construct such a facility.

Geographic Information Systems have been used as a tool for supply chain and logistics support for managers and planners searching for optimal facility locations. The model will use census and geographic data combined with the existing transportation network for Virginia to make decisions on possible locations for a new facility. *[Acknowledgement: Federal Highway Administration, Eisenhower Fellowship Program NSF-HBCU UP]*

Faculty Advisor: Ali Ansari, PhD, aansari@vsu.edu

252
Analysis of Multi-View Video Summarization Approaches

Christopher O. Goldsmith, University of California, Santa Barbara

Video summarization is a technique to discover how much of a video is necessary to show to a viewer to convey its key content, or similarly, the limits of removing video before essential information is lost. Multi-view video summarization seeks to extend this problem beyond a single video to a set of related videos, such as those in a surveillance network. By creating a

video summarization from multiple views, the algorithm must be able to handle a variety of factors that don't have to be accounted for in a single-view algorithm. These factors include different color values and intensities to spatial/temporal redundancy. Because of the subjective nature of preserving "important" parts of a video and challenges in presenting content from different views, it's difficult to quantitatively compare the quality of results from different summarization approaches. In this work, we present experiments for assessing summarization quality using human feedback. We define a summary as "good" if it captures both the common behaviors observed in the network while also pointing out deviations. In our experiments, we create synthetic videos of a road network with objects representing people traversing the path concurrently. The video is then summarized using several different approaches. Participants are asked to convey typical paths and anomalies, while indicating whether the summary is an effective representation of the original via a website. Currently, the results are statistically insignificant and nothing can be concluded. To amend this, the data collection process is still ongoing. Based on the results, conclusions may be drawn on how efficient the given summarization algorithms are compared to each other and assist optimizing multi-view video summarization techniques. It may even be feasible to construct a possible metric that could be used to immediately identify the quality of a video summarization. Future work would consist of: further creating and improving scenarios and methods in testing for the effectiveness of a multi-view video summarization algorithm, and implementing the two following video summarization algorithms: Trajectory Novelty and Optimal Reconstruction. *[Acknowledgement: NSF REU award to the Center for Bio-Image Informatics under grant NSF III-0808772 LSAMP grant NSF HRD-0802628S]*

Faculty Advisor: B.S. Manjunath, manj@ece.ucsb.edu

253
Landmark-Based Localization

Lalindra Jayatilleke, University of the District of Columbia

Localization is an important aspect of robotics that is of fundamental importance in the deployment of autonomous vehicles. Robots need to know where they are relative to a global frame of reference, or other robots. Robot odometry is a trivial way of acquiring distance travelled by an autonomous vehicle. However, odometry has inherent flaws such as errors caused by wheel slippage on ground based vehicles. Other platforms like Unmanned Aerial Vehicles (UAVs) do not have built-in odometry capabilities. Further, the Global Positioning System (GPS) has a 10 foot error, which contributes a significant error to the robots location. Landmark-based localization is an ideal supplement to odometry and GPS. Recognition of landmarks such as tags or terrain using cameras can provide localization data. The Parrot AR drone was the platform for the landmark-based localization experiments. The real-time camera feeds from the drone along with ROS (Robot Operating System) AR tag node providing the parameters: roll, pitch, yaw, x-metric, y-metric, z-metric. Utilizing a mathematical algorithm and the camera feed, the relative position of the drone to a point of origin was calculated. The error associated with the position was an acceptable 100mm-150mm, which was a significant improvement compared to other localization methods. Landmark-based localization is proving to be an effective way to attain position information when other sources such as GPS are unavailable. Despite its advantages, certain limitations and challenges need addressing. Dealing with limitations in camera image quality, lighting and locale restrictions would require further exploration. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Nian Zhang, nzhang@udc.edu

254
Emergency Detection and Relief Using Robotics

Randale Watson, Johnson C. Smith University
Christopher Cornwall, Clayton Gordon, Jamar Robinson, Kevon Scott, Raymond Thomas, Dr. Lijuan Cao, and Dr. Hang Chen, Johnson C. Smith University, NC

Due to the increase in natural disasters and terrorism attacks, emergency management and disaster relief are important issues that have been attracting a lot of research interest. When these events occur, it is almost impossible to send persons into the affected areas due to risks such as gas leaks and unstable structures. This research seeks to solve this problem, by creating a system which would be able to go into these areas and collect data. This data would be used to monitor the affected area and decide on the best way to relieve this emergency.

To achieve this goal a robotic system was designed with features that are found on an exploration robot. This robot contains numerous sensors and utilizes a DIY Security Camera to provide wireless video and audio capability. The data collected using these peripherals can be used to assess the damage caused by the disaster as well as help with relief.

When a natural disaster occurs, the robot will be deployed in the affected area. It will then be controlled wirelessly by the computer via a Logitech Cordless Precision Controller for PS3. Real-time wireless feed will be displayed on a Graphical User Interface to determine if any person is injured or dead, a change in the terrain and identify if there are any other dangers such as a gas leak. *[Acknowledgement: Department of Homeland Security Center of Excellence - Natural Disasters, Coastal Infrastructure and Emergency Management at Johnson C. Smith University]*

Faculty Advisor: Dr. Lijuan Cao, mwinters@jcsu.edu

Computer Science & Information Systems

255
Microsoft Kinect Sensor Hardware and Software Evaluation

Glennoah S. Billie, Southwestern Indian Polytechnic Institute, NM

My project evaluates the Microsoft Kinect game sensor input/ output and its suitability to perform as part of a human interface for a spacecraft application. The primary objective is to evaluate, understand, and communicate the Kinect system's ability to sense and track fine (human) position and motion. The project will analyze the performance characteristics and capabilities of this game system hardware and its applicability for gross and fine motion tracking.

The software development kit for the Kinect sensor was also investigated and some experimentation has begun to understand its development environment. To better understand the software development of the Kinect game sensor, research in hacking communities has brought a better understanding of the potential for a wide range of personal computer (PC) application development.

The project also entails the disassembly of the Kinect game sensor. This analysis would involve disassembling a sensor, photographing it, and identifying components and describing its operation. The disassembling was a 10 stage process with documentation to support reverse engineering. The kinect sensor is capable of emitting infrared beams in a grid matrix. The onboard PS1080 chip records the time and distance of each beam of infrared and generates a real time depth image through the depth image camera. The Kinect sensor is equipped with both a video and a depth camera; the video outputs are displayed as a standard video and a depth image video. The Kinect game sensor is military grade technology with potential for many practical applications.

Further research in interfacing multiple Kinect sensors is being experimented with. The potential for real time 360 degree video and depth imaging is the future of video capturing, entertainment, security and much more. *[Acknowledgement: This project has been supported and funded by the EV3 branch at NASA Johnson Space Center under the mentorship of Helen Neighbors and Dr. Nader Vadie, Ph.D., Faculty, Coordinator of Engineering and Engineering Programs, Southwestern Indian Polytechnic Institute (SIPI), Albuquerque, NM 87184.]*

Faculty Advisor: Dr. Nader Vadiee, nader.vadiee@BIE.EDU

256
Mobile Technology For STEM Education

Matthew Reader, North Carolina A&T State University

The widespread use of cell phones provides an opportunity for enhanced education. This research leverages this technology to allow unspoken interactions between students and teachers. The program sends a random text message to the student asking them to answer a scholastic question. The student would then attempt to answer the question by replying to the text message. Then the program reads the answer the student provides and sends another text message with the answer and lets the student know if they answered correctly. The text message of the solution from the program to the student will also provide a detailed approach for the solution. The program would be able to send a text message to the student as well as the professor of their choice showing how many questions the student attempted and how many they got right as well as wrong. The overall goal is to help students think critically both inside of class and outside of the classroom as well. This project involves programming Android devices to interface with the central server to receive these messages. The programs will be written in Java, and will need to incorporate several screen sizes and resolutions. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Christopher Doss, cdoss@ncat.edu

Electrical Engineering

257
Simulation & Experimental Analysis of Lithium-Ion & Nickel Cadmium Batteries at Different Temperatures and Operational Behavior

Carlos Anglas, SUNY New Paltz
Karen Ortiz and Dwayne Woolward, SUNY New Paltz, NY

Current and future electronic devices require the necessity to obtain the most storage capacity out of their batteries. Battery technology is lagging behind as the short battery life is restraining tomorrow's efficiency in creating more portable devices. This study is divided into three objectives. In an effort to improve battery life, Lithium-Ion and Nickel Cadmium based batteries are explored, in the first objective, to evaluate their effectiveness under certain conditions. The experiments test battery life at different temperatures as well as under different loads.

Our experiments show that under colder temperatures, the efficiency of the battery increases while hotter temperatures seem to have a different effect. Also the greater the resistive load, the longer the battery will last. In the second objective, we compare and contrast simulation models with experimental

results in order to find a suitable model for efficient future research. We test the validity of simulation models by comparing the results of MATLAB and Virtual Test Bed to experimental work. After comparing our simulation and experimental results, we conclude that temperature indeed has an effect on the duration of battery life. Comparisons of experimental results with different simulation models show where each model best replicates a battery's real-time discharge curve. We conclude that the Virtual Test Bed model better simulates the initial voltage output while the MATLAB model better simulates the decreasing discharge rate. For the third objective we study a relaxation phenomenon for the Nickel Cadmium battery. The relaxation phenomenon is explored through MATLAB simulation. Our MATLAB model shows how the relaxation in Ni-Cd batteries fares against continuous discharge. We can conclude that the battery lasts longer with intermittent discharge. *[Acknowledgement: LSAMP; NYS C-STEP]*

Faculty Advisor: Dr. Baback Izadi, bai@engr.newpaltz.edu

Electrical Engineering

258
Ethernet Controller for Host Communication with Energy-Efficient Microprocessor

Jasmine Berry, University of California, Berkeley / Norfolk State University

It is evident that chips are getting bigger in capacity through progressing time, thus increasing the difficulty in testing their functionality. The most common testing approach involves the use of fully programmable gate arrays (FPGAs) to send test data from a host PC station to the chip and return the chip's reply back to the host. This research study presents several techniques that were hypothesized to utilize a model to design a more robust protocol and to also provide faster synchronization of data with the chip via Ethernet connection. The results of such investigations of the circuits optimized reveal minimal logic utilization of registers and LUTs for the advantage of processor and memory performance. Successful communication, independent of the frequency, was provided between the host and chip, which can work at different magnitudes of voltage and frequency from the chip.

The goal of this project was to devise a more efficient Host-Target Interface and to correctly generate multiple clocks for proper synchronization of data between the Ethernet, off-chip (FPGA), and on-chip. Success was achieved in the methods of manipulating the design by voiding the start and stop commands and merging their functionality with the Write Control register command. Also, a new clock scheme was implemented to produce a frequency of 125 MHz to accommodate the 100 Mbps data transfer rate for the Ethernet controller. The alterations made in the system are now useful to become a part of future implementations for many potential core designs. Also, the design modifications mentioned in this study will assist in exploring energy consumption and its tradeoffs for the many microprocessors to come. Future plans for this project are still focused on increasing the efficiency of the RISC-V chip. One of the possible methods to approach in this is to incorporate a shift register to store the incoming bits. As of now, the bits are housed in a data storage location called buf_ram, which happens to be intricately intertwined within the circuit. But the absence of it will significantly reduce the need for more registers on the chip, consequently increasing chip performance. *[Acknowledgement: This study received support from the Berkeley Wireless Research Center, the SUPERB internship group, and the National Science Foundation for funding this research venture.]*

Faculty Advisor: Ruzica Jevtic, Borivoje Nikolic, bora@eecs.berkeley.edu

259
The Fabrication of Multi-Nanolayered Thin Film Thermoelectric Devices

Kreana Pye, Alabama A&M University

Thermoelectric materials are used as devices that efficiently convert heat into electricity, and vice versa. Effective thermoelectric materials have low thermal conductivity and high electrical conductivity. The performance of the thermoelectric devices is shown by a dimensionless figure of merit, ZT. $ZT=S2\sigma T/\kappa$, where S is the Seebeck coefficient in units volts per degree Kelvin, σ is the electrical conductivity and has units Siemens per meter, T is the absolute temperature in degree Kelvin and is the thermal conductivity in units watts per Kelvin-meter. Experimental research implies that the thermoelectric performance is directly proportional to the thermal conductivity.

The present research is conducted to verify that proper fabrication of a nanoscale thermoelectric device will result in a low thermal conductivity measurement. The reduction in thermal conductivity provides an increase the value of the thermoelectric figure of merit. Materials with a large thermoelectric figure of merit can be used to develop efficient solid-state devices that convert waste heat into electricity. The fabrication of these multi-nanolayered thermoelectric devices consists of thermal evaporation of coating materials and applying them in thin film layers onto a Silicon-based substrate; a process called Physical Vapor Deposition. Proper construction of effective thin film thermoelectric devices is heavily dependent on the interrelated material properties. It must contain appropriate ratios of the coating material during deposition, be created at the correct temperature and pressure, and be deposited onto the proper substrate. Successful

construction of the thermoelectric thin film devices allocates the testing of the thermal conductivity reduction theory by acquiring the thermal conductivity measurements, to verify that it produces a higher figure of merit; thus, developing high efficiency thermoelectric energy conversion devices. *[Acknowledgement: This research is supported in part by a grant from NSF program, HBCU-UP.]*

Faculty Advisor: Satilmis Budak, satilmis.budak@aamu.edu

Electrical Engineering

260
The Effect of Dielectric Absorption on Operational Amplifiers

Ambria Stringfield, Norfolk State University

Dielectric material is the insulating material found between the plates of a capacitor. As an insulator, this material does not allow current to flow. However, this material is designed to store an electrical charge. Some common dielectric materials are ceramic, polyester, electrolyte, tantalum, mylar, paper, air, mica and film. Capacitors are designed to store a certain amount of charge, and then lose that charge when a path for discharge is created. Dielectric absorption is an event that takes place when some capacitors fail to fully discharge. For unexplained reasons, some dielectrics keep some of their charge, and voltage remains on the plates of the capacitor. This is an undesirable occurrence. This research project presented the opportunity to determine two things. First, we attempted to determine the absorption in a mylar capacitor, and secondly, this research tested the possibility that this absorption negatively affected the output of a 741 operational amplifier circuit. The 741 is the most commonly used circuit of this type because it is very versatile and reliable as a general purpose amplifier. Results showed that during the first fifteen seconds after discharge, the capacitor had significant leakage. But in all tests, after fifteen seconds, leakage leveled out, indicating that dielectric absorption was taking place. This absorption did negatively affect the amplification of the test circuit. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Eleanor Hoy, elhoy@nsu.edu

261
Measurement Accuracy & Parabolic Dish Antenna Design Using Half- Power- Beam- With Impact

Jessica Taylor, Oakland University
Ashley Steffes, Oakland University
Jeffery Tlusty, Oakland University, MI

The purpose of this project was to characterize antenna measurement accuracy as a function of transmit antenna half-power beam-width over the frequency range of 824MHz to 960MHz in an outdoor automotive range test facility. A smaller half-power beam-width for the transmit antenna suppresses reflections from the ground resulting in decreased measurement error. This poster compares the antenna measurement accuracy of a quarter-wave monopole on a 1-meter diameter ground plane with a quad-ridge and parabolic dish transmit antennas having half-power beamwidths of 35º and 22º, respectively. *[Acknowledgement: NSF]*

Faculty Advisor: Dr. Barry Hester, bhester@susla.edu

262
Applications of Signal Processing in NASA Related Research

Marcus Thornton, Virginia State University
Shawn Mull, Ehsan Sheybani, PhD., and Singli Garcia-Otero, PhD., Virginia State University

This project is about using VHDL to program FPGA boards to assist in digital signal processing (DSP). The project was divided into three specific parts: learning VHDL, learning DSP, and finally taking the skills and knowledge learned in VHDL and DSP and incorporating the two to design a home security system. The home security system will use VHDL and a Xilinx Spartan 3 FPGA board. Data will be recorded. The resulting data from the SMAP project will be analyzed and the variance, skew, and kurtosis calculated. The result of the analyzed data will be used as a tool to design the security system by incorporating the VHDL and FPGA boards with DSP. *[Acknowledgement: NASA]*

Faculty Advisor: Ehsan Sheybani, Ph. D., esheybani@vsu.edu

Environmental Engineering

263
Elimination of Cruzan Rum's Vinasse Effluent Discharge Into the Caribbean Sea

Nathan D. Gubser, University of the Virgin Islands

Each gallon of rum manufactured generates from ten to twelve gallons of a 7.5% solid solution called vinasse. This substance is "composed of sugars, organic acids, amino acids, proteins, polysaccharides, and inorganic salt complexes", and is known to possess an "extremely high BOD (biological oxygen demand) and COD (chemical oxygen demand)".[1] Cruzan VIRIL Ltd. operates a rum distillery in St. Croix, U.S.V.I. Until recently, Cruzan has been permitted to discharge their vinasse directly into the Caribbean Sea, fostering an area of aquatic toxicity. However, updated environmental standards brought Cruzan to stop this practice and conduct evaluations of alternative technologies, leading to the design and development of an evaporative process facility. This facility will eliminate Cruzan's approximately 200 gallons/

minute of point source pollution, and provide an appropriate method for meeting the unique environmental needs of a small and remote land mass. Furthermore, water recovered from this evaporation process will be purified in an on-site reverse osmosis facility for re-use in fermentation. Subsequently, this facility will direct Cruzan's effluent through falling film evaporation technology to be condensed from 7.5% to 30% solids. Forced circulation evaporation technology will then be used to turn this substance into a 70% solids state, exceeding customer specifications of 65% solids, resulting in a desirable product for use as an animal feed additive. As such, the product will then be shipped off of the island. Scheduled for completion in early 2012, this development is an engineering solution to an environmental problem. Structural, civil, electrical, chemical, and mechanical engineering design elements are each integral in the application of this solution. Upon completion and facility start up, the plant is permitted a year for commissioning to ensure proper functionality. [1] LoBue,C., Pabst, Campbell, J. (2008 Apr. 24). Ambient monitoring survey of the Virgin Islands Rum Industries, Ltd. ocean discharge. Retrieved from http:// www.epa.gov /region2/ science/reg-2-8_charles_lobue.pdf
[Acknowledgement: This research was supported by an NSF grant "Interdisciplinary Innovations", UVI NSF HBCU-UP Award 0506096]

Faculty Advisor: Eric Douglas, edougla@uvi.edu

264
Teaching in the Cloud

Jamal Jones, North Carolina A&T State University

The purpose of this research is to focus on the design, build, and implementation of a cloud network for the ECIT department at North Carolina Agricultural and Technical State University. This cloud network will help facilitate effective communication between professors and students to allow students who do not have access to these resources the chance to use them away from the university. This cloud network will also allow students to store project data in an allocated space for further research and editing at a site away from the university but with full university privileges. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Robert Cobb, rcobbjr@ncat.edu

265
Electronic Name Tag (ENT)

Marquese Pollard, Savannah State University
Dr. Mohamad Mustafa and Dr. Asad Yousuf, Savannah State University

The purpose of this project is to develop a prototype electronic name tag (ENT). This project focuses on creating an ENT that can be used for conferences, visitors' badges, etc. The development of the ENT will help the world become more environmentally friendly. There are thousands of conferences across the country, annually, and many (if not all) of them use paper name tags with plastic covers and metal clips. The problem occurs once the event is over. The paper that initially served a purpose now goes to waste in a land fill. Now, with this concept, we can reduce this waste and help save the environment by saving trees in the process.

The ENT starts with a microcontroller, the brain of the system, which is a programmable electronic integrated circuit with built in processor memory and peripherals. The microcontroller is first programmed using the Basic Stamp Editor program. The microcontroller uses this program to display the information on the liquid crystal display (LCD).

The electronic equipment is housed in a case. The case is designed using 3D modeling software, Autodesk Inventor. After the design is complete, the manufacturing process (rapid prototyping) came next. Files must be formatted in sterolithography (STL) to be compatible with the printer software (Catalyst EX) for rapid prototyping. The Dimension SST 1200es (3D-printer) was used to create the three dimensional physical model to test the design of the case. The case is made from a durable acrylonitrile butadiene styrene (ABS) plastic. Once the parts have been manufactured, they are then assembled into the ENT. It is expected that this concept will save money in the long run since the ENTs can be reused.

The use of the ENT product will help us to become more environmental conscious users. The design methodology will assist the designers to also become involved in producing green products. Although the ENT prototype is functional, it is not the final product. It is bulky in size (due to the size of the electronic boards), and the LCD used cannot handle graphical images. Further research is needed to miniaturize the electronic parts which will allow us to design a much thinner case. In addition, the LCD display needs to be replaced with an LCD that is capable of displaying images to produce company logos.
[Acknowledgement: This research project was funded by National Science Foundation.]

Faculty Advisor: Dr. Mohamad Mustafa, mustafam@savannahstate.edu

266
Chlorine vs Chloramine Treatment in Drinking Water Treatment Systems

Chantel Simpson, North Carolina A&T State University
Dr. Stephanie Luster-Teasley, and Tameka Coly, North Carolina A&T State University

For many years the city of Greensboro in North Carolina used chlorine (Cl2) in their waste water treatment system. On July 26,

2011, chloramines were introduced as a new disinfectant method to improve the taste of drinking water. Chloramine is supposed to lessen the taste and smell of chlorine in water. The main reason for the switch is the EPA's strict guidelines for reducing the trihalomethanes (THMs) and haloacetic acids (HAAs) in Greensboro's water system. Trihalomethanes and haloacetic acids are byproducts of chlorine after it is used to treat water. Chlorine is a natural element that occurs commonly in the compound of Sodium Chloride (i.e. Salt).

Chlorine is mostly used as a disinfectant because of its cost effectiveness and rapid treatment. It is the least expensive method of water disinfection and most widely operated. When chlorine and a small amount of ammonia (NH3) are combined Chloramines are formed. Chloramines (NH2Cl) used in wastewater treatment do not include nitrogen trichlorides and/ or dichloramines, which contain an organic or an "R" group. These "R" group chloramines are the bi-products produced in low levels after chloramine treatment. Chloramines react slower than chlorine, but they are active longer (which means less chlorine is used). However, chloramines do not break down as readily and quickly in water and through the transport of pipes as chlorine does. Whether using chlorine or chloramines, the EPA requires municipalities to provide residual chlorine and chloramine in tap delivered to your home to prevent re-growth of bacteria as the water travels through the distribution system.

In our experiment we will explore how chlorine and chloramine in tap water reduces the bacteria (Enterococci, E. coli, and Total Coliform) contamination. For our work, water containing a source of Enterococci, E coli, and total coliform was mixed with city tap water at a 50:50 ratio. Our goal was to determine if the residual level of chlorine or chloramine present in tap water continued to provide protection against recontamination of water by bacteria as it travels through the distribution system. We also investigated how chlorine combined with sodium thiosulfate and chloramine with sodium thiosulfate in tap water can reduce the bacteria (Enterococci, E. coli, and Total Coliform). Our results show that chloramine is not as effective at protecting water against recontamination in the distribution system. *[Acknowledgement: LSAMP]*

Faculty Advisor: Dr. Stephanie Luster-Teasley, luster@ncat.edu

MATERIALS SCIENCE

267
Thermal Expansion Measurements on Coating Materials Made of Gadolinium (Gd) and Yttria-zirconia (Yz)

Jillian Crawley-Foster, Southern University, LA

Thermal barrier coatings (TBCs) are highly advanced materials systems usually applied to metallic surfaces; for example, aero-engine parts which operate at elevated temperatures. TBC systems usually have 3 layers, each serving a specific function: the bond coat, the thermally grown oxide layer (TGO), and a top coat. During in-service applications, spallation of TBCs from the super alloy substrate due to insitu thermal stress in the TGO layer which contributes to the failure of the system. This stress has been attributed to the coefficient of thermal expansion (CTE) mismatch between the TGO layer and bond coat. It is hypothesized that addition of reactive elements in the YSZ during processing may mitigate or retard failure rates.

This study will focus on the CTE measurements of a top coat layer made of Gadolinium (Gd) and Yttria-zirconia (Yz). The CTE measurements will then be compared to TBCs systems without GD to assess its efficacy in reducing CTE. The equipment being used in this study is a Dilatometer DIL 402 C by Netzsch. The testing is conducted according to ASTM E228. The principle and design of the dilamoter will be discussed as well as the CTE measurements. After comparing the CTE measurements, consideration for error factors can be determined and adjusted accordingly to improve the experimentation.
[Acknowledgement: NSF]

Faculty Advisor: Patrick Mensah, PhD, mensah@engr.subr.edu

268
Methodology for the Synthesis of Chitin/ Calcium Carbonate Layered Composites

Amarilis Declet, University of Puerto Rico, Mayaguez
Luis Ruiz, Bryan Maldonado, Fernando Ortiz, O. Marcelo Suarez, and Oscar Perales, University of Puerto Rico, Mayaguez

A detailed study of the interaction of chitin molecular species and calcium carbonate allowed the development of a method to produce a layered composite. Chitin is emerging as a potential polymeric substrate to study and synthesize biomimetic materials because of its biocompatibility, biodegradability, and non-toxicity to humans and the environment. For the present research, chitin molecular species was treated with the N,N-dimethylacetamide (DMAc) and lithium chloride (LiCl) solvent system to form films with unique characteristics. The crystallization of calcium carbonate was completed using a mineralization system. The calcium carbonate layer thickness can be controlled by selecting the diffusion time necessary for calcium carbonate formation. The present study represents an efficient way for fabrication of organic/inorganic layered composites like chitin/calcium carbonate. *[Acknowledgement: Center for Research Excellence in Science and Technology, U.S Army ERDC, Louis Stokes Alliances for Minority Participation]*

Faculty Advisor: Oscar Marcelo Suarez, msuarez@ece.uprm.edu

269
Friction Stir-Welding of Metal Alloy with Carbon, Boron and Silicon Powders

Julius Haynie, Virginia State University
Lipika Ghosh, Virginia State University

Although there have been numerous studies on Stir Welding, Friction Stir Welding is an alternative to traditional fusion-welding techniques, where metals are heated to their melting point/state and fused together as they cool to re-harden. Instead, friction stir welding is a solid-state welding technique, where thousands of pounds of pressure (psia) are applied via a robotic tool to 'stir' metals close to, but below, their melting point/state. The pressure and heat create atomic-level contact between the metals, and they form new bonds, i.e. weld, without melting. So instead of the beaded look that one would get from traditional welding, you would get a smoother look. The studies used in this project were to see which chemical powdered bonding substance is stronger and could be used to maintain a solid bonding of metals. The specimen used in this study was a 4 inch x 6 inch aluminum-6061 alloy. It was coated with three different nano powders (Carbon, Boron and Silicon) individually spread on the inside before welding. Each showed a unique reaction to the welding and gave different outcomes on which would hold together stronger after placed in a tensile testing machine. The mechanical properties were observed through the tensile test in this study. *[Acknowledgement: Virginia State University Research Funds]*

Faculty Advisor: Lipika Ghosh, Ph. D., lghosh@vsu.edu

270
Effect of Boron Levels and Vibrations in the Wear Coefficient of Aluminum Matrix Composites

Luis Miguel Sanchez, University of Puerto Rico, Mayaguez
Frances Perez, Nayomi Plaza, Andrea Lopez, Wesly Cuadrado, and O. Marcelo Suarez, University of Puerto Rico, Mayaguez

Aluminum matrix composites have been widely used because of their excellent mechanical properties and wear resistance. A new series of aluminum-zinc-silicon matrix composites reinforced with aluminum diboride particles was developed by gravity and vibration casting for aerospace and automobile applications. The effect of boron addition on the composites wear behavior was analyzed by pin-on-disk experiments. Wearing coefficient and the volume removed were determined via profilometry analysis of the wear track and a correlation was established with the superficial Rockwell hardness values. The wear volume and the wearing coefficient diminished as the diboride particle concentration increased in both castings. However, vibration-cast specimens were more homogeneous. Grain size determination and microscopy analysis allowed quantifying the significance of this homogeneity. *[Acknowledgement: Louis Stokes Alliances for Minority Participation, Centers of Research Excellence in Science and Technology]*

Faculty Advisor: Oscar Marcelo Suarez, msuarez@ece.uprm.edu

Mathematics and Statistics

271
Before-and-After Analysis of Accident Data: Does the Safe Traffic Operations Program Have an Effect on the Road Safety?

Kristina Padilla, New Mexico State University

The goal of the project is to assess the impact of the Safe Traffic Operations Program (STOP) on road safety. In March of 2009 the City of Las Cruces introduced the STOP which is commonly known as the red-light / speeding camera enforcement program at four intersections, i.e., Lohman-Telshor, Lohman-Walnut, Valley-Avenida de Mesilla, and Main-Solano. The program was implemented to improve road safety by discouraging red-light running and speeding, and consequently, decrease the number of accidents at signalized intersection. Some preliminary conclusions were obtained from both trend and statistical analyses. Several suggestions were discussed for future research as well. *[Acknowledgement: NSF (Grant HRD-0331446)), NMAMP (New Mexico Alliance for Minority Participation)]*

Faculty Advisor: Dr. Hansuk Sohn, hsohn@nmsu.edu

Nanoscience

272
The Structural Analysis and Characterization of Thermoelectric Materials.

Jermaine Clements, Alabama A&M University

Thermoelectric devices exemplify the thermoelectric effect, which implies that an applied temperature difference creates an electrical potential in a device that can directly convert heat into electric energy. These materials are researched to increase energy efficiency, and are commonly used for power generation and refrigeration purposes. The nano-layered thin film materials are being investigated with the intent of improving the thermoelectric figure of merit defined as $ZT=S2\sigma T/\kappa$, where S is the Seebeck coefficient, σ is the electrical conductivity, κ is the thermal conductivity, and T is the absolute temperature. Before this can occur, it must be verified that an effective thermoelectric material has been invented. In this work, various analysis and characterization methods are used to validate the efficiency of the fabricated thin film devices. Rutherford Backscattering Spectroscopy (RBS) is an analysis technique that consists of impinging a thin film sample with alpha particles and

measuring distance and angle of deflected particles. RBS is used for elemental or structural analysis of thermoelectric thin film materials. The techniques utilized for characterization include X-Ray Photoelectron Spectroscopy (XPS) and Raman Spectroscopy. XPS is a quantitative spectroscopic technique that characterizes and measures the elemental composition of the materials that exist within a thin film sample. Raman Spectroscopy is employed to extract information about the vibrational structure and elemental orientation of a sample based on inelastic scattering of monochromatic light, from a laser source. The aforementioned procedures provide vital information concerning the construction and composition of the thin films, and confirm that efficient thermoelectric materials are created and can be utilized for heat to energy conversion. *[Acknowledgement: HBCU-UP]*

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

Physics (not Nanoscience)

273
Analysis of Pitched Baseball Movement

Franklin Terry, Savannah State University

Baseball has been one of the most attractive sports in the US for over a hundred years, and thus much literature has focused on the physical theories of baseball and baseball players. With the help of updated high-speed techniques, such as a high-speed motion analysis system, recent articles have provided a better understanding of how theories can utilize the experimental quantitative data, including players' motion pictures, the initial and angular velocities, flight trajectory and total travel distance of baseball, and so on. This study contributes to the analysis of movement of pitched baseballs. Although there have been several articles on this, based on more recently updated theories, we revised and simulated the trajectories of pitched baseballs. There are a variety of different pitches, including fastball, curveballs, knuckleballs, sliders, etc. These are determined by the pitcher's arm, elbow, wrinkle, finger motion, force acting points, etc.

However, these are basically products of calculation on the effect of air resistance and the most important factors of air resistance which influence the baseball trajectory-gravity, drag force and Magnus (life) force. By adopting updated theories on these forces, the acceleration equation is obtained through Newton's equation F = ma. Solving this second order ODE (ordinary differential equation) system in MATLAB, we tracked the movement of pitched baseballs under the normal pitching environment and implemented computational simulation in the different types of pitches from the pitcher's release point to a point on home plate.

These generated results show how each pitch is distinguished in the flight pattern and the effect of spin on the flight of a baseball, and thus provides help for improving or developing better pitching techniques. Finally, it can be also applied for reforming the pitcher's habitual motion for more perfect pitching.*[Acknowledgement: National Science Foundation (NSF)]*

Faculty Advisor: Dr. Hyounkyun Oh, hoh@savannahstate.edu

Graduate Abstracts for Oral Presentation

Biological Sciences

Biochemistry (not Cell and Molecular Biology and Genetics)

Grad. OA #1

Bioactivity of Secondary Metabolites from the Entomopathogenic Bacteriu, Photorhabdus Luminescens Sonorensis Against Vaior Plant Pathogens

Rousel A. Orozco, University of Arizona

Symbiotic microorganisms represent an abundant and accessible source of novel bioactive compounds with potential applications in agriculture. Entomopathogenic bacteria in the genus Photorhabdus represent a rich source of such molecules, which possess insecticidal, nematicidal, antibiotic and antimycotic properties. The use of bacterial natural products in agriculture as environment friendly alternatives to harmful chemicals reduces pesticide application as part of integrated pest management.

The bioactivity of secondary metabolites produced by the nematode symbiont Photorhabdus luminescens subsp. sonorensis was evaluated by fermenting bacterial cultures and extracting crude extracts, using Triptic soy broth fermentations as controls. The extract's composition was analyzed by TLC, and HPLC-MS. Bioactivity of the metabolites was evaluated on the following plant pests and pathogens: Helicoverpa zea, Meloidogine incognita, Fusarium oxysporum, and Pseudomonas syringae.

Significant levels of bioactivity where detected on all test organisms, which suggest the presence of multiple compounds

with potential for agricultural bioprospecting. The most promising compounds for practical applications will be characterized by isolation and analysis of various fractions from the crude extracts, by elucidation of their structure and chemical nature, and by evaluating their bioactivity. *[Acknowledgement: Center of Insect Science at the University of Arizona, and NSF.]*

Faculty Advisor: S. P. Stock, spstock@email.arizona.edu

Biomedical Engineering

Grad. OA #2
Pathways to STEM Careers: Student Perspective in a Biotechnology Bridge Program

Andrea Goldfien, San Francisco State University

Success in college level math and science opens doors to advanced educational opportunities as well as careers in science, technology, engineering, and mathematics (STEM) fields. Students of color, whose first step into higher education is often the community college, and many of whom lack the academic preparation needed to succeed in college level courses, have limited access to and are underrepresented in STEM technical and academic fields. Bridge Programs have been found to help students build academic skills required for college success, but research on such programs has focused on academic and employment outcomes, overlooking the mechanisms by which the elements of the programs function to support student success.

This qualitative case study of a Bridge to Biotech program examined the ways in which the program's structural and instructional elements impacted student experience. Interviews with program faculty supplemented by classroom observation provided data on program design and implementation. Interviews with past and current students provided the data on student experiences. Curriculum documents and program evaluations contributed data on program design and student outcomes. Themes identified in the data analysis were verified through member checking. Early findings extend earlier research about persistence, and gathered student perceptions of the value of individual components of the Bridge. There are four substantial early findings from the research. First, the explicit career pathway leading to industry-recognized credentials attracted students to the Bridge program and motivated them to persist. Second, the one-semester time commitment for the Bridge encouraged unemployed and underemployed adults from a variety of backgrounds to enter the program. Third, the integrated math, language and biology courses in which skills and knowledge are applied to biotechnology, foster self-confidence in students.

A final early finding is that the cohort forming a learning community supports persistence. A question that remains unanswered is the degree to which student self-selection influences the efficacy of the Bridge program. Though past research has identified Bridge Programs as a promising approach to help underprepared students enter STEM careers, the current research, focusing on student experience, has the potential to help leaders better target their efforts and resources on strategies perceived by students as being most important to their success. *[Acknowledgement: The study was supported by NSF Grant 1003589 awarded to Norena Norton Badway, PhD., Graduate Program Coordinator, EdD in Educational Leadership Program, San Francisco State University, San Francisco, CA]*

Faculty Advisor: Norena Norton Badway, nbadway@sfsu.edu

Cancer Research

Grad. OA #3
Modulation of miRNA Expression in Prostate Cancer Cells by the Dietary Flavonoid Quercetin.

Lachundra Mosley, Tuskegee University

Prostate cancer is the most commonly diagnosed and the second highest cause of death in men. There is a growing interest to prevent prostate cancer through dietary adjustments or supplements. Quercetin is a widely available dietary polyphenolic flavonoid that is abundant in the skins of fruits and vegetables, and has anti-cancer properties. Even though research on flavonoids and their anti-cancer potential is ongoing, the mechanisms behind their abilities to inhibit carcinogenic processes are not fully understood.

We propose that dietary polyphenols, like quercetin, could modulate miRNA expression or biogenesis to influence prostate cancer biology. Therefore, we aim to identify the expressions of miRNAs, which are modulated by quercetin, and to characterize the cellular functions they regulate. To address this, we will first profile the expression of diverse miRNAs in control and quercetin-treated cells by using miRNA profiling PCR array technology. MicroRNAs that are strongly and consistently modulated by the treatment will be validated in further steps and their targets identified and validated through PCR. Changes in similarly treated normal prostate epithelial cells will be compared to those from cancer cells. DU-145 prostate cancer cells were used. These cells are already available in the lab and are routinely used in other studies. Conditions to culture and maintain the cells have already been established. The cells were exposed to 25 & 50M concentration of quercetin for 48 hours, followed by harvesting and extraction of total RNA. Control cells were treated with DMSO, a carrier used to solubilize quercetin. Harvested RNA was enriched for small RNAs, which include

microRNAs Small RNA samples were reverse transcribed into first strand cDNA. MicroRNAs in treated and control cells were quantitatively analyzed using quantitative real-time PCR. Targets were also analyzed using quantitative real-time PCR, and forward and reverse primers for target PCRs were found using NCBI primer blast and ordered from IDT technologies.

In this study we have found that the dietary flavonoid quercetin does have an effect on miRNA expression and gene expression of targets in treated DU-145 prostate cancer cells. We validated 17 out of 88 miRNAs screened, whose expression were significantly changed and identified and validated gene expression in targets linked to those miRNA's.
[Acknowledgement: This research is supported by TU/UAB/MSM partnership U54 CA118948 and NIH NCI/NIGMS 5SC2CA138178.]

Faculty Advisor: Dr. Mohammed A. Qazi,
maqazi@mytu.tuskegee.edu

ECOLOGY

Grad. OA #4
Evolved Reduced Investment in an Indirect Herbivore Defense Trait in an Invasive Tree, Triadica Sebifera

Juli Carrillo, Rice University
Evan Siemann, Ph.D. Rice University, TX

In the absence of coevolved natural enemies, plants are expected to experience selection away from costly herbivore defense towards growth and reproduction (Evolution of Increased Competitive Ability hypothesis), yet all tests of EICA to data have only examined direct defense traits. We conducted a greenhouse pot experiment to test whether invasive populations have reduced constitutive and induced investment in an indirect defense trait, extrafloral nectar (EFN) production, compared to native populations of Chinese tallow tree, Triadica sebifera. Overall, native populations invested more in indirect defense: Native populations had a greater number and percentage of leaves with EFN, produced more EFN volume, and had sweeter nectar compared to invasive populations, independent of treatment. Of the traits measured, we only detected a tradeoff between constitutive and induced number of leaves produced with EFN, but this tradeoff did not depend on plant origin.

Our results are the first to provide support for the EICA hypothesis for an indirect defense trait. This suggests that tri-trophic interactions such as indirect defense are under similar selection in the absence of herbivores as direct defense traits. Despite reduced investment in extrafloral nectar production, invasive populations still retain the ability to produce EFN, which may enable invasive plants to defend against herbivores in the introduced range. Together with the increased competitive ability of invasive populations, tallow tree appears to be an invasive plant that is able to both grow and defend.
[Acknowledgement: This study was supported, in part, by an NSF Graduate Research Fellowship and a Ford Foundation Fellowship awarded to J. Carrillo and NSF grant DEB 082056 awarded to E. Siemann.]

Faculty Advisor: Evan Siemann, siemann@rice.edu

MICROBIOLOGY/IMMUNOLOGY/VIROLOGY

Grad. OA #5
Dual Expression of Vaccinia Virus E3L protein Z-DNA and dsRNA Binding Domains

Susan A. Holechek, Arizona State University
Dr. Bertram L. Jacobs, Arizona State University

Vaccinia virus (VACV) is a member of the genus Orthopoxvirus of the family Poxviridae, and it is considered a highly effective vaccine against smallpox and other closely related viruses such as monkeypox and cowpox. VACV has a double-stranded DNA genome approximately 190 kbp in length and encodes for about 200 proteins. One of the main characteristics of this virus is that it is interferon (IFN) resistant as evidenced by replication of VACV in cultured cell lines treated with IFN. This effect is primarily mediated by the protein encoded by the E3L gene as deletion of the entire gene renders a VACV that is IFN sensitive.

The E3L protein has two domains: a Z-DNA binding domain in the amino terminus, and a double-stranded RNA (dsRNA) binding domain in the carboxy terminus. Both domains have been shown to be necessary for pathogenesis as a VACV mutant lacking the Z-DNA binding domain is less pathogenic than wild type in an animal model.

In order to test the hypothesis that both domains need to be linked together in order to block the IFN response, a virus that expresses both domains of E3L in different VACV loci was engineered and compared to wild-type VACV in cells in culture and for its ability to inactivate the IFN response. The dual expression virus was unable to replicate in JC cells, a cell line where E3L mutants lacking either the Z-DNA binding domain or the dsRNA binding domain are unable to replicate. Moreover, phosphorylation of the dsRNA dependent protein kinase (PKR) was observed at late times post-infection.

The present data support the hypothesis that both domains of E3L need to be linked together in order to block the IFN response suggesting that the Z-DNA binding domain of E3L could bind to dsRNA in its Z-form. *[Acknowledgement: This work was supported by NIH grant AI052347 awarded to Bertram L. Jacobs, Ph.D., Professor, School of Life Sciences and Center for Infectious Diseases and Vaccinology, The Biodesign Institute, Arizona State University, Tempe, AZ 85287.]*

Faculty Advisor: Dr. Bertram L. Jacobs, bjacobs@asu.edu

Grad. OA #6
Naringenin Effectively Inhibits the Phosphorylation of P38 MAPK and Lower the Expression Levels of CD80 and TLR2 to Down-regulate Pro-inflammatory Cytokines Secreted in Chlamydia Trachomatis-infected Macrophages

Abebayehu Yilma, Alabama State University
Shree Singh and Vida Dennis, Alabama State University

Chlamydia trachomatis, the leading cause of bacterial sexually transmitted infections, is responsible for a myriad of immunopathological changes associated with reproductive health. Chlamydia infects macrophages, ultimately leading to the secretion of several inflammatory mediators which put patients at risk for major health issues such as pelvic inflammatory disease and infertility. Controlling excessive production of inflammatory mediators, especially during the early stage of a C. trachomatis infection, may be a viable option to combat the disease. Previously, we have shown that naringenin, a natural flavonone with known anti-inflammatory activities, reduced TNF and IL-6 cytokine levels in a dose-dependent fashion in mouse in J774 macrophages after their exposure to live C. trachomatis or LPS. Herein, we investigated the mechanism(s) by which naringenin inhibits cytokines in mouse macrophages. Mitogen-activated-protein kinase (MAPK) family of proteins plays a crucial role in the signal transduction cascade leading to the production of inflammatory mediators.

We hypothesize that naringenin interferes with the MAPK signaling pathway to block production of pro-inflammatory cytokines. To test our hypothesis, western blotting was employed to assess the ability of naringenin to inhibit phosphroylations of p38 and JNK MAPK proteins using cell lysates collected from live C. trachomatis- or LPS-exposed cells either in the presence or absence of nanringen. Naringenin inhibited the phosphorylation level of p38 but not of JNK, and also that of the down-stream NF-kB transcriptional regulatory protein as induced by live C. trachomatis or by LPS. Flow cytometric analyses also revealed that naringenin down-regulated the expression levels, as induced by live C. trachomatis or LPS, of TLR2 and CD80, but not those of TLR4 and CD86 on macrophages.

Overall our data shows that the anti-inflammatory actions of naringenin in macrophages are, in part, mediated by inhibition of macrophage activation and of the p38 MAPK and NF-kB signaling pathways. Our data further provides evidence for naringenin as a novel therapeutic agent in the control of C. trachomatis-induced acute inflammation. *[Acknowledgement: This study was supported by Grant HRD-0734232 from NSF-CREST awarded to Shree Singh PhD, Director of the Center for Nanobiotechnology and Life Science Research at Alabama State University, Montgomery, AL, 36101.]*

Faculty Advisor: Dr. Vida Dennis, vdennis@alasu.edu

CHEMISTRY & CHEMICAL SCIENCES

BIOMEDICAL ENGINEERING

Grad. OA #7
DNA Surface Hybridization: Comparison of Theory and Experiment

Damion L. Irving, Polytechnic Institute of New York University
Ping Gong, Seventh Sense Biosystems, Cambridge, MA
Rastislav Levicky, Polytechnic Institute of New York University

Surface hybridization, in which double-stranded nucleic acid structures form at interfaces from sequence-specific pairing between complementary strands, is extensively encountered in the life sciences for analysis of DNA and RNA sequence composition. The design and interpretation of surface hybridization assays is complicated by poorly understood aspects of the interfacial environment that cause both kinetic and thermodynamic behaviors to deviate from those in solution. The origins of these differences lie in the additional interactions experienced by hybridizing strands at an interface. In this report, an analysis of surface hybridization equilibria is provided for a model system of end-tethered, single-stranded oligonucleotide 'probes' hybridizing with similarly-sized, single-stranded solution 'target' molecules.

Two theoretical descriptions, one derived from work by Vainrub and Pettitt (Vainrub, A.; Pettitt, B. M. Phys. Rev. E 2002, 66, 041905) and Halperin et al (Halperin, A.; Buhot, A.; Zhulina, E. B. Biophys. J. 2004, 86, 718), and the other an extended version that also accounts for salt-dependence of duplex formation, are compared to recent experiments performed as a function of salt concentration CB (0.012 mol L-1 to 1 mol L-1 sodium phosphate buffer) and probe coverage S0 (1.8 1012 to 1.4 1013 sites cm-2). Both models can reasonably account for experimental trends when the DNA volume fraction remains below ~ 0.25, corresponding to conditions of low to moderate CB and S0. Comparison of the free energy and salt-dependence of surface hybridization with corresponding values in solution points to prominence of probe-probe interactions within the surface environment. Neither model, however, can account for strong suppression of hybridization as the volume fraction of DNA approaches 0.3 under high buffer strength and probe coverage. Under these conditions, experiments reveal that hybridization yields become insensitive to increases in target concentration even though many probes remain available to bind targets. These observations are attributed to onset of packing constraints which, interestingly, become limiting significantly below maximum DNA coverages estimated based on ideally efficient hexagonal packing. *[Acknowledgement: The described work was supported by the National Science Foundation under*

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Faculty Advisor: Rastislav Levicky, damion.irving@gmail.com

CHEMISTRY (NOT BIOCHEMISTRY)

Grad. OA #8
Spectroscopic Investigation of the Binding of PCBs and Dioxins to Selective Peptides on Polyaniline Matrix

Edikan Archibong, University of South Florida

Background: PCBs and dioxins are major environmental pollutants. They are not biodegradable and have accumulated in the food chain, eventually ending up in the human body. The existing methods for analysis are costly and time consuming. Therefore, an increased demand for sensitive, inexpensive and reproducible methods for extraction and determination of toxins in the environment is needed. The working hypotheses of this project were: a) that polymer fibers post-modified with PCBs and dioxin selective pentapeptides will be effective tools for extraction of toxins from food and water; b) there is binding of glutaraldehyde (GA) and selective peptides to polyaniline matrix (emeraldine base, EB); and c) there is binding of toxins to the chemosensors.

Methods: The properties of the chemosensors, as well as binding of PCBs and dioxins have been studied using UV-Vis spectroscopy, fluorescence spectroscopy and PCA.

Results: The labeled peptides as well as peptides incorporated in the polymer matrix exhibit a broad absorption band at 334 nm which is linearly proportional to the concentration in concentration range from 0.01mg/mL to 0.07mg/mL; PCA analysis was performed on UV-Vis data to further clarify the binding between EB, EB-GA, and the corresponding peptides. The AMC labeled peptides on the matrix excited at 334nm showed a broad emission band from 350nm to 575nm. The amount of peptides on the polymer was calculated to be 3.30-7.76%. The chemosensors are stable in a broad pH range. When these ligands were mixed with dioxins and PCBs, the fluorescence quenching has been observed which was related to the concentration by a non-linear function.

Conclusions: Selective binding peptides were successfully incorporated in the polyanaline matrix; after 24 hours 4-16% leaching of peptides was observed depending on the pH. The peptides are connected to the polymer matrix through a chemical bonding. The chemosensors undergo significant emission changes in the presence of the toxins which are concentration dependent and can be used for quantification. Future work: The chemosensors will be used as solid phase extraction media to extract and concentrate dioxins and PCBs in food and water matrices. The data will be analyzed with GC/MS technique. (References: 1. Nakamura, C. et al. Dioxin-binding pentapeptide for use in a high-sensitivity on-bead detection assay. 2. Inuyama, Y. et al. Simple and high sensitivity detection of dioxin using dioxin-binding pentapeptide.) *[Acknowledgement: This project was funded through the NCFPD Center of Excellence by a grant from the Department of Homeland Security, Science and Technology Directorate, Office of University Programs as well as by a DHS SRT for MSI follow on grant.]*

Faculty Advisor: Dr. Nelly Mateeva, nelly.mateeva@famu.edu

MATERIALS SCIENCE

Grad. OA #9
Effect of the Acid-Base Properties of the Support of Supported Ruthenium Catalysts for the Conversion of Cellulose into Polyols

Darlene Z. Galloza-Lorenzo, University of Puerto Rico at Mayaguez
Nelson Cardona-Martinez, University of Puerto Rico at Mayaguez

The world's energy needs are increasing each year and with the combination of several factors including the diminishing of petroleum resources, the increase in the petroleum derivatives prices, as well as the increase of green house gas emissions, there is great interest of finding new processes to produce renewable fuels, such as the hydrogenation of cellulose by a bifunctional catalyst into sugar alcohols.

In this work, we focus on the study of the effect of the support acid-base properties on the catalytic performance during the conversion of cellulose into sugar alcohols, which can be used in a biorefinery platform as a renewable feedstock for the production of fuels and high value chemicals. The series of metal oxide supports studied include MgO, ZrO_2, TiO_2, two types of Nb_2O_5, Al_2O_3, and SiO_2. Furthermore, binary and ternary metal oxides were also analyzed such as WO_3-TiO_2, Al_2O_3-TiO_3, Fe_2O_3-TiO_2, two types of SiO_2-TiO_2 and SiO_2-TiO_2-WO_3.

Also we study a phosphate material like $NbPO_4$ and an ion-exchange resin like Amberlyst-15. The materials used display a wide range of acid-base properties. Ru was supported using evaporative deposition on all the supports. The catalytic activity appears to have a correlation with the Sanderson electronegativity for the single metal oxide materials passing through a maximum for Nb_2O_5 (CBMM) for the supports. For Ru/MgO, Ru/ZrO_2, Ru/Nb_2O_5 and Ru/SiO_2 there is no apparent effect of the support electronegativity over the overall activity of the materials. The catalytic materials were characterized using nitrogen adsorption, X-Ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR). Nb_2O_5 has a significantly lower surface area than SBA-15, but displays higher activity as

$NbPO_4$. The yield of the mesoporous material is equally better than Ru/Nb_2O_5 (CBMM), Ru/SiO_2, Ru/ZrO_2 and Ru/TiO_2 with respect to the hexitols yields; on the other hand Ru/SiO_2 shows the best sugar yield, and Ru/TiO_2 and Ru/ZrO_2 shows high yields with respect to hydrogenolysis products. The ternary metal oxide SiO_2-TiO_2-WO_3 and Amberlyst 15 had a better activity and yields than SBA-15, probably due to its more acidic character. Ru/WO_3-TiO_2, Ru/SiO_2-TiO_2 and Ru/SiO_2-TiO_2 (Deg.) displayed the best cellulose conversion; on the other hand Ru/SiO_2-TiO_2-WO_3 shows better yield to sugar alcohols. *[Acknowledgement: CREST Nanotechnology Center for Biomedical and Energy-Driven Systems and Applications (HRD-0833112).Wi(PR)2EM Wisconsin-Puerto Rico Partnership for Research and Education in Materials (DMR-0934115).]*

Faculty Advisor: Nelson Cardona Martinez, nelson.cardona@upr.edu

NANOSCIENCE

Grad. OA #10
Functional Nanofibers from Polymer/CNT and AuNP Composites As Active Components of Biosensors

Omotunde Olubi, Clark Atlanta University

Conductive fibers decorated with α,ω-bi-DNP (dinitrophenyl) groups capable of specifically binding with anti-DNP IgE have been prepared by electrospinning a solution of α,ω-bi-DNP -poly (2-methoxystyrene), polystyrene and single walled carbon nanotubes (SWCNT). The nanowires (200nm) were electrospun onto a silicon wafer substrate at a voltage of 10kV using either DMF or chlorobenzene. The d i-nitrophenyl (DNP)-functional groups were tethered to the fibers via oligo (oxyethylene) spacers. A (water and ethanol) solution consisting of poly (vinyl alcohol) and gold nanoparticles (AUNPs) was electrospun onto several substrates: glass, FTO, silicon, FTO on plastic and aluminum foil. The gold particle embedded fibers are being developed for photonic applications. The AUNPs (diameter ranged from between 3 - 43 nm in size) used in the preparation of the fibers were prepared by two methods: the liquid - liquid interface method and the one-phase synthesis technique. The α,ω-bi-DNP -poly (2-methoxystyrene) functional polymers were synthesized in the lab by first preparing the α,ω-di-hydroxyl-poly (2-methoxystyrene) by living anionic polymerization, followed by the functionalization of the di-hydroxyl polymer with the DNP functional group. The functional polymers have been characterized by 1H and 13C NMR, FT-IR, DSC, GPC, SEM, and TEM. Furthermore, we have also prepared conductive (based on polypyrroles) nanowire structures decorated with functional (DNP) groups capable of specifically engaging target anti- DNP IgE and IgE on mast cell surfaces. The binding affinity of nanowires containing 1% single-walled Carbon Nanotubes with anti-DNP IgE has been studied via fluorescently labeled FITC-IgE. The success achieved so far in this investigation suggests the possibility of developing functional nanofibers as the active component in biosensors. *[Acknowledgement: The authors gratefully acknowledge the support of National Institutes of Health NIGMS MBRS RISE Grant 5R25G0M60414 and National Science Foundation HRD-0630456, NSF CREST Program.]*

Faculty Advisor: Dr. Ishrat Khan, ikhan@cau.edu

COMPUTER SCIENCES & INFORMATION MANAGEMENT

COMPUTER ENGINEERING

Grad. OA #11
An Integrated Machine Learning and Control Theoretic Model for Mining Concept-Drifting Data Streams

Sai Kiran Mukkavilli, Tennessee State University

Anomaly-based network Intrusion Detection Systems (IDS) model patterns of normal activity and detect novel network attacks. However, these systems depend on the availability of the systems normal traffic pattern profile. But the statistical fingerprint of the normal traffic pattern can change and shift over a period of time due to changes in operational or user activity at the networked site or even system updates. The changes in normal traffic patterns over time lead to concept drift. Some changes can be temporal, cyclical, and can be short-lived or they can last for longer periods of time. Depending on a number of factors, the speed at which the change in traffic patterns occurs can also be variable, ranging from near instantaneous to the change occurring over the span of numerous months. These changes in traffic patterns are a cause of concern for IDSs as they can lead to a significant increase in false positive rates, thereby reducing the overall system performance. In order to improve the reliability of the IDS, there is a need for an automated mechanism
to detect valid traffic changes and avoid inappropriate ad hoc responses. ROC curves have historically been used to evaluate the accuracy of IDSs. ROC curves generated using fixed-time invariant classification thresholds do not characterize the best accuracy that an IDS can achieve in the presence of concept-drifting network traffic. In this paper, we present an integrated supervised machine learning and control theoretic model for detecting concept drift in network traffic patterns. The model is comprised of an online support vector machine based classifier (incremental anomaly based detection), a Kullback-Leibler divergence based relative entropy measurement scheme (quantifying concept drift) and feedback control engine (adapting ROC thresholding). In our proposed system, any intrusion activity will cause significant variations, thereby causing a large error, while a minor aberration in the variations (concept drift) will not be immediately reported as alert.

We have obtained results which verify our assumption that a small change to the data has significant effect on the classification accuracy. These results are shown graphically by plotting the ROC Curves and getting the respective accuracy. *[Acknowledgement: This study was supported, in part by a grant from NSF HBCU-UP Targeted Infusion HRD 1036307 awarded to Sachin Shetty Ph.D., Assistant Professor in the Department of Electrical and Computer Engineering, and Dr. S. Keith Hargrove, Dean of the College of Engineering, Technology, and Computer Science, Tennessee State University, Nashville, TN 37209]*

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

Computer Science & Information Systems

Grad. OA #12
Web-Based Animated Pedagogical Agent Online Learning System

Ruth Agada, Bowie State University
Dr. Jie Yan, Bowie State University, MD

Considering that in-class teaching time is very limited, it can be very challenging for an educator to instruct the student, while keeping the student's interest in the course high throughout the semester. This requires innovation in teaching, especially when the class is large. Web-based learning systems are becoming increasingly popular due to their appeal over the traditional text -based learning systems. The web-based animated tutoring system is designed to simulate the process of one-to-one tutoring of a small class, teaching and helping educators to further supplement the contents to suit the needs of the students. The intelligence of the web-based system comes from information related to the student knowledge, the specific domain knowledge, and the teaching strategies, which are represented by three basic components in the system.

In this research, we put forth a Web-based animated tutoring system for computer literacy, providing the student the opportunity to learn about certain aspects of the course. The agent will be implemented in the fall 2011 session of COSC 110, a computer literacy course at Bowie State University. Several instruction modules were created in which the student is presented with a lecture specified by the instructor, as well as topics to be covered in that lecture. Based on the subtopic selected by the student, only information pertinent to that subtopic is displayed. Following each lecture, quizzes are made available to test the students' comprehension and retention of the lecture. The quiz modules test students on information covered in each lecture module. Two issues were evaluated in the analyses: the comprehension level of the user after interacting with the system and the user's perception of their learning experiences as a result of the embedded animated agent. Overall we see that the results of the condition in which the agent is fully expressive shows a marked increase in the level of comprehension because as we speculated, the user is more invested in the software when the agent fully articulates emotion through head movement and facial expression. In addition, the condition in which the agent is partially animated illustrates that the comprehension level is the average of both the fully animated and non-animated agent. We hypothesized that the magnitude of the post-test scores were due to the students' interaction with the agent. *[Acknowledgement: This work is supported by NSF grant: IIS-0827188.]*

Faculty Advisor: Dr. Jie Yan, jyan@bowiestate.edu

Grad. OA #13
Network Data Collection and Security Visualization Using Syslog and PicViz

Brittany J. Brown, Virginia State University

Data mining is known for being a powerful technique for identifying patterns and providing insight into large amounts of data. Data mining techniques are widely used for surveillance, fraud detection and scientific discovery. However, it is generally recognized that data mining tools are in many ways not as powerful as humans. Humans by nature are visual and are capable of processing large data through maps and data plots. The human mind is very fast at processing visual data therefore out weighing data mining. In network security, visualization is an ever-growing means of network security management. Visualization of the data can enhance a network administrator's ability to detect intrusions or attacks on the network by improving their awareness of real time and recent network events that might have been missed otherwise.

This work is dedicated to challenging problems in security visualization. Having readily available data collected from live networks and visualizations, we are able to illustrate data with many dimensions in human-acceptable manner. First, we make use of syslog protocol and its implementations in the public domain and set up a log collection framework where Windows and Linux hosts send log messages to a syslog server, and the syslog server stores the log messages in a MySQL database. Second, picviz, a security visualization tool, is used which aids by adding colorful flare to visualization in order to improve awareness of real time and recent network events. The collected data is plotted using parallel coordinates where multiple dimensional data can be illustrated in two-dimensional view. The illustrations draw attention to unusual activity and encourage the analysis to explore and discover answers to previous concerns while posing new questions. *[Acknowledgement: National Science Foundation, LSAMP, and Virginia State University.]*

Faculty Advisor: Hui Chen, Hchen@vsu.edu

Grad. OA #14
Modified Low Energy Adaptive Clustering Hierarchy in Routing and Media Access Control in Wireless Sensor Networks

Sovandara Chea, Texas Southern University

Wireless Sensor Networks (WSN) composed of sensor nodes (single chip with embedded memory, processor, and short range transceiver), are used widely in many applications. From structure health monitoring to healthcare monitoring systems, sensor node play a vital role in data collecting.

Many benefits of using WSN include low cost sensors, multi-hop relay protocols, self-maintainability, and remote deployment. Energy Efficiency is one of the big challenges for many researchers. Energy efficiency can be done in various ways such as optimization in Media Access Control (MAC), and most importantly in routing protocol.

Routing protocol for Wireless Sensor Networks is challenging because of the resource's constraints such as computation power, energy, and radio communication ranges. Many protocols proposed to maximize one of the criteria based on the constraints listed above. Low Energy Adaptive Cluster Hierarchy (LEACH) is one of those proposed routing protocols which used both content-base and content-free protocols to maximize network's lifetime. LEACH is a hierarchy cluster based routing protocol that elects a set of cluster heads during setup phase then runs normal data exchange operation during steady phase. LEACH elects a set of nodes that have not been served as cluster heads in homogeneous networks. In heterogeneous networks, LEACH elects cluster heads based on the current level of left over energy. For inter-cluster communication, LEACH used Time Division Multiple Access (TDMA). For cluster-to-cluster communication, LEACH used Carrier Sensing Multiple Access (CSMA) protocol.

In this research, we would like to exploit LEACH's cluster head election policy to create a more efficient cluster head election policy. Our first approach is to use the amount of data transferred during the cluster head's role to calculate the next round of cluster head's election. For inter-cluster data communication, we will evaluate some of the dynamic-assignment content-free protocols such as Reservation-Based protocol, where a node sends a request for transmit to cluster head when it need to transmit data. For cluster-to-cluster's communication, CDMA Collision Avoidance (CDMA/CA) be evaluated to see if it is performed better than regular CDMA. *[Acknowledgement: This study was supported, in part, by a grant from NSF/CREST Center for Research on Complex Networks to Wei Wayne Li Ph.D., Director of the Center and Energy Efficient Wireless Sensor Networks, CREST University, Houston, TX 2011.]*

Faculty Advisor: Wei Wayne Li, liw@tsu.edu

Grad. OA #15
Evacuation Simulation in a Multiuser Virtual Reality Environment

Stephen Otunba, Bowie State University

Crowd simulations are powerful tools for visualizing, analyzing, and communicating how a venue will work or testing evacuations scenarios in emergencies. Human behavior is difficult to model and simulate due to the high level of uncertainty involved. User controlled agents in Virtual Reality (VR) environment can provide a means for more accurately observing human behaviors during emergency evacuations. We have implemented a multiuser interface to allow multiple user controlled agents to navigate in a virtual environment. Our hypothesis is that the "sense of presence" provided by the virtual environment will allow running simulations and conducting evacuation drills without the cost and risk of injury to live actors. The aim of this project is to provide a more accurate and realistic means for assessing human behavior in emergency scenarios using a game setup metaphor. Our work is based on agent based methods, which focus on individual and group behavior. Given the existing models and methods available, the research questions are as follows: What are the most effective approaches for training and testing evacuations scenarios in emergencies for unexpected events? How can we evaluate and validate the results of crowd simulations for these given applications?

Our virtual environment was created using 3D Studio Max and exported to Virtools which is a graphical game development platform. Virtools was used to implement the character and environmental behaviors. Also, the multiuser functionality was incorporated using the Virtools multiuser building blocks. The Virtools multiuser environment is based on a networking engine, which allows users to share content over the web or local networks and allows clients to modify virtual environmental conditions in real time.

The aim is to have our environment accessible through a web browser and implement a rewards system whereby users can earn points for completing certain objectives. Upon completion of the project, we would conduct user studies to assess the effectiveness of using user controlled agents in crowd simulations. This virtual environment will also be used to assess how certain human behaviors such as panic, anger, and stress influence evacuation in dangerous loss of life scenarios that cannot be evaluated in real life situations. The results of this project can be expanded and used in the assessment of crowd simulation in any industry or environment. *[Acknowledgement: The authors would like to thank The Chesapeake Information Based Aeronautics Consortium under the National Aeronautics and Space Administration for supporting the project. This study*

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Faculty Advisor: Dr, Sharad Sharma, ssharma@bowiestate.edu

Grad. OA #16
Interpreting Adjectives to Deal with Miscommunication

Michelle Snowden, Bowie State University

The purpose of this research is to find mechanisms for interpreting adjectives to help deal with miscommunication in natural language systems. If miscommunication occurs, metacognitive reasoning will interpret the adjectives to find where the miscommunication occurred. To this end, the research focuses on categorizing adjectives into various groups, finding mechanisms for interpreting adjectives under each category, and making use of these interpretations to identify and reason about miscommunication errors. In this presentation, we describe a classification scheme for categorizing adjectives based on their meaning and mechanisms to interpret some of these categories. Some of the issues that are addressed include, dealing with adjectives that may be categorized under two or more different groups, dealing with relationships between adjectives that belong to different groups and dealing with relationships between different adjectives in the same group. For example, lukewarm and warm are two adjectives that have similar meanings. *[Acknowledgement: NSF, NASA]*

Faculty Advisor: Dr. Darsana Josyula, djosyula@cs.bowiestate.edu

Grad. OA #17
Error Resilience Re-Del Agent in Telecommunication Network Systems

Nathaniel Nana Kojo Taylor, Bowie State University

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. These networks are often provided with building blocks consisting of accurate equipment inventory, a debugged initial configuration, and a specification of local configuration policies to support the holy grail of automation. In reality, what these networks really lack is the ability to leverage errors generated from these systems to their advantage. Error resolution in legacy network systems to automated provisioning systems is challenging. These challenges are rooted in the type of service request, infrastructure and network operational center practices. I propose a Re-Del Agent approach that proceeds in three phases: (i) analysis of infrastructural device data to summarize the existing network state and uncover any known errors; (ii) data mining to identify the device and their error type likelihood probabilities which ultimately will establish error type state transition probability (iii) use reinforcement learning and control to bypass high error devices to provision services.

The first stage defines the device error types, the second stage predicts the state transition probabilities and rewards, and the third stage uses a goal base agent for provision services regardless of the system errors. The agent provides reliability by increasing service provisioning success rate. I describe the architecture of Re-Del Agent, and present some examples from experiences applying the Re-Del Agent to several large enterprise networks. *[Acknowledgement: This study was supported, in part, by a grant from NSF awarded to Bowie State University, Computer Science Department, Bowie, MD 20715.]*

Faculty Advisor: Dr Bo Yang, byang@cs.bowiestate.edu

Grad. OA #18
Smart Meter Design for Wireless Advanced Metering Infrastructure (AMI)

DeMarcus Thomas, Norfolk State University

In this paper, we discuss the design of a smart meter for secure operation and automatic incident response in an advanced metering infrastructure (AMI). It is assumed that the meters are interconnected in a mesh as well as infrastructure WLAN using IEEE 802.11 standard. We discuss various communications and security interfaces of the smart meter. The multi-pronged goal of these interfaces includes controlling the radio fingerprint of the smart meter network on the one hand, and to be able to detect the position and movement direction of an attacker on the other hand. An alias-based anti-MAC-address-spoofing algorithm provides a quick fix for respective attacks. NS-3 simulation is also discussed for the current phase of the project. *[Acknowledgement: Celeste Matarazzo Lawrence Livermore National Lab Livermore, CA; Dr. Aurelia T. Williams, Norfolk State University, Norfolk, VA; Norfolk State University Computer Science Department, Norfolk,VA.]*

Faculty Advisor: Dr. Aftab Ahmad, demarcus.thomas@yahoo.com

Grad. OA #19
Analytic Model for Cluster-Based Two-Way Wireless Sensor Network (WSN)

Zhao Zhang, Texas Southern University

As one of the most promising technologies for the next decades, WSNs are often deployed to detect 'Interesting Events' that are bound to show some degree of temporal correlation across their occurrences, and thus enable a wealth of new applications where remote estimation is essential.

In this research, we present a cluster-based two-way linear WSN model, in which the multi-hop WSN consists of numbers of clusters arranged linearly and a sink, which is regarded as the data merging and network management center. Each cluster has a one cluster-head, which takes the responsibility of management and data relay, and a large number of slave nodes. The slave nodes can only communicate with the cluster-head while the cluster-head can also communicate with neighbor cluster-heads besides its slave nodes. Two kinds of channels exist in this model, which are control channel and traffic channel, and data flows in the two channels are regarded as control data and traffic data respectively. In the cluster-head, one buffer for each channel is used to receive and store the data arrived. The traffic flow in each channel can be modeled as a finite queue with single server, fixed rate and finite capacity. Data in queues are served in FCFS manner. The control data enjoys a preemptive priority in this model. Based on the model described above, we preformed the analysis of QoS issues including SSD (source-to-sink delay), throughput, DLP/DPP (data loss/pass probability), and also fairness in the future.

After the mathematical analysis of these QoS interested issues, we choose DLP at the individual cluster-head as the QoS metric. QoS supporting schemes are developed for dynamic traffic conditions in both control and traffic channels by controlling the request/data generating rate at individual clusters. Localized control method (cluster level) is applied with the concern of reducing control overheads, which helps to enhance the network performance. Numerical and simulation analysis will be conducted in the future to evaluate the performance of the scheme we proposed. And all network level QoS interested issues will also be evaluated to ensure that our scheme satisfies most of the QoS requirements. *[This study was supported by a grant from National Science Foundation/CREST awarded to Wei Wayne Li, Ph.D., Director of the CRCN, CREST University, Houston, TX 77004.]*

Faculty Advisor: Wei Wayne Li, liw@tsu.edu

ECOLOGY, ENVIRONMENTAL & EARTH SCIENCES

MATHEMATICS AND STATISTICS

Grad. OA #20
A Symmetric Intraguild Predation Model for the Invasive Lionfish and Native Grouper

Dustin Padilla, Arizona State University

Lionfish are top-level venomous predators native to the Indo-Pacific Ocean. Over the past decade, the species Pterois volitans and P. miles have become established throughout most of the western Atlantic Ocean, where they drastically impact coral reef communities. Overfishing of native species, such as grouper, who share their niche with lionfish may be the reason for the lionfish's success; research has suggested that at high density, groupers can act as a lionfish biocontrol. To determine if competition or predation is the mechanism behind lionfish suppression, we construct a symmetric intraguild predation model of lionfish, grouper, and prey. Thus, we assume lionfish and grouper compete for prey in addition to consuming juveniles of the other species. Holling type I functional responses are used to represent fecundity and predation. We conduct an equilibrium stability analysis and bifurcation analysis of the general model, and find that the system is able to coexist in an equilibrium or sustainable oscillations. After estimating parameter ranges, simulations and a sensitivity analysis indicate the parameters most influential to lionfish growth rate. The implied control strategies are then tested by varying harvesting and predation rates. *[Acknowledgement: This project has been partially supported by grants from the National Science Foundation (Grant DMPS-0838705), the National Security Agency (Grant H98230-11-1-0211), the Alfred P. Sloan Foundation and the Office of the Provost of Arizona State University.]*

Faculty Advisor: Carlos Castillo-Chavez, ccchavez@asu.edu

Grad. OA #21
Varying Effects of Connectivity and Dispersal on Interacting Species Dynamics

Kehinde Salau, Arizona State University

Increased landscape fragmentation can have deleterious effects on terrestrial biodiversity. The use of protected areas, as islands of conservation, has limits to the extent of biodiversity conservation due to isolation and scale. As a result, there is a push to transition from solely developing protected areas to policies that also support corridor management. Given the complexities of multi-species interaction on a fragmented landscape, managers need additional tools to aid in decision-making and policy development. We develop an agent-based model (ABM) of a two-patch metapopulation with local predator

-prey dynamics and variable, density-dependent species migration. The goal is to assess how connectivity between patches, given a variety of dispersal schema for the targeted interacting populations, promotes coexistence among predators and prey. The experiment conducted suggests that connectivity levels at both extremes, representing very little risk and high risk of species mortality, do not augment the likelihood of coexistence while intermediate levels do. Furthermore, the probability of coexistence increases and spans a wide range of connectivity levels when movement is less probabilistic and more dependent on population feedback. Knowledge of these connectivity tradeoffs is essential for assessing the value of habitat corridors, and can be further elucidated under the agent -based framework. *[Acknowledgement: This study was supported, in part, by a grant from NSF awarded to Kehinde Salau, Graduate Research Assistant for the Mathematical, Computational, Modeling Sciences Center, Arizona State University, Tempe, AZ 85282.]*

Faculty Advisor: Dr. Marco Janssen, Marco.Janssen@asu.edu

Plant Research

Grad. OA #22
The Effects of Land Management, Pollination, and Density Dependence on the Fecundity and Gene Flow of Gentiana autumnalis.

Ryan R. Rebozo, Drexel University

Gentiana autumnalis is a rare, early successional plant that is endemic to the New Jersey Pinelands. As is the case for many rare plants, development and associated habitat modification have reduced the availability of early successional habitats that are required for the establishment and maintenance of viable populations. As a result of anthropogenic fire suppression and forest canopy closure, several early successional plants are now restricted to roadsides managed by local municipalities. These roadside refugia often remain unburned and instead are mowed to reduce vegetation encroachment onto roadways. Mowing often occurs during the growing season and before the completion of the reproductive cycle. This practice also limits the success and viability of a population. The specific aim of this research is to determine if there is a relationship between land management practices (e.g.,mowing, burning) and Gentiana autumnalis patch size (density). Demographic data on survivorship, fecundity, and recruitment will be calculated by tagging individual plants in plots within each patch. A repeated measures design over successive years will elucidate whether a given patch is stable, increasing, or declining. Optimal foraging strategy suggests that density of conspecifics and maximum floral advertisement influence pollinator visitation rate. Thus, pollinator visitation rate will be measured to determine the optimal patch density required for floral advertisement and maximum seed set. Timed plant observations will identify pollinators, time pollinators spend on flowers, and pollinator constancy. Preliminary data (one field season) suggest that there is a positive correlation between the areal size of open roadside space and gentian density and that increased densities of both gentians and co-flowering plants increases pollinator species richness and pollinator visitation rate. Patch size may vary from a few individuals to several hundred individuals with some patches isolated by several miles. Future research questions will include the role mycorrhizal associations have on the growth of these plants, and what level of gene flow and inbreeding is experienced in these populations. Identifying management strategies that enhance population size and genetic diversity will be important for the conservation of Gentiana autumnalis and other rare plant species that depend on early successional habitats. *[Acknowledgement: LSAMP Bridge to the Doctorate Fellowship The Academy of Natural Sciences]*

Faculty Advisor: Dr. Walter Bien, wbien205@comcast.net

Water

Grad. OA #23
Quantifying the Contribution of Bank Storage Due to an Alteration in Stream Stage

Jeffrey Samson, University of New Mexico

The desire to control rivers to reduce risks of flooding while providing storage for agricultural use has resulted in the disconnection of rivers from their floodplains. An important and often neglected outcome of this detachment is the loss of a plethora of important ecosystem services. This research seeks to quantify the ecosystem service of bank storage as a result of an alteration in stream stage. The research hypothesis is that bank storage will be reduced in the absence of overbank flood events. The site chosen for this research has been the focus of two recent studies which will aid in the understanding of the system, and they have both yielded data that will be utilized in the model development and calibration of this study. The first of which studied the hydraulic conditions through a series of nested piezometers, and the second consisted of a sediment stratigraphy analyses that focused on understanding water transport. For the purpose of this study a significant amount of field and laboratory work is underway to determine the necessary properties that govern water flow through soil. These include saturated hydraulic conductivity as well as the development of wetting and drying water retention curves to account for hysteresis, which is thought to play a significant role in the bank storage process.

These findings, along with data obtained through the studies above and climatic data that has been gathered by a separate group at the University of New Mexico is being used to develop a numerical model using Hydrus-2D to quantify bank storage

under a variety of scenarios. Preliminary analysis of the data show a system that has developed an extremely low vertical conductivity and therefore bank storage is dominated by horizontal flow through the alluvial aquifer.

This unexpected finding details a floodplain that has built up a nearly impermeable layer of fine grained matter directly below the surface. This low-permeability layer is hypothesized to be growing due to the absence of flood waters and the deposition of dust and other fines which are being transported through the top layer by rain water. Future research to understand the factors associated with the growth of this layer as well as a comparison study to a healthy floodplain that receives flood waters has the potential to improve the hydrologic communities knowledge of how floodplain disconnectivity impacts the important ecosystem service of bank storage.
[Acknowledgement: Funding for this research was supported by the NSF-LSAMP cohort VIII grant awarded to Dr. Laura Crossey.]

Faculty Advisor: Mark Stone, stone@unm.edu

MATHEMATICS & STATISTICS

MATHEMATICS AND STATISTICS

Grad. OA #24
An Uncertainty Quantification of Epidemiological Measures Due to Model Assumptions and Its Implications on Public Health Interventions

Emmanuel J. Morales-Butler, Arizona State University

Quantifying the uncertainty that comes from the assumptions of mathematical models is a crucial aspect which must be required for any quantitative epidemiological study involving modeling of infectious disease. The direct plausible dangerous consequences from an inappropriate uncertainty quantification in the context of public health intervention strategies might lead to either i) making limited statements about the net effectiveness of a set of intervention strategies or ii) implementing inadequate or non -optimal intervention strategies. Thus it can misguide public health policy makers and increase the risk of a possible high mortality and morbidity.

The main objective of this study is to quantify numerically the uncertainty that arises from the assumption on the distribution of the infectious period in a Susceptible-Infectious-Recoved type model for tasks like: i) Assessing the net effectiveness of a set of intervention strategies and ii) proposing optimal control intervention strategies with the goal of mitigating the impact of the incidence of infectious individuals during an epidemic. Via some hypothetical examples we showed that quantitatively outcomes from these two main objectives were inconsistent to distinct assumptions for the distribution of the infectious period. Therefore, we concluded that model assumptions from mathematical epidemic models matter quantitatively.
[Acknowledgement: The author would like to thank the financial support by the NSF Cooperative Agreement HRD-0602425 (Louis Stokes Alliances for Minority Participation Program WAESO Western Alliance to Expand Student Opportunities Biodesigned and Sustainable Bridges to the Doctorate Phase IV).]

Faculty Advisor: Carlos Castillo-Chavez, ccchavez@asu.edu

Grad. OA #25
Type 2 Diabetes: Reversal of Beta-Cell Overcompensation and Restoration of Insulin Sensitivity

Anarina Murillo, Arizona State University

Type 2 diabetes (T2D) has been regarded as an incurable and progressive disease, however, findings from Lim et al. (2011) showed the reversal of beta-cell overcompensation after introducing a low caloric and low glucose diet intervention. 11 patients had significant differences in glucose levels, insulin concentration, and fat mass surrounding the liver although only 8 permanently recovered from T2D. The mathematical model proposed aims to explore the capacity to which normal blood glucose regulation can be restored. We mathematically explore the biological consequences of the effect of fat accumulation and beta-cell function due to the interplay of triacylglycerides (TG), adipose tissue (AT), and the liver-insulin sensitivity. We incorporated fat, the direct effect of insulin sensitivity, and the effect of beta-cell sensitivity in our model. Beta-cell sensitivity embodies a logistic response by first increasing as fat accumulates due to the compensatory response as blood glucose rises and eventually decreases due to beta-cell failure, marking the clinical onset of T2D and irreversibility due to severe loss of beta-cells.

Using the theory of dynamical systems and numerical simulations we analyze two representations of fat growth to investigate whether weight loss in the pre-diabetic and diabetic stages would reverse T2D, and study when this treatment strategy is no longer effective. Reversibility was found to be dependent on beta-cell mass by both insulin resistance and beta -cell sensitivity, which in turn are driven by fat accumulation in the liver.

The findings reflect when a patient's change in diet or physical activity may lead to recovery, however, this remains unclear for severe beta-cell dysfunction (e.g. passing the threshold point). Further research is needed on the impact of fat accumulation and degradation on beta-cell adaptation in order to better understand its role on beta-cell dynamics. These findings could offer insight into alternative treatment or intervention plans such as, diet interventions for the pre-diabetic and diabetic, and also the borderline overweight and obese, as well as prevention strategies. *(Lim EL, Hollingsworth KG, Aribisala BS, Chen MJ, Mathers JC, Taylor R; 2011)*.

Reversal of type 2 diabetes: normalization of beta cell function in association with decreased pancreas and liver triacylglycerol. Diabetologia, DOI 10.1007/s00125-011-2204-7.
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Faculty Advisor: Carlos Castillo-Chavez, ccchavez@asu.edu

Grad. OA #26
Explicit Solution of Certain Linear and Nonlinear Diffusion-Type Equations

Jose M. Vega-Guzman, Arizona State University
Dr. S.K. Suslov, Arizona State University
Dr. E. Suazo, University of Puerto Rico at Mayaguez

The study of partial differential equations has been of great interest for many researchers because it allows them to understand and describe phenomena arising in different fields of science. Recently, there has been considerable attention to methods for constructing solutions of nonautonomous dispersive systems that appear in Physics, Biology, Finances and in many other areas of study.

In this work we discuss a method of constructing explicit solutions of the initial value problem for certain nonautonomous diffusion-type equations in terms of solutions of certain Riccati-type systems. We adopt the ideas from the transformation theory to hypothesize that the proposed nonautonomous partial differential equation can be reduced down to the standard heat equation. We found that the reduction is possible if certain emerging Riccati-type system is completely integrable. This reduction allows one to find the solution of the Cauchy initial value problem for certain nonautonomous diffusion-type equations subject to arbitrary initial data. Some examples are presented in order to corroborate the proposed method.

A possible direction for further studies includes the construction of the analytic solution of the cable equation, used to describe mathematically the nerve cell as dendritic branch, using Fourier expansion of the emerging Bessel functions.
Acknowledgement: This research was supported in part by: 1.) The More Graduate Education at Mountain States Alliance (MGE@MSA) Alliance for Graduate Education and the Professoriate National Science Foundation Cooperative Agreement HRD-9978868; 2.) The Western Alliance to Expand Student Opportunities Louis Stokes Alliance for Minority Participation National Science Foundation Cooperative Agreement HRD-0602425; and 3.) The National Action Council for Minorities in Engineering Inc., an Alfred P. Sloan Foundation Program.]

Faculty Advisor: Dr. S.K. Suslov, sks@asu.edu

NANOSCIENCE

BIOMEDICAL ENGINEERING

Grad. OA #27
Cellular Endosomal Escape via Photothermal Generated Membrane Disruption and Relaxation

Joseph K. Young, Rice University
Adam Y. Lin, Rice University, Arthi Satyanarayan, and Rebekah A. Drezek, Rice University

Endosomal escape is a well-known hindrance for successful delivery of macromolecular drugs, genes and imaging agents into cell cytoplasm. Plasmonic-based photothermal heat generation and thermal relaxation/disruption of endosomal membranes is an approach to overcome this restriction. In this study, a pulsed laser (800nm) was used to induce heating of the NIR-transparent media with near infrared light-absorbing hollow gold nanoshells (HGNs) in living SK-BR-3 human breast carcinoma cells. The HGNs were approximately 40nm to 50nm in diameter with an absorption peak centered at 800nm. In order to confirm endosomal escape, SK-BR-3 cells were transfected to express RaB5a-GFP fusion. Upon early endosome formation, a localized protein within the endosome fluoresces identifying the endosome. Fluorophores of a different wavelength (Cy5) were attached to the HGNs surface via oligonucleotides, 24 bases in length, for fluorescent identification and tracking of the particles within the cells. Laser-induced elevated temperatures of the HGNs caused a heat gradient around the HGN clusters within the endosome.

It was observed that upon cellular irradiation with a pulsed NIR (800nm), laser thermal disruption and relaxation of the endosomal membrane occurred and the HGNs were released into the cytoplasm of the cell. Prior to laser irradiation, endosomal encapsulation of the fluorescently tagged HGNs within the GFP expressing endosome was confirmed via colocalization of the fluorescent markers by confocal microscopy. After irradiation, colocalization was lost, and tagged HGNs were observed within the cytoplasm of the cell. The heating effect is localized resulting in no heating of the cellular fluid outside the endosomes. Endosome escape was not observed in cells that were irradiated with the laser where no HGNs were present under equal conditions. Future research involves cell viability studies after cell irradiation and the addition of doxorubicin (DOX) to the HGN complex for release into the cell cytoplasm. *[Acknowledgement: This study was supported, in part, by a grant from the Department of Defense*

awarded to Rebekah A. Drezek PhD., Professor of Bioengineering, Rice University, Houston, TX 77005.]

Faculty Advisor: Dr. Rebekah Drezek, joekyoung@gmail.co

Materials Science

Grad. OA #28
Electrospun Nanofibers for Applications as Fuel Cell Components

Ana Lucia Vega Avila, University of Puerto Rico, Mayaguez
Ricky Valentin, Andres Velasco, Surinder Singh, and Carlo Otano, University of Puerto Rico, Mayaguez

The development of materials that allow reducing the cost and improving the efficiency for fuel cells is critical to promote the massive use of this ecofriendly energy source. Electrospun nanofibers of polymer and composites had proven to be excellent substrates for dispersion of metal catalysts and enzyme immobilization for electrodes and bioelectrodes; also, they are being currently evaluated as ion exchange membranes in fuel cells. The feasibility of the use of electrospun nanofibers laid on their high surface, tunable porosity and suitable mechanical properties is worth studying.

Following these promises, we have synthesized aligned Polyacrilonitrile (PAN)-multiwall carbon nanotubes (MWCNT) electrospun nanofibers with MWCNT loading ranging between 5%-50%, for application as cathodes in bio fuel cells, using the enzyme catalase as catalyst. Also we had prepared electrospun composite nano-electrodes based in silver nanoparticles dispersed in PAN, with loading of 30%-60%, for possible applications as anodes in sodium borohydride fuel cells. Both electrodes were characterized using Scanning Electron Microscopy (SEM) and Cyclic Voltammetry (CV). Oxidation of MWCNT was verified using UV spectroscopy. Enzyme loading in the bioelectrodes was measured with the Bradford method. A factorial 23 design of experiments was applied to evaluate the effect of electrospinning parameters in the diameter of the fibers.

It was found that loading below 2% of MWCNT in the fiber membranes does not improve the electrochemical response of the biocathode. Meanwhile, improvements in the catalysis properties of the electrospun membrane were achieved with enzyme immobilization which can be attributed to the ability of the enzyme to catalyze the reduction of hydrogen peroxide in test electrolyte (PBS 0.2M + 10mM H2O2). The 60% loading of Ag in the silver electrode exceeded previous reports by Park et al. [1] of Ag loading in electrospun electrodes (50%). The electrode was characterized as collected in 10 mM NaBH4 dissolved in 0.1 M NaOH solution as electrolyte. Voltammograms show evidence of anodic peak at 600 mV versus Ag/AgCl electrode.

The results allow us to conclude that electrospun fibers are promising materials for fuel cell electrodes; however, for both catalase bioelectrode and silver nanoelectrode, increases in the electrical conductivity are expected to improve their electrochemical behavior. We are currently evaluating the effect of the graphitization in the properties of the electrodes. *[Acknowledgement: This study was supported by a grant from Argonne National Lab awarded to Ricky Valentin Ph.D., University of Puerto Rico, Mayaguez, 2008.]*

[1] Soo-Jin Park and Se-Hyuk Im; Electrochemical Behaviors of PAN/Ag -based CNFs; Bulletin Korean Chemiical Society; Vol. 29, No. 4; 2008

Faculty Advisor: Ricky Valentin, ricky.valentin@upr.edu

Nanoscience

Grad. OA #29
Enhanced Localized Surface Plasmon Resonance Dependence of Silver Nanoparticles on Molar Ratios of Citrate Stabilizers

Felicia A. McClary, Howard University
Dr. James W. Mitchell and Shauna Gaye-Campbell, Howard University

The study of plasmonic silver nanoparticles (AgNPs) has become a rapidly developing area of nanotechnology as a result of an array of optical applications. AgNPs, prepared by a microwave thermolysis reduction method using sodium citrate as the reduction and stabilizing agent, reveal large enhancements in the localized surface plasmon resonance (LSPR) as the citrate to mole ratio of silver ion (Ag^+) is varied from 1:1 to 1:10. The unusually large and linearly increasing plasmon absorbance bands for AgNPs occur at molar ratios of 1:1 to 1:5, while at larger, increasing molar ratios, 1:6 to 1:10, the LSPR sharply decreases. Over the entire concentration range investigated, dynamic light scattering measurements (DLS) and field emission scanning electron micrographs (FESEM) confirm the presence of spherical nanoparticles with an average hydrodynamic diameter of 42 nm ± 10 nm. Particle agglomeration is controlled at lower molar ratios, 1:1 to1:5. However, as the citrate concentration is increased beyond 1:5, agglomeration begins with particle sizes increasing to 65 nm.

These patterns in enhanced absorbance and agglomeration are attributed to the formation of thermodynamically favorable multinuclear silver intermediate clusters at ratios 1:5 and below. Maximizing the LSPR enhancement by controlling the stoichiometric ratio of Ag^0 to citrate provides highly stable silver nanoparticles with potential as substrates displaying substantial enhancements for surface analytical characterization and imaging applications. *[Acknowledgement: This research is funded by the NSF-CREST Grant 0833127 awarded to James W. Mitchell, Ph.D., Director of the CREST Center for Nanomaterials*

Characterization Science and Processing Technology, Howard University, Washington, DC 20059.]
Faculty Advisor: James W. Mitchell, jwmitchell@howard.edu

Grad. OA #30
EM Characterization of Thin Metal Films Deposited on Polymer Substrates

Felipe Rivera, Brigham Young University
Richard Vanfleet, Brigham Young University

The integration of electronic components onto flexible substrates has created many interesting products, from flexible displays and solar cells to wearable electronics. This, in conjunction with increasingly shrinking electronic geometries, has opened the need to study the behavior of these materials and devices in the nano scale, in a manner parallel to semiconductor manufacturing. Traditionally, semiconductor device manufacturers rely on cross-sectional Transmission Electron Microscopy (TEM) for studying and monitoring the process, as well as observing and investigating defects and interface layers.

Furthermore, Focused Ion Beam (FIB) TEM sample preparation has also provided a tool to produce high-quality, site-specific, TEM cross-section samples for the semiconductor industry. Sample preparation is one of the critical steps in TEM analysis that significantly determines the quality of the characterization and chemical analysis of the smallest and most critical features. However, the use of polymers as the substrate presents an array of new challenges that must be overcome in order to apply the techniques used for semiconductors in the study of polymer devices.

For example, due to the nature of the polymer substrate, as the sample is thinned to a thickness suitable for TEM analysis, the sample will begin to warp, heat up, charge, and melt. We add here an alternative FIB cross-sectional TEM sample preparation method where several TEM samples (of thin metal films deposited on polymer substrates) were prepared and analyzed by TEM and Energy Dispersive X-ray Spectroscopy (EDX). Some of these samples included commercial recordable DVDs as well as thin films deposited on templated polymer nano-structures. This preparation method proved successful and reliable with an array of different polymer substrates and polymer nanostructures. In the case of a commercially available DVD, an EDX profile allowed the observation of the alloying and migration of silver into a gold film 30nm thick. The reliability of this sample preparation method has the advantage of extending the use of FIB instruments (currently without a cryo- stage) to prepare site-specific TEM samples for the study of materials deposited onto polymer substrates. *[Acknowledgement: Brigham Young University, Moxtek Inc., Millenniatta Inc.]*

Faculty Advisor: Richard Vanfleet, rrv3@physics.byu.edu

PHYSICS

CANCER RESEARCH

Grad. OA #31
Analysis of KXRF Data

Rose Prenus, Florida A&M University

The KXRF, K shell -x-ray Fluorescence detector, is an instrument used to measure back scattered photons. The fluorescence X-rays excite the electrons in the K atomic shell of the following metals of interest (Cadmium (Cd), Tungsten (W), Copper (Cu) and the electrons rapidly de-excite back-scattered photons. The fluorescence photons are detected by a germanium solid-state detector and are processed by a Digital Spectrum Analyzer, DSA 1000. The DSA 1000 receives the digital data and converts them to analogue signal, which are further processed in the genie 2000.

We present the offline analysis program, genie 2000 by Canberra, and outline the analysis stream. The genie 2000 software along with Gamma Acquisition and Analysis (GAA) program has an interactive nuclei database. The K- X- ray Fluorescence (KXRF) analyzer is an instrument designed by Dr. Elliot Treadwell at Florida A & M University. The instrument is used to measure the concentration of heavy metals and minerals. Following radiation emit, the atoms are excited and emit radiation via fluorescent x-rays from K-shell electrons. The radiation is then scatted by the atoms. The metals' fluorescence and the mechanism by which the radiations are scattered was recorded by Digital Spectrum Analyzer (DSA) 1000. The DSA 1000 detector converted the radiation accounts to computer analysis for better quantification. In the process of analyzing radioisotopes generated at the Jupiter facility at Livermore National Lab using high-energy laser exposure, the following elements were analyzed, Cadmium, lead, tungsten, copper. We present the genie 2000 computer software along with Gamma Acquisition and Analysis (GAA) program that was used to acquire and analyze the data. The software organizes and stores the information on CAM file. *[Acknowledgement: This research was funded through Florida A&M University CREST Program.]*

Faculty Advisor: Carol Scarlett, carol.scarlett@famu.edu

MATERIALS SCIENCE

Grad. OA #32
A Study of Oxygen Concentration on the Direct Current Magnetization of Single-Crystal Bismuth Strontium Copper Oxide Superconductors Grown by the Floating-Zone Technique

Daniel Hart, Southern University, Baton Rouge

Ever-increasing US energy demands will eventually far outpace the capacity of the current power grid infrastructure due to the inefficient delivery of electricity. A major source of inefficiency is due to resistive losses associated with the use of copper transmission cables. One solution for enhancing overall system efficiency is to replace existing copper transmission cables with high, critical temperature (TC) superconducting materials which exhibit essentially zero resistive losses below a TC. It is generally argued that for high-temperature superconductors to be cost-effective in power grid applications, the TC must be at or above the boiling point of liquid nitrogen, 77 K. As a result, despite their demonstrated technical feasibility, the very high cost of refrigeration has kept many superconducting materials off the market for years. High quality, single crystals of BSCO were investigated to better identify the elusive mechanism of superconductivity in copper oxide superconductors.

This material was grown from a single crystal seed of BSCO using the floating-zone technique. The effect of growth conditions and nominal composition of the feed rod on the magnetic properties were investigated using the Superconducting Quantum Interference Device. The temperature dependence of the direct current magnetization on oxygen concentration was studied using as-grown and underdoped (oxygen-deficient) samples. Underdoped crystals were achieved by annealing as-grown BSCO in evacuated quartz tubes and flowing argon.

The magnitude of the superconducting signal was found to increase nearly an order of magnitude with annealing in flowing argon at 450°C for 24 hours. However, the TC was only slightly increased from a value of 7 K for as-grown samples to 10 K for samples annealed at 450°C for 24 – 36 hours in flowing argon. The TC was found to vary with annealing temperature according to an exponential curve which plateaued around 24 hours. These results indicate that annealing in flowing argon is only a slightly more effective method for enhancing TC of as-grown BSCO. Further work is needed to better understand the mechanism of superconductivity in high-TC copper oxide superconductors. *[Acknowledgement: Brookhaven National Laboratory National Science Foundation]*

Faculty Advisor: anthony stewart, tstew08@gmail.com

Physics (not Nanoscience)

Grad. OA #33
Measuring the Proton and Gamma Spectrum at the Jupiter Laser Facility

Patrice Edwards, Florida A&M University

The Jupiter Facility at Livermore National Laboratory (LLNL) has very recently demonstrated the ability to use high intensity laser beams to produce large quantities of antimatter. The primary beam from the laser is focused onto one of several heavy metals or light nuclei targets to produce a secondary beam that can contain up to: 1010 positrons, 1011-12 electrons, along with an unknown number of protons and gammas per laser pulse. Their research opens up a vast window of experimental opportunity, from measuring novel weak interactions to studying the radioactivity of isotopes in a manner previously unavailable. In the experiment described here, we used the secondary beam of particles to illuminate targets of tungsten (W), brass (Cu & Zn), tantalum (Ta), Indium (In) and even chalk (CaC03). We then looked at the numbers of radioactive decays using a KXRF Germanium Detector some 80-100 days after the illumination for comparison to the decay spectrum taken within minutes of the illumination.

Our goal was to extract the numbers of protons and gammas produced in the secondary beam, and thus characterize the experimental environment for future research at the Jupiter facility. The activity spectrum data allows us to use the direct results of interactions between the protons and high energy gammas of the secondary beam. For example, an incoming proton on a tungsten nuclei can interact to produce an unstable renium nuclei: W184(p,n)Re184. Thus measuring the photons produced by the decay of an unstable renium nuclei gives a measure of the numbers and energy of the incoming protons in the secondary beam. However, many such interactions give rise to nuclei that emit effectively the same spectrum lines (e.g. W183(g,p)Ta182, and Ta182 has the same gamma spectrum as Re182). Having a measure of the activity spectrum at these two very different times following illumination allowed us to distinguish between isotopes that are long and short lived with identical gamma spectra, such as renium and tantalum.

In our final analysis, we were able to disclose the numbers of protons, electrons, and gammas by looking at many radioactive elements. In future efforts we will develop a procedure to measure the weak interaction cross section for a positron on a neutron. This work has been supported by the Florida A&M University's CREST center. *[Acknowledgement: This research was supported by the Florida A&M University's CREST Program.]*

Faculty Advisor: Dr. Carol Scarlett, carol.scarlett@famu.edu

Science & Mathematics Education

Social Sciences/Psychology/Economics

Grad. OA #34
Sunday School and STEM: The Perceptions of Religion on the Selection and Persistence in Collegiate STEM Programs

Erin Lynch, Tennessee State University

Since issues in underrepresentation of minority students in STEM still exist nationally and are potentially related to academic persistence, K-12 preparedness, and even minority

students' degree of religiosity (Pluviose, 2008; Riegle-Crumb & King, 2010; Hilton & Lee, 1988; Smyth & McArdle, 2004; Brickhouse et al., 2000; Harris & Koenig, 2006), further inquiry of the socio-cultural views of students needs to be examined.

With funding from National Science Foundation's Directorate for Education & Human Resources (HBCU-Undergraduate Programs), educational researchers at Tennessee State University have begun to explore the socio-cultural dimensions of science and technology through the voices of undergraduate students involved in a Rising Sophomore Research Institute. Over a summer session, rising sophomores participated in seminars and collaborative projects to support students during their matriculation to the university's upper-level STEM courses. To assess for student science views as they relate to socio-cultural ones, researchers interviewed STEM majors regarding their views on science, perceptions of the differences between K -12 and collegiate STEM experiences, as well as their personal views on theology, society, and culture as they all relate to science through a semi-structured focus group interview.

An analysis of the phenomenological trends from the focus groups have helped to elucidate the intellectual and socio-cultural dimensions that impact minority students' persistence in collegiate STEM programs. While some research indicates minorities and women select STEM majors more readily than their white counterparts (Riegle-Crumb & King, 2010), the fact of the matter is minorities are still attaining degrees in STEM areas at a lower overall rate (NSF, 2007). This research seeks to further explore why and whether religiosity levels have profound impacts on STEM persistence as heard through the words of these undergraduate students. *[Acknowledgement: National Science Foundation, Directorate for Education & Human Resources (HBCU-Undergraduate Programs).]*

Faculty Advisor: Dr. Leigh Arino de la Rubia, leigh.arinodelarubia@gmail.com

TECHNOLOGY & ENGINEERING

BIOMEDICAL ENGINEERING

Grad. OA #35
Microfluidic-Based Multi-Compartment Culture Platform for Visualization and Analysis of Intracellular Organelle Trafficking within Neuronal Subcellular Compartments

Hector Hugo Caicedo, University of Illinois at Chicago
Scott Brady, Tulika Sarma, and Gustavo Pigino, University of Illinois at Chicago

Intracellular transport of molecules plays a critical role in both the survival and function of neurons. A single nucleotide polymorphism in proBDNF (Val66Met), located in a region of proBDNF that interacts with sortilin, results in missorting of proBDNF, affecting its transport and localization within neurons.

This polymorphism has been associated with increased risk for Alzheimer's disease, and other neurological conditions. In this work, we report a novel open access multi-compartment microfluidic primary culture platform suitable for efficient loading of cells near microfluidic barriers that isolate cell bodies from neuronal processes, and optimized for both fluidic isolation of different compartments over a long-term period and live imaging analysis of neuronal protein transport and subcellular localization to test the hypothesis that sortilins are critical for the generation of secretory granules and release of neurotrophins.

The performance of the device has been validated with fluorescent micro-beads and dyes loaded in the different somatodendritic (SD) and terminal compartments of the device, demonstrating efficient cell loading and fluidic isolation over a long period of time (more than 96 h without adding additional liquid to any compartment). Moreover, motor, cortical, and hippocampal neurons from E17 embryonic mice have been loaded into the SD compartments and successfully isolated from chemical microenvironments of axonal terminals. The cultures have been prepared for immunocytochemistry by using Dapi satin for cell bodies and Anti-Tubulin (DM1A) stain for axons. Additionally, genetic manipulations with recombinant pmaxGFP, APP-YFP and GFP-Tubulin have been carried out and then analyzed by fluorescent microscopy to visualize the structural conformation of different neuronal subcellular compartments within the different chemical microenvironments of the microfluidic chamber.

Currently, we are using our platform to perform genetic and pharmacological manipulations to study trafficking of fluorescently labeled proteins such as BDNF-GFP, GFP-tagged V66M mutant proBDNF, and synaptophysin (P38-mcherry and P38-orange) by using life cell imaging for differences in organelle packaging, and targeting to cellular domains. Our microfluidic device allows us to manipulate the fluidic microenvironment of at least three different populations of neurons at the same time to unravel molecular mechanisms of fast axonal transport of selective neuronal proteins.

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Faculty Advisor: Scott Brady, stbrady@uic.edu

Grad. OA #36
Surface Modification of Magnesium Based Implant Material with Chitosan Biopolymer

Christopher Mahoney, North Carolina A&T State University
Jeanette Delva, Bennett College and N. Bhattarai, North Carolina A&T State University

Magnesium (Mg) has been found to be a biocompatible metal in the production of degradable implants used for human body. There are many factors to be considered in choosing magnesium such as biocorrosion rate, accumulation of hydrogen gas upon degradation, tissue regeneration properties, etc. Polymer based coatings for orthopedic implants aid in tissue healing, bone growth around an implant, and bonding of an implant to the bone. The primary focus of our research is the use of natural biopolymers, such as chitosan, as a possible coating for Mg implants. Chitosan, a naturally derived polymer from crustacean shell, is biologically renewable, biodegradable, nonantigenic, and biocompatible. Previously, chitosan has been proven to create the environment needed by cells to regenerate tissue and bone. A newly developed Mg based alloy (Mg/Zn/Ca: 93.7/6/0.3) by our research center has been utilized in this study. Alloy surfaces were created by modified mechanical polishing and degreased with acetone. After creating rough surfaces by ultrasonic processing, surfaces were modified with several layers of sodium alginate in water and chitosan solution in dilute acetic acid. Surfaces were air dried under fume hood. We hypothesize that various sizes of pore morphology of the polymer coating were created on the alloy surfaces. Studies on stability of polymer coating and corrosion property of the metal alloy in simulated body fluid condition will show significant attachment of chitosan and alginate by FT-IR spectroscopy. In-vitro osteoblast cell culture with these modified alloy surfaces will display positive responses with minimal toxicity. An uncoated magnesium alloy surface will be used as the control to observe the cells response to the metallic implant. In future, we plan to use a chitosan nanofibrous structure as an additional layer of surface modification. *[Acknowledgement: Biomedical Engineering Department, NSF-ERC Revolutionizing Metallic Biomatrials]*

Faculty Advisor: Narayan Bhattarai, nbhattar@ncat.edu

Grad. OA #37
Electrochemical Inhibition of Pseudomonas Aeruginosa Persister Cells

Tagbo Niepa, Syracuse University
Jeremy Gilbert and Dacheng Ren, Syracuse University

Hypothesis statement and importance of the research: The rapid development and spread of multidrug resistant bacteria is a major challenge to public health. It is well recognized that bacterial cultures commonly contain a subpopulation of phenotypic variants, known as persister cells, that are dormant and extremely tolerant to antibiotics. When the antibiotic treatment is stopped, persister cells can regenerate the bacterial population with a similar percentage of persister cells. The high frequency of persister formation in stationary phase planktonic cultures and in sessile microbial colonies, known as biofilms, renders both states extremely challenging to antibiotic treatment.

Such antibiotic tolerance leads to numerous cases of chronic infections; e.g., nearly half of the nosocomial infections in the U.S. are due to medical device associated biofilms. Thus, innovative technologies are needed to effectively eliminate persister cells, especially those in biofilms. In this study, we report for the first time that bacterial persister cells can be effectively eliminated by weak electrochemical currents (ECs). By applying 70 μA/cm2 of direct current (DC) for 1 h, the viability of Pseudomonas aeruginosa PAO1 persisters was reduced by 99% and synergistic effects between DC and tobramycin (Tob) were observed. These results are helpful for understanding the mechanism of persister formation and for developing more effective control methods.

Methods and Controls: To investigate the susceptibility of P. aeruginosa PAO1 to low-level DCs, an electrochemical cell was constructed by inserting two electrodes along the opposite sides of a plastic cuvette. Bacterial cells harvested from exponential and stationary phase cultures were resuspended in 0.85% NaCl buffer with a density of 108 - 109 cells/mL. Persister cells were harvested by treating the cultures with 200 μg/mL ciprofloxacin for 3.5 h and centrifugation. A DC was supplied to P. aeruginosa PAO1 cells in a galvanostatic mode for 1 h using a potentiostat (Potentiostat WaveNow, Pine Research Instrumentation, Raleigh, NC). Tob was used as the representative antibiotic to study the synergy with EC. The effects on persister cells in biofilms were studied by culturing biofilm on an electrode (either cathodic or anodic) before treatment. The effects of DC-released ions were also investigated. Treatment of P. aeruginosa PAO1 with 70 μA/cm2 DC using stainless steel (SS) 304 electrodes led to significant killing of stationary phase cells; e.g. around 3 logs of killing was achieved with 1 h treatment. In addition to normal cells, the viability of isolated persister cells was reduced by 2 logs after EC treatment for 1 h. In comparison, P. aeruginosa PAO1 cells at exponential phase were completely eradicated after 1 h of DC treatment using SS 304 electrodes. Moreover, the cidal effects of DC treatment were improved in the presence of 1.5 μg/mL Tob when SS 304 was used to deliver the DC. The persister cells in biofilms were also found to be effectively eliminated by 70 μA/cm2 DC. Interestingly, incubation of persister cells with ions generated by the same level of DC did not lead to the same level of killing, suggesting that the movement of ions by EC may be important for the observed effects. Conclusions and future problem questions: In this study, we show that bacterial persister cells can be eliminated by low level DCs and synergistic effects exist with certain antibiotics, e.g. Tob.

To our best knowledge, this is the first report of persister control by low-level DCs and synergy with antibiotics, a phenomenon we named electrochemical inhibition of persisters (EIP). It has potential applications in treating medical device associated or skin infections where a low level electric current can be delivered locally. We care currently conducting further study to understand the mechanism of EIP by characterizing the electrochemical reactions and the effects on bacterial cells at both cellular and genetic levels. *[Acknowledgements: The authors are grateful to Blue Highway Inc. for supporting the project. We also thank Dr. Thomas K. Wood at Texas A&M University for sharing the strain P. aeruginosa PAO1.]*

Faculty Advisor: Dacheng Ren, dren@syr.edu

Grad. OA #38
Relationship Between Measures of RBC Deformability and Their Ability to Perfuse an Artificial Microvascular Network

Jose Sosa, Tulane University

Adequate perfusion of the microvasculature depends on the ability of individual red blood cells (RBCs) to deform while passing through microvessels with wildly different diameters ranging from 100 µm arterioles / venules down to 3 µm capillaries. Information about the deformability status of RBCs in a blood sample can be a powerful diagnostic tool for various pathologies including diabetes, sickle cell disease, malaria and sepsis. A decline in RBC deformability may signal a patient's predisposition to manifestations of cardiovascular disease including hypertension, myocardial ischemia and stroke. The two existing technologies most readily available for use in the clinical setting for assessing RBC deformability are micro-pore filtration and ektacytometry. Micro-pore filtration measures the ability of RBCs to undergo folding deformations while passing through capillary-size (5 µm) pores. Ektacytometry quantifies RBC elongation in response to a well defined shear stress field in a highly viscous fluidic environment.

In this study we compared the ability of these methods to predict the ability of blood to perfuse a vascular network. The development of the artificial microvascular network (AMVN) device enables researchers to assess the perfusion rates in vitro. The AMVN, fabricated using photolithography, consists of channels modeled after mesenteric microvasculature. Within the AMVN, RBCs experience most types of deformations they would encounter in vivo including capillary and large vessel deformations.

Human whole blood was collected from healthy consenting volunteers, washed, leukoreduced and exposed to graded concentrations of glutaraldehyde (ranging from 0% to 0.1%) for 10 minutes to reduce the deformability of RBCs. Samples were washed again and adjusted to 40% hematocrit. Each sample was analyzed using the AMVN device, RheoScan-D ektacytometer, and Nuclepore polycarbonate filter concurrently. Deformability is not a unique property, but is operationally defined by the measurement system. Ektacytometry and filtration assess one type of deformation that may not directly represent the ability of a blood sample to perfuse the microvasculature as shown by AMVN data.

Further development of the AMVN technology will enable accurate and inexpensive testing of RBC deformability at the point-of-care in a variety of clinical settings. *[Acknowledgement: This work was supported in part by an award from the National Blood Foundation, a grant from the National Science Foundation and the Louisiana Board of Regents through the Louis Stokes Louisiana Alliance for Minority Participation at Tulane, and a grant from the Newcomb Tulane College Honors Program.]*

Faculty Advisor: Dr. Sergey Shevkoplyas, shevkop@tulane.edu

Civil/Mechanical/Manufacturing Engineering

Grad. OA #39
Process Windows Considering Two Conflicting Criteria: The Injection Molding Case

Alicia Berenice Rodriguez Yáñez, University of Puerto Rico at Mayaguez
Jose M. Castro, Ohio State University, Mauricio Cabrera-Rios, University of Puerto Rico at Mayaguez

Injection molding (IM) is the most important process for polymer manufacturing. An important challenge in this process is how to determine the molding settings to ensure meeting multiple quality criteria. This task is greatly complicated by the fact that the flow of molten polymers depends simultaneously on temperature, pressure, and material deformation velocity. Setting controllable variables (CVs) that relate to these three phenomena is not trivial, since their behaviors are tightly coupled and one change in a particular controllable variable geared to improve one quality criterion is often detrimental to another one, i.e. a conflict exists. In this work, conflicting criteria are considered simultaneously to determine a process window for IM. The best compromises between the two criteria are identified through the application of two multiple criteria optimization concepts: (i) dominance and (ii) Pareto optimality. The aim with this work is to provide a formal and realistic strategy for setting processing conditions in IM operations. The development of the strategy is constrained to computer-simulated parts at this point. Scalability and experimental validation will be investigated towards the end of the project.

The strategy is under development at UPRM using the finite element mesh of a mold to produce parts for ASTM destructive tests along with polymer flow simulation software (Moldflow). The performance measures (PMs) considered for a first case are: Cycle Time and Total Weight. The CVs are: Melt Temperature

(Tm) (degC) and Mold Temperature (Tw) (degC). These are varied in the ranges [227, 260] degC and [13, 49] degC respectively.

The best compromises in the first case are found in two areas: (1) setting Tw at 13 degC and varying Tm in the range of [227, 260] degC and (2) setting Tm in 260 degC while varying Tw in the range of [13, 49] degC. The predicted values for the associated PMs are all within less than 5% error of the simulated values.

The results so far indicate that the proposed strategy is effective and efficient on prescribing competitive processing conditions in IM operations. It uses a modest number of simulation runs and provides important information on the tradeoffs of quality criteria in conflict. We are currently working on the simultaneous analysis of three PMs. Additionally; an experimental validation of the strategy is due in the following months of the project. *[Acknowledgement: This study was supported by NSF under Grant HRD 0833112]*

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

Computer Engineering

Grad. OA #40
Enhancing the Classification Accuracy of IP Geolocation

Hellen Maziku, Tennessee State University
Dr. Sachin Shetty, Tennessee State University

Location aware applications such as targeted online advertising and cloud auditing use IP geolocation to determine the geographic location of an IP address on the Internet. Previous studies indicate that the accuracy of IP geolocation can be improved by incorporating more and different types of geolocation information other than relying on network delay alone. The current classifier based IP geolocation framework locates an IP address with an average error distance of 253 miles which still raises the possibility of classifying an IP address into a wrong city or county. To reduce this error distance, we propose a Naïve Bayes IP geolocation framework that uses 6 features (4 of which are novel). Our delay based features include: average delay, standard deviation and variance of the instantaneous delay. Our population based features include: population density of a county and classification of each county into rural, urban or capital. We also use number of IP aliases on a node as one of our features. We use Planetlab as a live measurement platform to generate our delay based data. The Planetlab Consortium is a group of computers available as a live testbed and currently comprises 1090 nodes worldwide. Tennessee State University has recently become a member of the Planetlab consortium. We select 69 Planetlab nodes within the United States with known geographic locations as our monitors. We identify 142,937 IP nodes through a full mesh traceroute from Planetlab nodes. We use Maximind database to filter out nodes with known city and county locations and perform IP alias resolution to reduce the nodes to 23,843. To collect our delay based measurement set, we send ping probes from the 69 monitors to all the 23,843 nodes. We collect the population based data from the US census bureau website. Iplane, which is a scalable service providing accurate predictions of Internet path performance for overlay services, provides lists of alias clusters which we use to get the number of aliases for all our target nodes. With only one feature (average delay) tested, our new classifier gives a less average error distance of 212.09 miles, compared to the present classifier that gives an average error distance of 278.96 miles. This is very promising as we move on to the next phase of incorporating data for the remaining 5 features. To the best of our knowledge, this is the first proposed framework that aims to improve the accuracy of the present classifier based IP geolocation. *[Acknowledgement: This study is supported by a grant from NSF HBCU-UP awarded to Sachin Shetty Ph.D., Assistant Professor at the Department of Electrical and Computer Engineering, Tennessee State University, Nashville, TN 37209.]*

Faculty Advisor: Dr. Sachin Shetty, sshetty@tnstate.edu

Grad. OA #41
Virtual Reality Based Visualization Environment for Structural Health Monitoring Analysis

Asmah Muallem, Tennessee State University
Sachin Shetty, Tennessee State University

Structural Health Monitoring (SHM) analysis has been carried out in various research projects to detect structural problems, thereby providing an early indication of physical damage. SHM analysis is carried out by applying machine learning techniques to analyze structural health data. Unfortunately, the analysis is usually conducted using two dimensional visual environments. The interpretation of these two dimensional visual environments to obtain more insight on the structural problems can be tedious. Our research presents a virtual reality (VR) based technique to provide visualization for SHM analysis. Our research data is generated within the SHM research group based on sensor readings collected from an aircraft aluminum plate structure within the University of Dayton Research Institute (UDRI). These sensor readings depict the conditions of the plate structure which can translate to a crack in the plate. The focus of the SHM research group is to analyze the sensor readings by utilizing time-frequency analysis techniques for feature extraction and neural networks for classification to employ testing on the data. MATLAB is used to implement the neural network classifier producing classes associated with confidence levels in the range of 0 to 1 and grouping the confidence levels into different classifier categories. The Dempster-Shafer theory is used for the decision fusion algorithm to fuse the decision made by the three classifiers with

five possible classes. Our VR application is developed using popular VR software called DFusion. Visualization is rendered using off-the-shelf or custom designed 2D/3D objects. Our VR application demonstrated Dfusion's ability to improve the representation of the damage to the physical structure through use of real-time analysis and user interactivity. Future work focuses on further manipulation of 3D objects to represent damages and an implementation of an AR environment for the visualization of damage to the aircraft as a whole. *[Acknowledgement: This study was supported, in part by a grant from NSF HBCU-UP Targeted Infusion HRD 1036307 awarded to Sachin Shetty Ph.D., Assistant Professor in the Department of Electrical and Computer Engineering, and Dr. S. Keith Hargrove, Dean of the College of Engineering, Technology, and Computer Science, Tennessee State University, Nashville, TN 37209]*

Faculty Advisor: Sachin Shetty, sshetty@tnstate.edu

Computer Science & Information Systems

Grad. OA #42
Assessment and Development of a Virtual and Augmented Reality Based Assembly Design System

Husam Adas, Tennessee State University
Stephanie Starling and Ashia Coleman, Tennessee State University

Virtual Assembly Design System (VADS) is a Virtual and Augmented Reality (VAR) based engineering application which allows engineers to plan, analyze, and evaluate the assembly of mechanical systems. VAR is an emerging technology that combines real and virtual objects in a real environment in real time. VAR provides a rich contextual environment for educational, training, manufacturing, and medicinal applications to name a few. In the VAR environment, the user is presented with an assembly scene, with the various parts located where they would be in the real assembly plant. The VAR user can then perform the assembly interactively and perform a host of other engineering tasks in the virtual environment. In our proposed VADS, we will implement the six-bar quick return mechanism. A six-bar quick return is mechanism made up of six links and 2 to 3 grounds, depending on the desired output, and is a widely used design in industrial machine tools when a machine is needed to arrive from point A to point B slowly, and then return from B to A quickly. The objective of the proposed VADS is to provide a VAR environment for Tennessee State University's Mechanical Engineering students to understand the assembly of the six-bar quick return mechanism. Currently, students learn the development and assessment of assembling the six-bar return mechanism by using physical prototyping. However, physical prototyping is very time-consuming and somewhat expensive. In addition, once made, physical prototypes are either difficult or impossible to modify. Our project will help students understand the assembly and function of this mechanism, allowing them to virtually assemble and interact with the mechanism.

The development of the VADS will involve the implementation of the following phases:

1. Creation of a virtual environment representing the components involved in the six-bar return mechanism
2. Design of the real six-bar return mechanism and incorporate markers for object tracking
3. Interaction between the virtual and real environment
4. Evaluation and verification of results.

We use Vizard, ARToolkit, video vision goggles, and a head mounted display to overlay virtual images on real mechanical parts and supper impose instructional and feedback messages on students' camera view, guiding the Mechanical Engineering Student throughout the process. *[Acknowledgement: This research was funded by NSF grant HBCU-UP Targeted Infusion HRD 1036307]*

Faculty Advisor: Dr. Sachin Shetty, sshetty@tnstate.edu

Materials Science

Grad. OA #43
Damage Quantification in Polymer Composites using Advanced Nondestructive Monitoring

Jefferson A. Cuadra, Drexel University

Damage is an inherently dynamic and multiscale process that consists of several stages, which vary significantly based on material type and overall component design. In structural assessment, detection of (early) damage initiation and progressive damage accumulation are vital to respond promptly and avoid catastrophic failures. For this purpose, available non-destructive testing (NDT) methods are useful in structural health monitoring applications, particularly at threshold load levels at which the probability of local damage detection is low due to several environmental, structural or measurement difficulties.

The goal of this research is to demonstrate the potential of data fusion in structural damage detection, identification and remaining life estimation, by integrating heterogeneous monitoring techniques and using extracted information for data-driven modeling. A proof-of-concept material class is selected and includes certain types of polymer-matrix composites, which are promising for lightweight and high strength structures, such as wind turbines. Damage monitoring is achieved in this research by investigating the deformation and damage of glass-fiber reinforced polymer composites used in wind turbine blades by a novel hybrid mechanical testing and NDT monitoring system, combining the Acoustic Emission (AE) and Digital Image Correlation (DIC) methods with a standard servohydraulic testing frame. Uniaxial fatigue experiments with variable

frequencies and load ratios were performed, while continuously recording NDT data.

Preliminary full field strain measurements show the progressive development of structural 'hot spots' which are further associated with locations in which inelastic strains accumulate and damage initiates. The combination of DIC with mechanical data reveals hysteretic stress-strain loops, which: i) shift with increasing fatigue cycles (i.e. indication of plastic strain accumulation), ii) change their slope (i.e. stiffness degradation due to fatigue), and iii) have smaller loop areas (i.e. changes in their energy dissipation due to accumulated damage). In addition, extracted features from the recorded AE signals reveal three characteristic stages of fatigue life. Such quantified information will be used to build a mathematical model of multi-site damage accumulation, incorporate this model in a Finite Element computational scheme and construct a framework for reliable fatigue remaining life-predictions. *[Acknowledgement: Theoretical Applied Mechanics Group, and Louis Strokes Alliance for Minority Participation.]*

Faculty Advisor: Antonios Kontsos, akontsos@coe.drexel.edu

Grad. OA #44
Fabrication and Characterization of Porous Zinc Via Selective Dissolution of Al-Zn Alloys

Elvin G. Estremera, University of Puerto Rico, Mayaguez
Rafael Soler, Amarilis Declet, Ronald Valle, Ulises Barajas, O. Marcelo Suarez, and Arturo J. Hernandez-Maldonado, University of Puerto Rico, Mayaguez

Selective dissolution can be used to fabricate macroporous metals. The desired porosity is formed during selective chemical removal of one or more components out of the alloy. Depending on the alloy concentration, electrochemical potentials and alloy cooling rate, porosity can be tunable between less than 2 nanometers up to the submicron range. Because of their high surface area, these materials can be used for catalysis applications. Some metals, like nanoporous gold, become chemically active once porous, while others can be functionalized with a more noble metal to produce catalysts with low precious metal loading. This brings up the need for low cost porous metals.

We have successfully fabricated porous zinc via selective dissolution of various Al-Zn alloys. These alloys were quenched to promote finer microstructure. The alloy specimens were cut and polished prior to the selective corrosion to favor a uniform dealloying process. Sodium hydroxide solutions were used to selectively remove the aluminum atoms. Concentration and cooling rate were varied to observe their effect on the attained pore size. The microstructure of the resulting porous sponge was characterized using x-ray diffraction and scanning electron microscopy. Nanoindentation measurements were used in the characterization of the material's mechanical properties. Our results revealed that porosity depends highly on the Zn concentration of the alloy, the cooling rate upon alloy fabrication while the mechanical properties were affected by that cooling rate and the corrosion levels. The effect of an applied electric potential should be studied to further understand the corrosion process. *[Acknowledgement: National Science Foundation under Grant HRD 0833112 (CREST Program).]*

Faculty Advisor: O. Marcelo Suarez, msuarez@ece.uprm.edu

NANOSCIENCE

Grad. OA #45
Acquisition of Tip-Sample Dissipation Models through Spectral Inversion

Jeffrey Williams, University of Maryland, College Park

Motivation: Tip-sample dissipation has been extensively investigated within AFM. Dissipation in intermittent contact imaging modes is particularly relevant for soft viscoelastic samples, for which the dissipative forces can be a significant component of the total tip-sample interaction. Our work aims at exploring the direct acquisition of the tip-sample interaction model describing the total force as a function of the instantaneous tip position and velocity. With such a model, mechanical properties can be extracted about a complex material at the nanoscale.

Methods: Our approach is based on the spectral inversion method introduced by Stark et al.[1] and optimized by Sahin et al.[2] using a Torsional Harmonic Cantilever, which enhances the higher harmonics of the tip response. The research approach initially relies on numerical simulations of the THC system[3] for a range of key experimental parameters (resonance frequencies, force constants, quality factors, sample viscoelastic properties, excitation and setpoint amplitudes) and a known tip-sample dissipative model[4].

Results and Future work: In each case, the tip-sample interaction force trajectory is reconstructed numerically as a function of position and velocity using Fourier analysis, from which analytical models are developed for sets of conditions that maximize the position-velocity phase space of the tip motion. As a future work, we wish to develop a model to describe the influence of contact time on recovering viscoelastic properties of the material. *[Acknowledgement: The authors gratefully acknowledge the NSF Louis Stokes Alliances for Minority Participation-Bridge to the Doctorate for supporting this work.]*

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Faculty Advisor: Santiago Solares, ssolares@umd.edu

Graduate Abstracts for Poster Presentation

BIOLOGICAL SCIENCES

CANCER RESEARCH

GP #1
The Effects of SFRP1 Loss on Inflammation and Insulin Resistance in a Diet Induced Obesity Model

Lotfi Mateo Bassa, University of Massachusetts Amherst

Breast cancer is the highest diagnosed cancer in women and is the second leading cause of death in women (Perou et al. 2000; Sorlie et al. 2001; Sorlie et al. 2003; Mattie et al. 2006). Obesity is a health issue that is rising dramatically in the U.S. 61.8% of U.S. women are either overweight (body mass index [BMI] 25.0-29.9 kg/m2) or obese (BMI ≥30 kg/m2) (Ogden et al. 2006). Furthermore, postmenopausal obesity has been demonstrated to increase the risk for developing breast cancer and is also associated with more aggressive forms of cancer. Our lab is interested in a family of Wnt antagonists called the secreted frizzled related proteins. The Wnt proteins regulate cell proliferation, differentiation, inflammation and developmental processes in many organisms. Aberrantly activated Wnt signaling contributes to the genesis of a multitude of human cancers, including breast cancer (Polakis 2000). Due to these interesting global effects, we have focused our studies on how SFRP1 expression levels regulate susceptibility to breast cancer and whether alterations in levels of this protein may affect both systemic changes (i.e. glucose, insulin, inflammation) or local cell autonomous changes to alter susceptibility. Here, we used a SFRP1 KO mouse model and induced obesity via a high fat diet for 12 weeks. Body weight and fat content, as well as glucose and insulin levels, were evaluated. The animals were euthanized at the end of the study and the fat pads, livers and pancreases were isolated, weighed and processed for future studies using IHC and qRT-PCR. Our hypothesis was that loss of SFRP1 would cause increased insulin resistance and increased inflammation. Our results demonstrated that the knock out animals on a high fat diet became more insulin resistant and fat and that certain inflammatory factors were increased. We observed a striking difference in glucose transporter expression between wildtype and knockout animals in different organs suggesting one possible reason for the change in insulin resistance. *[Acknowledgement: The Northeast Alliance for Graduate Education and the Professoriate; The Rays of Hope Foundation; Baystate Health System.]*

Faculty Advisor: Sallie Smith-Schneider, Sallie.Schneider@baystatehealth.org

CELL AND MOLECULAR BIOLOGY

GP #2
Noelin-1 (Olfactomedin-1) Regulates the Invasion Step of Epithelial-Mesenchymal Transition (EMT) in Heart Valve Development

Alejandro Lencinas, University of Arizona

Heart valve formation is initiated by epithelial-mesenchymal cell transformation (EMT) of endothelial cells in the atrioventricular (AV) canal. It was shown that transforming growth factor beta (TGFß) mediates this EMT as a two-step process of activation and invasion. We found a secreted glycoprotein, Noelin-1, in microarray data for this tissue. Noelin-1 (Olfactomedin-1) is known to mediate EMT in neural crest cells but is not well understood. Immunostaining for Noelin-1 in pre-EMT AV canals showed Noelin-1 expression in myocardial cells. Exogenous Noelin-1 added to AV canal cultures increased the number of invading mesenchymal cells compared to controls. Anti-Noelin-1 antibody treatment inhibited EMT in the collagen gels. Exogenous Noelin-1 induced elevated expression of TGFß2 and 3, fibullin-2, ALDH, and ACTA2 by real time RT-PCR profiling. The continued dispersion of endothelial cells on the gel surface after blocking antibody treatment and the up-regulation of TGFß3 and fibullin-2 in treated explants suggests that Noelin-1 is a late mediator of the invasion step of EMT. These data indicate that Noelin-1 is present and necessary for EMT in the AV canal and suggest that it may be a new and important regulator of heart valve formation. *[Acknowledgement: Initiative for Maximizing Student Diversity, NIH/IMSD. More Graduate Education at Mountain State Aliance, NIEHS (Superfund) and NHLBI]*

Faculty Advisor: Raymond Runyan, rrunyan@email.arizona.edu

MICROBIOLOGY/IMMUNOLOGY/VIROLOGY

GP #3
Colonization of Mucoid and Non-Mucoid Streptococcus Pneumoniae in the Cystic Fibrosis Mouse Model of Respiratory Infection

Evida Dennis, University of Alabama at Birmingham
Marilyn J. Crain, David E. Briles, and Mamie T. Coats, Alabama State University

Streptococcus pneumoniae (SP) is a prominent respiratory pathogen and a leading cause of morbidity worldwide, but its role in the Cystic Fibrosis (CF) lung has not been well studied. The major pathogen in CF lung disease is Pseudomonas aeruginosa which is associated with worse prognosis when it transitions to a mucoid phenotype. During collection of SP from pediatric CF patient sputum specimens, our research group found that most of the SP lung isolates were highly mucoid. Our previous studies indicated that the CF lung environment may be favorable for highly mucoid SP, which are likely to promote biofilm formation. We hypothesized that mucoid SP were more likely to successfully infect mice with the CF mutation Cftrtm1UncTg (FABPhCFTR) (CF-mice) than wild type mice without the mutation (WT-mice). CF-mice and WT-mice were infected via the intranasal route with SP strains isolated from the sputum of patients with CF: a mucoid serotype 3 isolate (CHB 756) and a non-mucoid serotype 19A isolate (CHB 1058) were compared. A mucoid serotype 3 lab isolate WU2 was used as a reference. Colonization was measured by evaluating the total number of SP CFU collected from tracheal lavage fluid, lung homogenates, and blood from infected mice 5 days post-intranasal infection. There were significantly more CFUs recovered from the lungs of CF-mice than WT-mice infected with mucoid isolates CHB 756 (P=0.0153) and WU2 (P=0.0041). There was no significant difference between the total number of CFUs recovered from the lungs of CF-mice and WT-mice infected with non-mucoid isolate CHB 1058 (P=0.4510). Additionally survival among CF-mice infected with CHB 1058 (non-mucoid) at day 5 post-infection was much greater (100%) than in mice infected with mucoid strains WU2 (77%) and CHB 756 (0%). Our results indicate that mucoid SP can both colonize and cause infection in mice more effectively than non-mucoid SP, and do so more readily in the lungs of CF-mice than in the lungs of WT-mice. The conclusions of this study support the association of mucoid bacteria with worse prognosis in individuals with CF, and provide a better understanding of why mucoid strains of SP are more common in the lungs of CF patients than in normal individuals. *[Acknowledgement: This work was supported by funds from the Gregory Fleming James Cystic Fibrosis Research Center, UAB.]*

Faculty Advisor: Marilyn Crain, MCrain@peds.uab.edu

MICROBIOLOGY/IMMUNOLOGY/VIROLOGY

GP #4
Chlamydia Trachomatis MOMP Combined with PLGA and IL-12 as a Mucosal Vaccine

Stacie J. Fairley, Alabama State University
Taha Murtada, Praseetha Subbarayan, Alain B. Waffo, Shree R. Singh, and Vida A. Dennis, Alabama State University

As one of the most reported sexually transmitted health pathogens in the world, research on vaccine development for Chlamydia trachomatis has been a formidable task. Our research group is focusing on using the major outer membrane protein (MOMP) of C. trachomatis as a potential vaccine candidate against this pathogen. We have previously shown that recombinant MOMP (rMOMP) elicits a poor immunological Th1 response in vivo in the mouse model. This low response can be attributed to possibly the degradation of rMOMP within the cell during delivery by proteolytic enzymes. Therefore, we are hypothesizing that encapsulation of full-length rMOMP (FrMOMP) within Poly D, L-lactic-co-glycolic acid (PLGA) nanoparticles along with the addition of IL-12 will protect the recombinant proteins from proteolytic enzymes and induce a higher Th1 immune response than previously shown. Furthermore, encapsulation will enhance the slow release of the vaccine from PLGA. To test our hypothesis, the FrMOMP (gene fragments corresponding from amino acid 1-361) was cloned and expressed in pESUMO plasmid in order to obtain the FrMOMP construct. Restriction enzyme, PCR, and sequencing analyses confirmed the presence and good orientation of the FrMOMP construct. The FrMOMP was transformed into E. coli (DE43) for expression of the protein followed by SDS and Western blotting, which revealed the predicted FrMOMP protein of ~52 kDa. Stimulation of mouse J774 macrophages with various concentrations of FrMOMP revealed that 5 g/mL of the protein induced the production of IL-6 and IL-12 cytokines. Additionally, encapsulation efficiency studies of FrMOMP or IL-12 in PLGA showed greater than 95% encapsulation of these proteins. Overall, our data show successful expression of the FrMOMP protein and stimulation of an immune response by in vitro analyses. Further characterization studies of the encapsulated proteins are ongoing prior to immunogenicity and efficacy studies in BALB/C mice. The incorporation of IL-12 and FrMOMP in PLGA is a novel concept and may fashion a different perspective in future vaccine development. *[Acknowledgement: This study was funded by NSF-CREST grant 0734232 awarded to Shree R. Sing, Ph.D., Director for the Center of Nanobiotechnology, Alabama State University, Montgomery, AL 36116.]*

Faculty Advisor: Dr. Vida A. Dennis, vdennis@alasu.edu

GP #5
The Study of Antimicrobial Activity from Vinegar on Bacteria Species

Talaysha Lingham, Delaware State University

Food poisoning is a major concern for consumers and the food industry. There is interest in applying effective antimicrobial compounds from natural resources. Organic acids such as vinegar have been found as safe antibacterial agents. Fresh fish products have a short shelf-life. In most seafood products, microorganisms are the major cause of spoilage. The aim of this research was to study the antimicrobial activity from vinegar on foodborne pathogens and various species derived from catfish. The vinegar will be applied as antimicrobial components in food in order to improve shelf life and food safety.

Components of the vinegar were separated to confirm acetic acid using Chromatography. The zone of inhibition test was performed on the bacteria with concentrations of vinegar acidity: 0, 0.5, 1, 2.5 and 5%. The minimum inhibitory concentration (MIC) was determined on the bacteria with the highest and lowest zones of inhibition. For the foodborne pathogens, Serratia marcescens resulted in the largest 5% acidity zone of inhibition with a MIC of 0.3%. Staphylococcus aureus resulted in no clear zones. For the bacteria isolated from catfish, the MIC ranked from 1 to 0.03%. For the foodborne pathogen, the vinegar was the most effective on Serratia marcescens. It does not seem to inhibit the growth of Staphylococcus aureus. Vinegar seems to be more effective on the bacteria isolated from catfish than the foodborne pathogens.

The unpleasant off-flavors of the fish are associated with bacterial spoilage. Sensory evaluation will be performed on the catfish marinated with the vinegar acidity concentrations. The vinegar could be used as a substitute ingredient in food that will decrease and inhibit bacteria growth. *[Acknowledgement: This research was supported by: Greater Philadelphia Region LSAMP Bridge to the Doctorate Program; EPSCoR-CIBER Seed Grants.]*

Faculty Advisor: Dr. Jung-lim Lee, jlee@desu.edu

Nanoscience

GP #6
Formulation of a DNA-chitosan Based Vaccine Against Chlymadia Trachomatis

Chino D. Cambridge, Alabama State University
Alain B. Waffo, Komal Vig, Shree R. Singh, and Vida A. Dennis, Alabama State University

Chlamydia trachomatis is an obligate intracellular pathogen, and the most reported cause of bacteria sexually transmitted infections worldwide. To date there is no vaccine aiding in the eradication of this pathogen. The purpose of this study was to develop a nanoparticle-encapsulated DNA vaccine using the major outer membrane protein (MOMP) of C. trachomatis. We hypothesize that a DNA-nanoparticle based vaccine using MOMP would induce mucosal immune responses which will provide protection against a C. trachomatis genital tract infection. The complete antigenic region of the MOMP gene was amplified and cloned into a phCMV1 vector. This construct (phCMV-MOMP) was then encapsulated in chitosan, a polymeric nanoparticle known to increase surface membrane permeability and enhance mucosal immune responses. To ensure that the recombinant phCMV-MOMP was completely encapsulated in chitosan, the complex was subjected to in vitro biochemical and physio-structural characterizations including restriction enzyme digest, DNA release, zeta potential, Fourier transform infrared spectrophotometry (FT-IR) and transmission electron microscopy (TEM) analyses. Our results showed the protective properties of chitosan functioning in shielding the DNA from the restrictive enzymes degradation. Cumulative DNA release data analysis showed a gradual release capacity of the DNA from nanoparticles up to 120 hours. Zeta potential analysis divulged the stability of the nanoparticle and its encapsulated DNA through comparative results obtained from only chitosan nanoparticles (.0327mv), to that of the encapsulated DNA (2.08mv). FT-IR results confirmed these properties of the nanoparticles, functional groups, as well as the charges associated with the nanoparticles and encapsulated DNA. Encapsulation efficiency was also confirmed by spectrophotometry. Finally, visual analysis of the encapsulated DNA was conducted via TEM further allowing the confirmation of its complex morphology. Overall in vitro analysis of the encapsulated DNA vaccine construct revealed its worthiness as a vaccine candidate for further testing in vivo in the mouse model. *[Acknowledgement: This study was funded by the NSF-CREST grant 0734232 awarded to Shree R. Singh, PhD, Director for the Center of Nanobiotechnology, Alabama State University, Montgomery, Al 36116]*

Faculty Advisor: Dr. Vida Dennis, Vdennis@alasu.edu

Plant Research

GP #7
Examination of African Plants to Determine Their Capability of Anti-Bacterial Activities

Faryal Farrukh, Tennessee State University

More than one-third of the world's human population is likely to be infected by bacterial pathogens. Mycobacterium tuberculosis (MTB) is a pathogenic bacterial species in the genus Mycobacterium and the causative agent of most cases of tuberculosis (TB). Infections caused by drug-resistant strains of Mycobacterium tuberculosis range from 0 to 57% (with a median of 10.2%). New infections caused by multi-drug resistant (MDR) forms of M. tuberculosis range from 0 to 14.2%, (median 1.1%). Patients undergoing re-treatment harbor MDR strains at a 7% median incidence. Yet the existing pipeline of anti-M. tuberculosis agents is weak. (NIAID & M.A. Aziz et al.).

A crude extract of Hypericum perforatum, a perennial medicinal plant known as "St. John's wort" in Western Europe is widely used as antidepressant in Africa,but the naturally occurring red pigments hypericin and pseudoyhpericin have antiviral, antiretroviral and antibacterial activities. Our research is studying the effect of crude plant extracts from Nigeria on the growth of pathogenic bacteria. The bacteria are exposed for 15, 30 and 60 minutes. Colony growth after exposure is used to determine the effects of the crude extracts from the Nigerian plant (Hyepericum perforatum).

Preliminary results show that these crude extracts inhibit MTB growth, and additional research on the viability of these extracts to treat MTB infections will be presented. *[Acknowledgement: This research is partially supported by the HBCU-UP program.]*

Faculty Advisor: Dr. Leigh Arino de la Rubia, larino@tnstate.edu

GP #8
Combined Effect of Selenium and Basil, Fenugreek and Mustard on Anticancer Properties

Samantha Levy, Tennessee State University
Christina Lee and Destiny Gray, Fisk University, TN

The organic form of Selonoprotein (methylselenocysteine) has been reported to protect from prostate and lung cancer. However, a toxic level of Selenium (Se) in human nutrition is harmful. The intake of Selenium has to be in organic form, but plants can only uptake Se in inorganic form. In addition to that, Se is yet to be considered as a beneficial plant nutrient for normal plant growth and development. The challenging aspect of biofortification of Se is subject to bioavailability of the Se element to plants which is determined by several environmental and genetic factors of a particular plant species. Plants such as basil (Ocimum species), Fenugreek (Trigonella foenum-graecum) and mustards (Brassica species) are also found to have health promoting factors including, diabetic, arthritis and cancer preventing, antimicrobial properties.

By combining and increasing the uptake and accumulation of organic Se into basil, fenugreek, and mustard plants, we expect to achieve additional benefit. Therefore, this study focuses on the combined effect of the element Se and the plant's secondary metabolites on cancer prevention and antimicrobial properties by increasing the secondary metabolites and organic Se in these species. The treatment consisted of complete modified Hoagland's mM concentrations of macronutrients (NO3-N, PO4-P, K, Ca, Mg, and S) and microM concentrations of micronutrients (Fe, Mn, Cu, Zn, B and Mo) plus five microM (0.1, 0.2, 0.4, 0.8 and 1.6) concentrations of Se added to each treatment solution. The leaf tissue Se content ranged from149 to 350 ng/g of dry weight in Se treated plants.

Therefore, we will presenton on (1) the plant species' ability for uptake, partionining, and accumulation of organic and inorganic Se, and (2) various levels of nitrogen (N) and sulfur (S) for the optimal levels of secondary metabolites and its effect on cancer preventing, and antimicrobial properties*. [Acknowledgement: This work was partially supported by NSF -HBCU-UP grant 0927876, UNCF, USDA, International Plant Nutrition Institute, Dept. Education Grant P120A060075.]*

Faculty Advisor: Dharma Pitchay, dpitchay@tnstate.edu

CHEMISTRY & CHEMICAL SCIENCES

CANCER RESEARCH

GP #9
Exploration of Binding Modes Between p300 and Chetomin by Zn Ejection Using Computational Methods

Mike Cato, Jackson State University
Megan Peach and Marc Nicklaus, National Cancer Institute, Frederick, MD

The analysis of the interaction between the zinc-finger transcription factor p300 and a class of small molecules called epipolythiodioxopiperazines (ETPs) is determined. These compounds appear to unfold p300. This phenomenon is significant for cancer because if p300 is unfolded it disrupts the HIF pathway; consequently the tumor cells' ability to function under hypoxic conditions becomes limited. Density Functional Theory (DFT) and Docking methods (GLIDE) were used to determine structural characteristics, binding modes, and a possible mechanism of action between Chetomin and p300. Our calculations reveal that the tetrahedral geometry remains intact after p300 binds with Chetomin. An approximate barrier energy exists of 5 kcal/mol for the binding of Chetomin to p300 and orbital interactions illustrate that stabilization of the p300-Chetomin complex prior to Zinc Ejection is the result of back donation of Zinc electrons to the empty d-orbitals of the Sulfur atoms in Chetomin. *[Acknowledgement: NSF-CREST; NIH-CRTA]*

Faculty Advisor: Prof. Jerzy Leszczynski, jerzy@icnanotox.org

CHEMISTRY (NOT BIOCHEMISTRY)

GP #10
Theoretical Calculations of the Ionization Potentials and Electron Affinities of Guanine, Cytosine, Adenine and their Methyl Derivatives

Noel Matthews-Gardner, Jackson State University
David Magers and Glake Hill, Jr., Jackson State University, MS

The relative abundances of the ion radicals produced in DNA are dependent upon electron affinities of bases for anions, the ionization energies of the bases for cations, and subsequent proton-transfer reactions between base pairs. A number of reports have focused on the ionization energies of DNA bases and indicated guanine as the most likely site for the hole in irradiated DNA. Also, experimentalists have found that the C5 site on the cytosine atom is a promutagenic methylation site. The N3 site of adenine is thought to be the next favored site of methylation and is considered to be play a paramount role in toxicity by a methylating agent. Yet, few investigators have considered the effects of ionizing radiation of the tautomers of

guanine, cytosine, adenine or methylated DNA bases despite their confirmed importance in mutagenic activity. In this work, the energetic and structural properties of DNA have been investigated by examining the electron affinities (EA) and ionization potentials (IP) of guanine, cytosine, adenine and several related compounds using the B3LYP density functional hybrid. We tested the hypothesis that electron attachment and removal play key roles in stability, structure and dipole moments of the guanine, cytosine and adenine tautomers. Using the 6-311++G(df,pd) basis set, all non-methylated guanine, cytosine and adenine structures show slightly negative adiabatic electron affinities whereas the methylated guanine, cytosine and adenine compounds are relatively stable with respect to dissociation. All density functional (DFT) quantum-chemical calculations were accomplished using the Gaussian-03 and 09 software. Geometries of the thirty-one model compounds were established by full optimization of all geometric parameters in the following order of level/basis sets: B3LYP/6-311G(d,p), B3LYP/6-311+G(d,p), B3LYP/6-311++G (df,pd). Structural and electronic distribution changes upon electron removal and attachment lead to decreased and increased dipole moments, respectively. Our goal in this study is to determine which tautomers remain structurally sound with the removal and addition of an electron to further our research by stacking and pairing DNA bases. We plan to continue our research by pairing guanine and cytosine major tautomers to determine how stability and susceptibility changes and by determining thymine's susceptibility. *[Acknowledgement: We gratefully acknowledge Title III and NSF-CREST HRD 0833178 for financial support and the Mississippi Center for Supercomputing Research for grants of computer time.]*

Faculty Advisor: Dr. Glake Hill, noelmatthews@msn.com

GP #11
Catalytic Hydrodeoxygenation of Propionic Acid Over Supported Group VIII Noble Metals

Yuliana Lugo-Jose, University of South Carolina
Christopher Williams (advisor) and John R. Monnier (co-advisor), University of South Carolina

The production of oil from biomass derived sources is a difficult task, since bio-oil molecules contain high amounts of oxygen functional groups that have to be removed prior to supplementing and/or replacing fossil fuels. In this study, the process of removal of oxygen from a carboxylic acid functional group was studied utilizing Propionic Acid (PAc) as the model compound. The catalytic hydrodeoxygenation (HDO) reaction of PAc was investigated over different supported group VIII noble metals. The reactions were carried out in a single-pass plug flow reactor where PAc is co-fed with hydrogen in order to produce hydrocarbons. The reactions were exposed to temperatures ranging from 200-400ºC and a hydrogen pressure of 1 atm, where the catalytic activity and selectivity of each catalyst was determined. Characterization techniques such as temperature programmed oxidation/reduction (TPO/TPR), Fourier transform infrared spectroscopy (FT-IR) and H_2-Chemisorption were utilized to distinguish the physical/chemical properties of the catalyst. The key reaction intermediates where found to favor the production of alcohol, aldehydes, esters, ketones, and can involve a series of reactions containing two or more of these intermediates. Therefore, a reaction mechanism of these intermediates is proposed. We concluded that the catalytic hydrodeoxygenation of PAc can be achieved over supported group VIII noble metals. Unfortunately, the gas-phase reaction required high temperatures and the expected reaction pathways derailed from the formation of hydrocarbons to other side reactions such as ketonization and esterification. Interestingly, the results showed that the ester produced, lead to the formation of hydrocarbon at higher temperatures. The catalytic evaluation showed that the rate for Pd/C was higher than on Pd/SiO_2. Additionally, the rate of reaction of hydrogen is independent of the hydrogen concentration leading to a zero order reaction. Future work will focus on the synthesis and implementation of monometallic and/or bimetallic catalysts for the HDO of PAc reaction, to evaluate the catalytic performance and understanding of the acid decomposition on the surface of the catalyst. *[Acknowledgement: USC Nanocenter South East Alliance for Graduate Education and the Professoriate (SEAGEP) Alfred. Sloan Foundation]*

Faculty Advisor: Dr. Christopher Williams, willia84@cec.sc.edu

GP #12
Functional Nanoscale Polyaniline Metal Salt Composites for Ammonia Detection

Tiana Shaw, Clark Atlanta University
Dr. Michael Williams, Clark Atlanta University, Atlanta, GA

Nanoelectrochemical sensors have shown increased promise in detection of environmental pollution. Ammonia, in large quantities, is extremely hazardous to an aquatic ecosystem. It is important to develop a material sensitive to the analyte to be detected. Polyaniline has been shown to be an excellent polymer for sensor capabilities. In sensor applications, nanostructured polyaniline has greater sensitivity and faster time response relative to its conventional bulk counterpart due to higher effective surface area and shorter penetration depth for target molecules. The conductivity of polyaniline can be changed/controlled through the reaction of redox reactive materials that can be complexed to create metal-salt composite materials. The change in ratio of the imine to amine groups in the polyaniline should indicate the binding and reduction or oxidation of the polymer when mixed with a metal. In our study, copper (II) nitrate was bound to polyaniline. Copper creates a more selective sensor for ammonia because of its redox reaction with ammonia. Therefore the metal-salt composite was then used to construct a sensor that detected a

change in the composite's conductivity. The study of the electrochemical and morphological properties of the polyaniline provided a confirmation of the sensor's effectiveness. The metal-salt composite was characterized using UV- Visible Spectroscopy, IR Spectroscopy, and Scanning Electron Microscopy. *[Acknowledgement: This study was supported, in part, by a grant from NSF/CREST awarded to Ishrat Khan, Ph.D., Director for the Center of Functional Nanoscale Materials, Clark Atlanta University, Atlanta, GA 30314.]*

Faculty Advisor: Dr. Michael Williams, mdwms@cau.edu

Materials Science

GP #13
Examination of Melt Mexing RTM 370 With Surface Enhanced Graphite

Lionel Wilfred Cross, Clark Atlanta University

Studies of various phenylethynyl terminated imide resins have shown that these materials do indeed possess the necessary thermal properties causing them to be very durable at high temperature. Addition of graphite filler into the PETI system should provide greater thermal, mechanical, and electrical properties. Previous studies have shown that multiwalled carbon nanotubes (MWCNTs), carbon nanofibers, and surface enhanced graphite can be effectively dispersed in phenylethynyl terminated imide (PETI) resins through a process of high torque melt mixing. A combination of the energy transferred by melt mixing and the formation of charge transfer complexes with the resin system may have caused the graphite delaminate to give dispersed graphene sheets. However, our initial efforts to disperse and delaminate surface enhanced graphite in RTM 370, another PETI resin, were unsuccessful. The lack of delamination using the RTM 370 was attributed to the lacking of the more electron rich 1, 3, 4-APB component present in other studied resin systems. We are currently examining the dispersion and delimitation of graphite in RTM370 by utilizing PETI 298 along with RTM370 by high torque melt mixing. Rheological and DSC data shows that these two resin systems are compatible and can be co-cured while maintaining the higher T_g characteristic of the RTM 370. X-ray diffraction exhibits very strong 002 peaks at 2θ = 26.7° for graphite corresponds to the d-spacing of 3.33 Å between two graphene sheets in graphite. In a 2 wt% graphite 50:50 resin sample a new peak can be seen at 18.36 corresponding to a d-spacing of 4.81. Further studies are being conducted to confirm the delamination of the graphite material. In summation the collected data thus far suggest that the combination of RTM 370 and PETI 298 will disperse and delaminate the surface enhanced graphite while maintaining the thermal properties of the RTM 370. *[Acknowledgement: This material is based upon work supported by NASA Cooperative Agreement NCC3-1044.]*

Faculty Advisor: Eric A. Mintz Ph.D, emintz@cau.edu

GP #14
Next-Generation Nanotube-Based Gas Sensors

Deon Hines, The City College of the City Unversity of New York

There is enormous interest in detection of simple andcomplex odors by mean of electronic instrumentation. Our work focuses on creating derivatized-nanotube-based "electronic noses" for the detection and identification of gases, with an emphasis on explosive materials, by an approach that mimics the mammalian olfactory system. We have grafted single-walled carbon nanotubes (SWNTs) with an array of electron-donating and electron withdrawing moieties and have characterized some of the physicochemical properties of the modified nanotubes. Gas sensing elements have been fabricated by spin coating the functionalized nanotubes onto interdigitated electrodes (IDEs). Exposure of these IDEs to organic vapors and the successful classification of the data obtained via electrochemical measurements indicate that the system can function as a gas sensor of high repeatability and selectivity for a wide range of common analytes. *[Acknowledgement: Center for Exploitation of Nanostructures in Sensors and Energy Systems, National Science Foundation]*

Faculty Advisor: Dr. Daniel Akins, akins@sci.ccny.cuny.edu

Nanoscience

GP #15
Functional Nanoscale Biodegradable Polymers for Controlling/ Studying Material-Cell Interactions

Jereme Doss, Clark Atlanta University

Functionalized nanomaterials have an expansive range of potential uses in biomedical applications. Functionalized synthetic (biocompatible and/or biodegradable) polymers that control or monitor cell signaling can be effective antagonists and promising drug candidates. We have developed a series of biodegradable functional polymer systems (with dimensions in the nanoscale) for creating allergy-effective drugs, using RBL mast cells and anti-2,4 dinitrophenyl (DNP) IgE antibodies that sensitize these cells by binding to high affinity IgE receptors(Fcε RI), creating polymers which are effective inhibitors of degranulation of mast cells stimulated by a potent allergen. The inhibition is possible because of the specific interaction of the functional polymers with the proteins (IgE) on the mast cell surfaces to control cell-signaling, i.e. intelligent design of functional materials to manipulate cellular functions. The functional polymer system is based on biodegradable poly (lactides) carrying two, three or four 2,4-dinitrophenyl (DNP) groups. These polymeric ligands are effective inhibitors of degranulation of mast cells stimulated by a potent allergen and thus are a potential model drug system. Additionally these lactide based polymers bind and achieve steady state binding

with solution IgE within a few seconds at low concentrations, achieving about 75% of the binding below 0.2 uM. The preparation, characterization, processing and effectiveness of the functional polymers to control material-cell interactions will be discussed. *[Acknowledgement: This study was supported, in part by a grant from the NSF awarded to Ishrat Khan Ph.D., Director of the Center for Functional Nanoscale Materials, Clark Atlanta University, Atlanta, GA, 30314.]*

Faculty Advisor: Dr. Ishrat Khan, IKhan@cau.edu

GP #16
Dispersion and Delamination of Graphite in PETI 298 by High Torque Melt Mixing

Candace James, Clark-Atlanta University

We have previously shown that multiwalled carbon nanotubes (MWCNTs) and carbon nanofibers can be effectively dispersed in phenylethynyl terminated imide (PETI) resins by high torque melt mixing, and processed into polymer matrix composites with improved electric conductivity, mechanical properties, and resistance to moisture adsorption. Our hypothesis is that PETI-298 oligmers will successfully aid in the dispersion, intercalation, and delimitation of expanded graphite by the energy imparted by high torque melt mixing. Graphite is considerably less expensive than MWCNTs or graphene, and if extensively delaminated and dispersed would be expected to provide enhanced mechanical, thermal, and electrical properties to the polymer matrix composites (PMCs). Rheology, Raman spectroscopy and X-ray powder diffraction, and thermal analysis data will be presented for graphite PETI 298 composites prepared by high torque melt mixing that supports the dispersion, intercalation, and delimitation of the graphite in the polymer matrix. The combination of the energy imparted by melt mixing and formation of charge transfer complexes with the PETI resin may have delaminated the graphite to give dispersed graphene sheets.

Rheological data show that when complex viscosity (η*) vs. temperature for PETI 298, and 1, 2, 4, and 10 wt% graphite dry mixed into PETI 298 are graphed as the PETI-298/graphite mixtures are heated, the resin initially melts and continues to decrease in viscosity, reaching a minimum viscosity at 280 to 300° C. Upon continued heating, the resin starts to cure, gel, and fully solidify. X-ray diffraction exhibits very strong 002 peaks at 2θ = 26.7° for graphite corresponds to the d-spacing of 3.33 Å between two graphene sheets in graphite. In the 1 wt% melt mixed graphite sample new peaks are observed at 2θ = 18.3, 24.5, 25.5, 26.6 and 27.9°, corresponding to 4.81, 3.62, 2.49, 3.34, and 3.10 Å, respectively.

Work is in progress to further characterize the state of the graphite based material produced upon high torque melt mixing with PETI-298. In conclusion, the observed changes in the melt Rheology, XRD, and Raman spectra suggest that the graphite can be dispersed, intercalated and delaminated during the high torque melt mixing with PETI 298. *[Acknowledgement: This material is based upon work supported by NASA Cooperative Agreement NCC3-1044.]*

Faculty Advisor: Eric A. Mintz Ph.D, emintz@cau.ed

WATER

GP #17
The Effect of Sodium Bicarbonate on TiO2 Photocatalytic Inactivation of the Beta Galactosidase Recombinant Adenovirus

Derrious Lowe, Clark Atlanta University

One of the most pervasive problems afflicting many people throughout the world is inadequate access to clean water, and research related practical ways of purifying water continue to be needed. Photocatalytic inactivation of microorganisms by titanium dioxide (TiO2) is now being studied as a potential point of use in water treatment technology. When TiO2 absorbs light, electrons (e-) and positive holes (h+) are formed inside the crystals that can migrate to the surface and directly cause oxidative damage to microorganisms, or generate reactive oxygen species (ROS) including OH, H2O2, and O2·- which can also damage microorganisms. Previous studies have shown that treatment of viruses, bacteria, and fungi with TiO2 and light leads to the inactivation of the microorganism. In our laboratory we are testing the hypothesis that addition of sodium bicarbonate (NaHCO3) modifies and enhances the photocatalytic activity of TiO2. In this study we assessed the photocatalytic activity of TiO2 with a Beta Galactosidase Recombinant Adenovirus, Beta Galactosidase, and Bovine Serum Albumin in the presence and absence of 10 mM NaHCO3. Two specific aims were pursued: 1) To investigate the damage to β-Galactosidase Recombinant Adenovirus capsid and/or attachment proteins when exposed to TiO2 under UV light and 2) to determine the mechanism of TiO2 photocatalytic inactivation. A chemiluminescent reporter gene assay system was used to detect the activity of β-Galactosidase before and after photocatalytic exposure. The photocatalytic degradation of BSA was followed by the detergent compatible (DC) protein assay and oxidative protein modification was assessed using 2,4 –dinitrophenylhydrazine (2,4 DNPH) as a marker for protein partial oxidation. Our studies show that the adenovirus was inactivated by 96 % and 83% within two hours in presence and absence of 10 mM bicarbonate respectively. Degradation of both proteins was enhanced by the addition of NaHCO3 to the TiO2 photocatalyst. In the test for partial oxidation of BSA, we observed that twice as many carbonyls groups were formed under photocatalysis with TiO2 and NaHCO3 after 24 h exposure than without NaHCO3. These results support our hypothesis. Future work will include the photocatalytic activity of TiO2 on

the individual amino acids with and without NaHCO3. *[Acknowledgement: This study was supported by WaterCAMPWS, under the NSF Grant CTS-0120978, and was also supported by MBRS RISE under the cooperative agreement number NIH/NIGMS Grant 2R25GM060414.]*

Faculty Advisor: Dr. Eric Mintz, emintz@cau.edu

COMPUTER SCIENCES & INFORMATION MANAGEMENT

COMPUTER SCIENCE & INFORMATION SYSTEMS

GP #18
A Distributed, Content-Aware Cloud-Enabled Wireless Sensor Network Platform

Felix Njeh, Bowie State University

Wireless Sensor Networks (WSNs) play a very vital role in academia and industry. The rapid development in Micro-Electro-Mechanical Systems (MEMS) technology has facilitated the development of smart and highly capable sensors to solve a multitude of real world problems. This wide use of WSNs demands a secure, distributed and globally available network of sensors. Several different technologies have evolved and are used unilaterally to facilitate the deployment and use of WSNs. The sensors could be orbital or terrestrial and fixed or mobile.

Cloud Computing (CC) is one of such innovative technologies that provide convenient, on-demand network access to a shared pool of configurable computing resources (in our case, sensors) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Our research utilizes WSNs as an underlying technological platform on which other technologies are assembled to provide a robust, distributed and innovative sensor network. The distributed, content-aware cloud-enabled Wireless Sensor Network platform is termed CloudSensorWeb. Sensor networks are found in disparate locations all around the world and support a myriad of applications.

To validate the functionality of our model, a simulation was performed using NS-2; which is a discrete event simulator for wired and wireless networks. The NAM program generates the simulation below. In this simulation you see the packets as they move from node to node. The trace file from the simulation is then used to analyze the results.

The experimental test-bed setup provides tools to setup a ZigBee network, design, test and upload applications, make web service calls and provide connectivity to the Internet. Web applications access real-time sensor data through the network. The quality of service provided by the AODV routing protocol is evaluated with respect to the number of protocol packets transmitted against the number received. We observe that there is a large overhead. The sensor nodes almost always receive more packets than sent by the source node due to the broadcast nature of the protocol.

The comforting aspect is that the destination receives the data sent close to 100 percent of the time. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Bo Yang, byang@bowiestate.edu

ECOLOGY, ENVIRONMENTAL & EARTH SCIENCES

CLIMATE CHANGE

GP #19
Indicators for Examining Potential Chronic Respiratory Effects of Climate Change

Crystal Romeo, University of Maryland-College Park
Amir Sapkota, University of Maryland; Suril Mehta, U.S. EPA; Jennifer D Parker J, National Center for Health Statistics, CDC

The effect of climate change on human health is a critical emerging issue that will intensify in the coming decades. Climate change will augment the existing chronic disease burden particularly in westernized societies where people live longer, often with chronic diseases such as asthma, which currently affects 23 million Americans. One of the major challenges in quantifying the impact of climate change on chronic diseases is the lack of a suitable exposure metric that appropriately captures climate change with adequate temporal and spatial resolution. To address these questions, we have linked meteorological data collected from over 15,000 stations scattered across the continental United States with the National Health Interview Survey (NHIS) for the 1988-2008 period. We have generated county-level exposure variables including extreme hot and cold days, heat waves and cold waves using the 1960-1980, 1970-1980, and 1988-2008 timeframes as a baseline period. We have found that the result of using different temporal resolutions (seasonal, 12, 36, and 60 month) as well as baseline periods on the exposure metric is not parallel. The use of a baseline year that is the same as the reference year yields average exceedence days that are smaller than using prior years as the baseline period. The implication of using an exceedence-muting baseline may affect the results once the temperature variables are linked with the health survey. This study shows that it is important to consider the baseline years used to generate exceedence days in developing indicators for climate change. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Amir Sapkota, Ph.D., amirsap@umd.edu

Abstracts

ECOLOGY

GP #20
Exotic Herbivore Limits Plants While Nutrients Increase Herbivore Size

Maria Meza-Lopez, Rice University

Exotic herbivores often co-occur at high densities with exotic plants in eutrophic aquatic ecosystems, which can be a response to nutrient enrichment, common dispersal pathways, or the interactions between native and exotic species or the interactions between exotic species. The effect that exotic species establishment has on food web structures often focuses on a single trophic level or is unknown. In this greenhouse experiment, we tested these hypotheses: 1) if nutrient enrichment has a positive effect on exotic and negative effect on native plants then exotic plant biomass will be larger, 2) if nutrient enrichment has a positive effect on exotic herbivores then exotic herbivores will be larger as nutrients increase, 3) if exotic herbivore performance depends on the geographic origin of plants that they consume then herbivore size is going to be different depending on the whether the plant is native or exotic, and 4) if exotic herbivores impact native plants then native plant biomass is going to be lower than exotic plant biomass. We used common native and exotic species from southeastern Texas. Ninety-six 19-liter containers were assigned three treatments in a factorial design: exotic herbivore [presence or absence of Pomacea insularum (island apple snails)], plant identity [exotic Eichhornia crassipes (water hyacinth), or Alternanthera philoxeroides (alligator weed)}, or native [Limnobium spongia (frog's bit), or Hydrocotyle umbellata (water pennywort)], and nutrient addition [zero, low, or high]. We collected plant biomass and exotic herbivore size data after 6 weeks.

Results showed that nutrients did not have a significant effect on plants. The exotic herbivore increased in size with nutrients suggesting that nutrients can facilitate herbivore invasions by allowing it to reach reproductive maturity earlier. The growth of the herbivore varied among plant species but it did not depend on the plant's geographic origin suggesting that the herbivore will consume everything. Native plant bio mass was lower only with increasing nutrients and exotic herbivores suggesting that the herbivore could increase plant invasion success in invaded nutrient enrich habitats

Future research question: Do nutrients enhance the biotic interactions between exotic species contributing to an invasional meltdown in native communities?
[Acknowledgement: AGEP Ford Predoctoral Fellowship]

Faculty Advisor: Evan Siemann, siemann@rice.edu

GP #21
Vernal Pool Biophysical Condition and Breeding Amphibian Community: the Effect of Urbanization and Canopy Cover in Northern Alabama

Esther Morales-Vega, Alabama A & M University
Yong Wang and Timothy Baldwin, Alabama A & M University

Many amphibian communities are negatively influenced by increased urbanization and local habitat changes. The anthropogenic activities alter the biophysical and environmental conditions of amphibian breeding habitat. The objectives of this study were to assess the effect of (1) landscape change from forest to urban and (2) local habitat change of the amount of canopy cover surrounding vernal pools on pool biophysical conditions and pool breeding amphibian communities. The study was conducted at six vernal pools in forest landscape (three open and three closed canopy) in James D. Martin Skyline Wildlife Management Area, Jackson County and four urban pools (two open and two closed canopy) in Huntsville City, Madison County, Alabama.

In the summer 2009, we conducted weekly amphibian sampling using twelve cover boards, twelve PVC pipe tubes and four litter traps around each breeding pool. Amphibian larvae, metamorphs, and adults were identified and measured for snout-vent length (SLV), tail length (TL) and weight. We measured dissolved oxygen, pool area, canopy cover, pH and temperature of each pool.

Our results suggest that urbanization and canopy cover affected amphibian species richness and abundance and vernal pool biophysical conditions. Vernal pools in forested landscape had higher amphibian species richness than those in urban landscape. Urban pools had higher water pH and soil temperatures. Salamanders species occurred only at pools with closed canopy cover regardless of the landscape type. Open forest vernal pools had higher water pH probably because these pools had more macrophytes that removed carbon dioxide from the water during photosynthesis process increase.
[Acknowledgement: This study was supported by Minority Access to Research Career Program of University of Puerto Rico at Humacao; and Research Experience for Undergraduates program at Alabama A & M University, which were funded by National Science Foundation.]

Faculty Advisor: Yong Wang, yong.wang@aamu.edu

ENVIRONMENTAL ENGINEERING

GP #22
Transport and Deposition Kinetics of Nano-TiO2 in Saturated Porous Media

Itzel Godinez, University of Illinois at Chicago

Christophe J. G. Darnault, University of Illinois at Chicago

Elucidating the mechanisms of physico-chemical filtration of manufactured nanoparticles in subsurface environments is essential to assess the potential threat that nanoparticles impose to aquifer systems and public health. The present study investigated the aggregation, transport and deposition kinetics of titanium dioxide nanoparticles (nano-TiO2) as a function of ionic strength and the presence of anionic (sodium dodecylbenzene sulfonate, SDBS) and non-ionic (Triton X-100) surfactants.

The hypothesis is that the stability, mobility and deposition of nano-TiO2 in the primary and secondary energy minima are controlled by salinity and type of surfactant. Saturated laboratory-scale column experiments were conducted with solution suspensions at different ionic strengths (e.g. 0.0011 M, 0.011 M and 0.11 M). The single-collector efficiency for physico-chemical filtration in saturated porous media was applied to characterize the particle deposition and maximum transport distance of nano-TiO2 under favorable and non-favorable transport conditions. The Derjaguin-Landau-Verwey-Overbeek (DLVO) theory was utilized to calculate the total interaction energy between a particle and a collector.

The experimental results revealed that pristine nano-TiO2 underwent aggregation in suspension prior to attaining kinetic stability. The size of the nanoaggregates increased with increasing ionic strength. The addition of surfactants provided steric stabilization to the suspended nanoaggregates. The break through curves (BTC) and the DLVO profiles demonstrated that at 0.0011 M the nanoaggregates were constantly captured and released from the secondary energy minimum. This dynamic reversible process was possible due to the presence of shallow secondary energy wells. At 0.011 M nano-TiO2 deposited in both the primary and secondary energy minima. In addition, the nanoaggregates deposited in secondary energy wells were released from the soil by vanquishing the energy barrier with deionized (DI) water. At 0.11 M the release of nano-TiO2 during the flushing cycle (DI water) indicated the presence of non-DLVO forces such as hydration forces in the saturated soil system.

This point requires further investigation to properly assess the transport of nanoparticles under high ionic strength. SDBS was most effective in enhancing the transport of nano-TiO2 at 0.0011 M (Lmax 337 cm) whereas Triton X-100 was most effective at 0.011 M (Lmax 111 cm). The data presented above confirms my hypothesis. *[Acknowledgement: This study was supported, in part, by the NSF-UIC Bridge to the Doctorate Fellowship.]*

Faculty Advisor: Christophe Darnault, darnault@uic.edu

MATHEMATICS & STATISTICS

ASTRONOMY AND ASTROPHYSICS

GP #23

An Investigation in Astrophysical Gas Dynamics: Analyzing Two -Wave Interaction in Ideal Magnetohydrodynamics Using Numerical Analysis and Simulation

Marvin Q. Jones, Jr., Princeton University / North Carolina A&T State University

T.V. Zaqarashvili and B. Roberts (2006) present an interesting problem in ideal Magnetohydrodynamics. They state that it has been found that a sound wave is coupled to an Alfven wave with double the period and wavelength when the sound and Alfven wave speeds are equa. This paper presents a solution to this problem using simulation and numerical methods through Athena 1.1 (Gardiner and Stone, 2005), which is a higher order, unsplit Godunov method for ideal MHD that utilizes constrained transport to preserve the divergence-free constraint of the magnetic field. According to Zaqarashvili and Roberts, the Alfven wave drives the sound wave through the ponderomotiveforce, while the sound wave returns energy back to the Alfven wave through the parametric (swing) influence. As a result, the two waves, alternatively exchange their energy during propagation. This process of energy exchange is faster for waves with stronger amplitudes. The phenomenon can be of importance to astrophysical plasmas, included the solar atmosphere and solar wind (Zaqarashvili and Roberts, 2006). This paper will also present an investigation of the claim that the process of energy exchange is faster when waves have stronger amplitudes. *[Acknowledgement: Princeton PSURE (Princeton Summer Undergraduate Research Experience) The Leadership Alliance North Carolina A&T State University Talent-21 HBCU-UP Program.]*

Faculty Advisor: James M. Stone, jstone@astro.princeton.edu

MATHEMATICS AND STATISTICS

GP #24

Cocktail Vaccine; A New Approach to Decrease Threat of Pandemic Influenza

Romarie Morales, Arizona State University

The recurrent threat of a pandemic influenza outbreak became a reality around April of 2009, keeping most nations vigilant and making decisions that attempted to benefit each of their countries. Among these decisions was the purchase of the non-yet existent vaccine that was suppose to protect the population from the current transmitting virus. These vaccines started to be

produced after the virus had been identified, and it took around six to seven months to be dispatched to different countries. As these time passed, the spread of the virus continued. Our previous results considering cases when the basic reproductive number, number of secondary cases generated by a primary infectious case in a totally susceptible population, R0 is as high as 2, with a time delay of 30 days, the strain related vaccine will have no effect on reducing the transmission of the disease. To assist this issue, some scientists have proposed the use of a cocktail vaccine that will provide partial immunity to the individuals. Following this proposition, and with the aid of an SVIR stochastic model, we focus on the long-term effect of the vaccine. Also, using game theory techniques, we evaluate different scenarios where the individuals decide whether to use the cocktail, seasonal vaccine or free ride with and without government interventions (tax or subsidies). Finally we assess the cost (or decrease of cost) spent on the fabrication and distribution of the cocktail vaccine vs. the virus target vaccine, the economic effect of the pandemic and the overall decrease on the transmission of the virus. *[Acknowledgement: MGE@MSA AGEP]*

Faculty Advisor: Carlos Castillo Chavez, ccchavez@asu.edu

NANOSCIENCE

BIOMEDICAL ENGINEERING

GP #25
Effect of Surface Properties on the In Vitro Uptake of Iron Oxide Nanoparticles

Vanessa Ayala-Rivera, University of Puerto Rico, Mayaguez
Adriana P. Herrera, Magda Latorre-Esteves; Madeline Torres-Lugo, and Carlos Rinaldi, University of Puerto Rico, Mayaguez

Carboxymethyl dextran (CMDx) coated nanoparticles are widely used in biomedical application, but the effect of nanoparticle composition and surface charge on their colloidal stability and cellular uptake has not been assessed. Recognizing the important role that surface charge may play in cellular uptake and particle cell interaction, the present work aims to evaluate the effect of surface charge and composition of CMDx coated iron oxide nanoparticles on the colloidal stability and cellular uptake. Carboxymethyl substituted dextrans with different degrees of substitution, ranging from 38 to 5 groups per chain, and of various molecular weights were prepared and reacted by carbodiimide chemistry with amine-silane coated iron oxide nanoparticle's. Colloidal stability of these nanoparticles was evaluated by dynamic light scattering and zeta potential measurements. Results showed that decreasing the polymer molecular weight or the nanoparticle's surface charge did not affect the nanoparticles' colloidal stability at physiological conditions. CMDx nanoparticles were incubated with CaCo-2 human colon cancer cells, and nanoparticle-cell interactions were visualized by confocal laser scanning microscopy while internalized iron oxide was measured by Inductively Coupled Plasma-Mass Spectroscopy. Mechanisms of internalization were analyzed using pharmacological endocytosis inhibitors. For cells not treated with inhibitors, results showed increased internalization as the nanoparticles had increasingly negative charge. Treatment with Amiloride a fluid-phase endocytosis inhinbitor reduced the internalization of the less negatively charged nanoparticles to a statistically significant degree, while this was not the case for the more negatively charged nanoparticles. Receptor-mediated endocytosis inhibitors, Dansylcadaverine and Fillipin, were used to inhibit two different receptor-mediated internalization pathways. Dansylcadaverine and Fillipin seem to exert their most inhibitory effect on the internalization of the more negatively charged nanoparticles. Since there are no known receptors for carboxymethyl-dextran, this effect could be due to non-specific interactions between nanoparticles and serum proteins that are normally internalized through receptor-mediated pathways. These results suggest that particle-cell interactions are most likely to be charge dependent. Internalization patterns suggest that CMDx nanoparticles uptake occurs via non-specific interactions. *[Acknowledgement: This study was supported, in part, by a grant from NSF/NIRT, University of Puerto Rico, Mayaguez and by a grant from NSF/CREST, University of Puerto Rico, Mayaguez.]*

Faculty Advisor: Dr. Carlos Rinaldi, carlos.rinaldi@upr.edu

MATERIALS SCIENCE

GP #26
Investigation of Microfluidics and NEPCM for High Heat Flux Microelectronics Cooling

Julaunica Tigner, Tuskegee University

The growing demand for microelectronic systems to be smaller and faster has increased the energy released by these devices in the form of heat. Microelectronic systems such as laptop computers are not exempted from these demands. The primary, traditional technologies currently used to remove heat generated in these devices are fins and fans. In this study, traditional cooling methods were compared to more novel methods like microchannel (MCs) cooling using flowing water and cooling using phase change materials (PCMs) like paraffins with the addition of nanoparticles. Temporal and steady state data were obtained. The results of the study indicate that the fan, fin, microchannels and nanoparticle enhanced phase change materials (NEPCM) achieved cooling levels of 3°C, 6°C, 5° C, and 5°C respectively. The results obtained to date suggest that microchannel cooling and NEPCM are promising methods for cooling high heat flux microelectronic systems.
In addition to conducting experiments, this study includes analytical modeling based on assuming that the simulated

microelectronic system is isothermal and heat is lost from the system by free convection. Using these assumptions, a simple ordinary differential equation (ODE) describes the system,and integration of the ODE yields an expression for temperature as a function of time that can be compared to both the temporal and steady state experimental data. Currently, the consistency of the model with the experiments depends heavily on the assumption/calculation of the free convection heat transfer coefficient. *[Acknowledgement: This material is based upon work partially supported by the US Department of Energy under Award DE-SC0002470 and NASA/UNCF-SP]*

Faculty Advisor: Dr. Tamara Floyd-Smith, tfloyd@mytu.tuskegee.edu

MICROBIOLOGY/IMMUNOLOGY/VIROLOGY

GP #27

The Antimicrobial Effect of Metallic Nanoparticles on the Growth of Streptococcus Pneumoniae

Ronda K. Bibbs, Alabama State University
Mamie Coats, Rhonda D. Harris, Shree R. Singh, and Vida A. Dennis, Alabama State University

Streptococcus pneumoniae (pneumococcus) is an encapsulated gram-positive, catalase-negative bacterium that is associated with high mortality of children and the elderly. S. pneumoniae is the leading cause of community-acquired bacterial infections of the upper and lower respiratory tract. The high morbidity and mortality, increases in antibiotic resistance coupled with the less than optimal coverage of current vaccines point to the need for new prophylactic and treatment measures. Metallic nanoparticles are good candidates as an alternative way to treat and control the outbreak and spread of infectious pathogens including S. pneumoniae. In this current study, we hypothesize that metallic nanoparticles (gold (Au), silver (Ag), and titanium oxide (TiO2)) will have antimicrobial effects on the planktonic growth of S. pneumoniae. The size and the morphology of the metallic nanoparticles were examined by transmission electron microscopy (TEM). TEM imaging showed the relative size of gold, silver and titanium to be 20 nm, 20 nm and 15 nm, respectively. To examine the bactericidal effect in the presence of metallic nanoparticles, S. pneumoniae (1.0x103 CFU/mL) was grown in liquid media in the presence of various concentrations of nanoparticles and incubated for 5 hours. Following incubation, surviving bacteria was quantitated on blood agar plates using serial dilutions. There was a significant reduction in the survival of pneumococci grown in the presence of Ag (0.25 mg/ml), TiO2 (50 mg/ml) and Au (0.007 7 mg/ml) nanoparticles compared to controls, phosphate buffer saline (PBS). The minimal inhibitory concentrations of the nanoparticles were all to inhibit >99% of pneumococcal survival within the first hour of exposure. These data provide evidence to support the hypothesis that metallic nanoparticles exhibit antimicrobial properties that aid in the killing of S. pneumoniae. Future studies will examine the effect of the metallic nanoparticles on the development and stability of pneumococcal biofilms. *[Acknowledgement: This work was supported by NSF-CREST (HRD 0734232) to create The Center for Nanobiotechnology & Life Science Research at Alabama State University, Montgomery, AL 36104]*

Faculty Advisor: Dr. Mamie Coats, mcoats@alasu.edu

NANOSCIENCE

GP #28

Beta-Cyclodextrin/Beta-Sitosterol Inclusion Complexes as Anti-tumor Drugs

Janet V. Cowins, Clark Atlanta University

Beta-Cyclodextrin (β-CD) has been widely used as a host molecule for a variety of guest molecules. While the exterior of this molecule is hydrophilic because of the primary and secondary hydroxyl groups on the upper and lower perimeter of this moiety, the interior of the β-Cyclodextrin is hydrophobic. β-Cyclodextrin is soluble in water. Therefore, β-Cyclodextrin is an ideal carrier of hydrophobic drugs. Additionally, functionalization of β-Cyclodextrin with appropriate groups permits site specific drug delivery. We hypothesize that the β-Cyclodextrin-PEG-Folic Acid (β-CD-PEG-FA)/Beta-Sitosterol bio-conjugate will be an efficient, tumor-specific complex for drug delivery. Since most tumor cells over-express folic acid, inclusion of folic acid in the construct will direct phytosterols to tumor sites. To understand and determine the stability of the β-Cyclodextrin/Beta-Sitosterol non-covalent conjugates or 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 resonance shift of β-CD protons as the concentration of Phytosterol is increased. NOESY (Nuclear Overhauser Effect Spectroscopy) NMR studies suggest that most of Beta-Sitosterol was encapsulated in the β-CD cavity, as evidenced by cross peaks between Beta-Sitosterol hydrogens and the hydrogens inside β-CD's cavity. Additionally, FT-IR and DSC studies also indicate the formation of stable β-Cyclodextrin/ Beta-Sitosterol inclusion complexes. The initial studies suggest that the complexes have potential as anti-tumor drugs. *[Acknowledgement: National Institute of Health]*

Faculty Advisor: Dr. Ishrat Khan, ikhan@cau.edu

GP #29

Preparation of Poly(styrene sulfonate-sodium)-block-poly (ethylene oxide)/LDH (layered double hydroxide) Complexes as Drug Delivery Vehicles

LaDena Holley Bolton, Clark Atlanta University

Ishrat Khan, Clark Atlanta University

Delivery of bio-active molecules to cellular membranes by functionalized nanoparticles is an emerging area of therapeutic research. The advantages of nanoparticles include having functionalities that permit the targeting to specific tissues and cells as well as the added control over their dimensions in order to maximize therapeutic efficiency. In this study we are developing a series of water soluble nanoparticles for drug delivery. We are testing the hypothesis that these nanoparticles as complexes of poly(styrene sulfonate-sodium)-block-poly (ethylene oxide)/layered double hydroxide (LDH) will serve as efficient complexes for drug delivery to cells. The block copolymers are prepared by the hydrosilylation of the Si-H functionalized polystyrene with allyl functionalized poly (ethylene oxide). The Si-H functional polystyrene is prepared by anionic living polymerization. So far we have prepared four pure block copolymers. The nanosized LDH is prepared by co-precipitation and hydrothermal treatment. The complexes are prepared by the direct intercalation of the di-block copolymers into the interlayer of the nanosized LDH. Our preliminary studies indicate that LDH/organic copolymer hybrids or complexes increase in water solubility and thermal stability with a decrease in PSS/PEO ratios. Our current work is targeted to develop an understanding of the specific properties (physical attributes and functional properties) of the complexes and to translate this understanding into developing an efficient framework for targeted cancer therapeutics. Our future work focuses on the competitive intercalation of the various block copolymers, defining LDH specificity for a given copolymer composition.

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Faculty Advisor: Ishrat Khan, ikhan@cau.edu

GP #30
Donor-Acceptor Pyrene Alkylamide Derivatives Affinity for Metallic Carbon Nanotubes and Graphene

Chantel I. Nicolas, Clark Atlanta University

It has long been understood that single-walled carbon nanotubes (SWNTs) have unique electronic properties that are characterized by their (n, m) chiralities. However, as prepared, SWNTs typically are a 2:1 ratio of semiconducting (sem-) to metallic (met-) SWNTs. These bundles of SWNTs are ineffective in various electronics applications owing to the variety of properties that exist in a mixture of sem- and met- SWNTs. Therefore, an effective dispersion method is required in order to separate these bundles into SWNTs of similar type characteristics so that their qualities can be focused effectively towards their respective applications. While it has been shown that large aromatic molecules can preferentially suspend met-SWNTs, the investigation of the effect of functional groups on selection mechanism is lacking. Three pyrene alkylamide derivatives that differ by alkyl chain length have been shown experimentally to separate SWNTs according to electronic structure and diameter: PA-18-C-6, PB-18-C-6 and PC-18-C-6. Using tight-binding density functional calculations, we investigated the interactions between these pyrene derivatives and SWNTs. Binding energies of each pyrene alkylamide derivative interacting with SWNTs within the 0.8-1.2nm diameter range were calculated. Results, which are in accordance with previous experimental work, show that PA-18-C-6 is selective towards SWNTs with diameters less than 1.0nm, while PB-18-C-6 and PC-18-C-6 are selective towards those with diameters that are greater than 1.0nm. These results along with recent data from our charge transfer analysis led us to hypothesize that there exist distinctive charge-transfer behavior exhibited by these derivatives. This computational approach provides a way to effectively investigate the spontaneous self-assembly of molecules onto the sidewalls of SWNTs and graphene. *[Acknowledgement: 1. NSF CREST; 2. AFRL; and 3. NIH MBRS RISE]*

Faculty Advisor: Xiao-Qian Wang, xwang@cau.edu

PHYSICS

NANOSCIENCE

GP #31
Movement of Polystyrene Beads in Ficoll Solutions

Elton Jhamba, Delaware State University
Martha Gwengi, Danielle Ferguson, and Hacène Boukari, Department of Physics and Pre-Engineering, OSCAR Center, Delaware State University
Ralph Nossal, NICHD, National Institutes of Health, MD

We apply fluorescence confocal microscopy to monitor movements of fluorescent polystyrene beads embedded in solutions of nonfluorescent Ficoll (MW=70 kDa; diameter~ 11 nm). Ficoll is a neutral, highly-branched, hydrophilic polysaccharide, commonly considered as a spherical nanoparticle and used for studying the effects of crowding on the structural and dynamical properties of biomacromolecules and other substances. Here our focus is on the interplay between the size of the polystyrene beads and the relevant mesh size(s) of the host Ficoll polymeric solutions. We measured the movements of the beads (50nm, 100nm, 500nm, 5µm) in varying concentrations of Ficoll (up to 1.2g/ml). Using a Leica

TCS SP5 microscope, we acquired time-lapse images from the samples (ficoll+beads) over short times (~10 seconds) to track the local movements of the beads. Analysis of the data suggests that the basic Ficoll nanoparticles are not hard spheres. Rather, entanglements between the Ficoll polymers occur and are necessary to explain the volumetric occupancy of the polymers in water. Particle-tracking analysis of the images indicates that the diffusion of the polystyrene beads depends on the concentration of Ficoll, allowing us to assess changes in the viscoelastic properties of the solutions as a function of the concentration. We compare the present results with those obtained from dynamic light scattering. *[Acknowledgement: OSCAR, NIH, CREST, Delaware State University]*

Faculty Advisor: Dr. Hacene Boukari, hboukari@desu.edu

Physics (not Nanoscience)

GP #32
Photothermal Lens Spectrometryof Turbid Samples

Isaac Basaldua, Delaware State University
Aristides Marcano and N. Melikechi, Delaware State University

Photothermal spectrometry is currently being considered for imaging and microscopy studies of complex turbid biosamples as an alternative to photoacoustic and fluorescence methods. Previous studies report that the photothermal signal is not affected by the presence of turbidity since it measures the amount of heat deposited in the sample as a result of the absorption of light. However, these studies are limited to samples with turbidity coefficients below 1 cm-1. Real biosamples, like human skin, exhibit turbidity values above 10 to 100 cm-1. In this study, we perform photothermal lens experiments in samples with turbidity above 1 cm-1. The experiments are conducted using a pump-probe photothermal lens scheme. As pump light, we use 100 mW at 800 nm from a Ti -Sapphire laser pumped by a 10 W second harmonic Nd-YAG laser. As probe light, we use 1 mW CW radiation at 632 nm from a He-Ne laser. The samples are water solution of latex microspheres of different diameters at concentrations that simulate a high turbidity environment. Photothermal responses of the samples at CW and femtosecond regimes are investigated. We show that the signal increases slightly between 20 to 40% up to values of turbidity of 4 cm-1.

We associate this effect to the increase of effective propagation distance of the pump light due to multiple scattering in the samples. For turbidity above 4 cm-1, the photothermal signal decreases. We understand this effect as the result of decrease of the thermal gradients due to the absorption of the scattered field. However, a measurable signal can still be detected for samples with turbidity values around 8 cm-1 for which reduction of the intensity of light related to turbidity is more than three orders of magnitude. Future studies should demonstrate the possibility of using the photothermal methods for imaging applications of biosamples with turbidity above 10 cm-1. *[Acknowledgement: This research has been supported, in part, by a grants from NSF/CREST and from NASA URC programs awarded to Dr. Noureddine Melikechi, Director of the Center of Applied Optics for Applied Research, Delaware State University, Dover, Delaware.]*

Faculty Advisor: Aristides Marcano Ph.D., amarcano@desu.edu

Technology & Engineering

Biomedical Engineering

GP #33
Patient-Specific Analysis of the Cerebral Vasculature

Griselda Cardona, University of California, Berkeley

Stroke patients only have a three-hour window where physicians can use blood thinners because too little information is known on the safety and efficacy of blood thinners. Thus, it is imperative to expand that window by providing physicians with a more patient-specific overview of the time-varying risks of a stroke through a fluid analysis of the patient's brain. As of now, in order to ultimately provide patient-specific analysis, a patient's Computerized Tomography (CT) scan will undergo an automated image process of segmentation (isolating the cerebral vasculature), skeletonization (extracting the centerline from the segmented image), geometric measurement, and mapping into a 1D space. With the segmentation process partially automated, the focus of this project is to identify the difficulties in automating the skeletonization process by manually skeletonizing a patient's Circle of Willis.

The method to manually skeletonize the arteries along one major axis consists of extracting the centerline by taking the plane perpendicular to that artery and locating the center point. For example, if an artery was predominantly along the Z-axis, the X-Y axis is examined. Furthermore, for arteries with curvature along the three axes, extracting the centerline was completed by analyzing two different views of that artery and matching the points. For example, extracting center points from the X-Y axis separately from the Y-Z axis and matching them according to the Y points.

The completion of the manual skeletonization revealed that the difficulties in automating the skeletonization process would lie in the internal carotids and in the posterior cerebral arteries due to their curvature in the three axes. Most importantly, the manual skeletonization also highlighted the missing communicating arteries in the patient's Circle of Willis, which prompted the need to characterize the results through a literature review for comparison and verification of possible anomalies. The literature review addressed the high possibility

of a patient missing arteries, but an even higher possibility of a patient having hypoplastic arteries (vessels less than 1 mm in diameter). Therefore, if a patient's artery is less than 1 mm, and a pixel size is 0.5 mm, the thin arteries could have been disregarded during the segmentation process. Thus, as the project moves towards a more automated system, an assessment of the current imaging process must be done to avoid returning to previous steps. *[Acknowledgement: UC LEADS, CAMP, WiSE (Women in Science and Engineering)]*

Faculty Advisor: Tony M Keaveny, tmk@me.berkeley.edu

Civil/Mechanical/Manufacturing Engineering

GP #34
The Prater Bridge Over the Danube in Vienna: Construction, Repair, Widening, and Maintenance Issues

Rodrick Evangelist, Drexel University/University of Technology at Graz

In today's society, the idea of keeping up with maintenance is a number one priority when constructing new structures and materials. Bridges are a major aspect within our infrastructure system that needs to be carefully monitored. Bridge maintenance is undertaken to extend the life of the structure and to ensure that it functions as designed, thus ensuring public safety. This research project deals with the construction, repair, widening, and maintenance issues of the Prater Bridge that spans across the Danube River in Vienna, Austria. The Prater Bridge, originally called The Fourth Danube Bridge, has a rich history of construction complications.The purpose of this study is to develop an understanding of the complex load-carrying history of this bridge, which suffered an almost-collapse due to local plate buckling during erection in 1969 and was later strengthened and widened by one traffic lane in 1996.

Today, the bridge is suffering from local deterioration in welds and bolts in the areas affected by the 1996 refurbishment.The approach in this project was to design and model the Prater Bridge using RSTAB3D, which is a German beam finite element software program. The program showcased the stresses and strains, moment distributions, deformations, internal forces, and such of the Prater Bridge just prior to the buckling event of 1969. The "Elastic Buckling of Plates" (EBPlate) software program which calculates accurate values of elastic critical stresses for plates was used in determining the buckling stresses of the stiffened lower box plate of the bridge.

Additionally, the software ABAQUS was used to build a detailed shell-element model of the region currently affected by local cracking in welds. The results of FEM-calculations using this model were compared with strain measurements on the actual bridge. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Dr. Harald Unterweger, h.unterweger@tugraz.at

GP #35
Synthesis and Characterization of Mobile Phase Parameters using Hydrogel Membranes with Metal Affinity for Protein Purification

Dawn Harrison, Prairie View A&M University
Dr. Felecia Nave and Dr. Audie Thompson, Prairie View A&M University

Hydrogels are currently being used as an alternative to the conventional separation process for biological molecules. They have the potential to be used for artificial organs, controlled release devices and bioseparation processes. Prospective uses for hydrogels are great, but they have limited selectivity between proteins of similar size and have low protein loading. To combat this problem, we will combine the smart polymer, polyvinyl alcohol (PVA), with the metal ion Ni2+. We have demonstrated that the metal affinity ligand, Cu2+, had a significant impact on the solubility and transport properties of chicken egg white lysozyme. We are functionalizing a PVA membrane with the metal nickel and will investigate the solubility as well as the diffusion of lysozyme.

In further studies we will purify the soluble protein R. sphaeroides Cox11p expressed by taking advantage of histidines attraction for nickel on the functionalized membrane. The membrane consists of the PVA hydrogel connected to a spacing element (1, 4-Butanediol diglycidyl ether (1, 4-BDE), which serves as a covalent connector between the hydrogel and the metal chelating ligand, iminodiacetic acid (IDA). 1,4BDE was chosen in previous research because of its length and reactivity with PVA and the chelating ligand. The chelating ligand IDA was chosen because it is a tridentate chealtor requires simple preparation, and is reliable. The metal ion nickel was chosen because when attached to the chelating ligand IDA it is a good separator for histidyl proteins and has been shown to be the preferred metal ion in conventional affinity chromatography.

Our study enhances the preparation of metalloproteins for characterization and metal binding studies. The impact of reaction conditions on the degree of functionalization, solubility, and transport properties of R. sphaeroides Cox11p in the membrane will confirm that metals engrafted in PVA provide selective means to isolate a protein. The project shows how metal affinity hydrogel membranes enhance protein solubility, and purification of a metalloprotein with less contamination than other chromatography processes. The isolation of a recombinant soluble protein will allow continuous studies on metal binding and lead to advancement of hydrogel membranes for protein purification. In conclusion, incorporation of metal affinity ligand provides a selective means to increase the R.shaperiodes Cox 11 loading and control release properties

thus producing a better product than before. *[Acknowledgement: Dr. Felecia Nave, HUBCU-UP]*

Faculty Advisor: Dr. Felecia Nave, fmnave@pvamu.edu

GP #36
Merge Ratios at Active Merge Bottlenecks

Paulina Reina, Arizona State University

Merges are common features of freeways and significantly affect the performance of networks particularly in congestion. It is known that merging traffic induces systematic lane-changing maneuvers that often instigate congestion and stop-and-go traffic. Therefore, merge behavior, more precisely the interactions between conflicting streams, is a key component of predicting the onset and evolution of congested traffic.

The existing merge model by Newell and Daganzo assumes that vehicles from conflicting traffic streams merge in a fixed ratio when both merging streams are queued. Previous experimental studies show that the real merge behavior in congestion conforms to the merge model very well; in particular, empirical merge ratios agree with the assumption of a fixed merge ratio when merge outflows are restricted by queues. In the present project, data from two freeways in California unveil the merge behavior at active bottlenecks in comparison to fully congested merges. An active merge bottleneck is present when both incoming approaches are congested and downstream of the merge traffic is freely flowing. In contrast, a fully congested merge is present when both upstream and downstream locations are congested.

Four conditions were considered to locate suitable merge sites. The first condition is that both upstream approaches must be congested so that merge ratios can be measured. The second is that each site must behave as both an active merge bottleneck and a fully congested merge at different time periods. The third is that no ramp-metering must be present since this would restrict the inflows and thus the merge ratio. The fourth condition is that traffic flow is conserved between the upstream measurement locations and the merge.

The results show that when merges were fully congested, the merge ratios were (nearly) fixed. However, when the merges were active bottlenecks, the merge ratios decreased as the bottleneck discharge flow increased. Findings from this study provide important insight related to merge dynamics at an active bottleneck. However, future investigations are recommended on several different fronts.

As discussed above, merge geometry seems to play an important role in the merge behavior and should be systematically investigated with more merge sites and data. Moreover, lane utilization can also affect merging dynamics. Research on these issues is ongoing. *[Acknowledgement: Bridge to the Doctorate Fellowship]*

Faculty Advisor: Soyoung Ahn, soyoung.ahn@asu.edu

Computer Science & Information Systems

GP #37
User Research of an Educational Web-Based Learning Environment: Preliminary Findings and Experiences

Candice H. Adams, Auburn University

With the popularity of the Internet rising, there are many new types of web-based applications being introduced daily, such as social networking sites (i.e. Facebook), online gaming (i.e. World of Warcraft), and simulations sites (i.e. SecondLife). Middle and high school age students spend countless hours immersed in online sites such as the ones mentioned above. Technology has the power to transform the level of education provided by secondary schools because it facilitates an environment that can be tailored to each student. Web-based learning environments provide a low cost and effective way to deliver and engage students in a particular subject. 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.

This poster presents the usability research results of the ChemiNet application. We had 21 students participate in our study. The research focused on the preference between web-based learning and traditional learning in terms of accessibility to instructional material, ease of use, and ability to focus on material. For comparison purposes, participants compared a course in the program they were involved in to that of the course taught through the web-based learning environment.

The responsiveness of the website during the study appeared to be at 100%, indicating that all participants were able to navigate through the application in order to evaluate their experience of using the web-based environment. Regarding the usability of the computer workstation, over 90% of the users felt comfortable with using a computer for general use. This percentage was taken into consideration when evaluating the results for the web-based learning environment. Based on the results from the survey, a majority of the student felt they prefer web-based learning over traditional learning. These results as well as future research in the area of web-educational technology will be discussed.

Faculty Advisor: Cheryl Seals, sealscd@auburn.edu

MATERIALS SCIENCE

GP #38
Surface Heating of Iron Oxide Nanoparticles in Alternating Magnetic Fields

Liliana Polo-Corrales, University of Puerto Rico-Mayaguez

Biomedical applications such as magnetic fluid hyperthermia (MFH) and magnetically triggered drug release are enabled by the dissipation of energy in the form of heat when magnetic nanoparticles are exposed to an alternating magnetic field (AMF). The present study reports indirect measurements of the surface temperature of iron oxide nanoparticles in an alternating magnetic field (AMF) through the temperature induced change in fluorescence of a thermoresponsive/ fluorescent polymer consisting of poly(N-isopropyl acrylamide) (pNIPAM) copolymerized with a fluorescent modified acrylamide (FMA) monomer whose fluorescent intensity increases as its surroundings change from hydrophilic to hydrophobic. The pNIPAM-co-FMA coated IO nanoparticles were concentrated to 1% w/v (magnetic core) in water. The fluorescence intensity and the sample temperature were measured using an optical fiber probe and a fiber-optic thermometer respectively during external heating in a range of temperature of 25 to 60°C and alternating magnetic field heating at 38.4 kA/m and 233 kHz for ten minutes. This study revealed that when the particles are subjected to external heating the fluorescence remains constant up to about 35°C, above which it increases. When the nanoparticles are exposed to an alternating magnetic field the fluorescence intensity increases immediately, even when the medium temperature is below 35°C. This suggests that the nanoparticle surface temperature increases to above 35°C immediately upon application of an alternating magnetic field and is higher than the temperature of the surrounding medium. Current work is focusing on the study of the change in fluorescence intensity of free pNIPAM-co-FMA and monitoring the fluorescence intensity at different AMF power *[Acknowledgement: NSF NIRT grant CBET-0609112 NSF CREST grant HRD-0833112]*

Faculty Advisor: Carlos Rinaldi, carlos.rinaldi@upr.edu

SOCIAL SCIENCES/PSYCHOLOGY/ECONOMICS

GP #39
Exploring Empirical Guidelines for Selecting Computer Assistive Technology for People with Disabilities

Jennifer Border, Wright State University, OH

Accessing a computer workstation for numerous hours of typing is a critical part of completing work for all students. Often students access the computer to type using a traditional QWERTY keyboard, which over time can cause pain and develop into repetitive motion injuries (RMI). Ergonomic technologies are available that students can use to reduce the occurrence of pain and RMIs. However, it is a difficult and complex process to select just a few options due to the numerous options available and specific needs of each student. This process is similar to the process people with disabilities (PWD) have to go through when selecting assistive technologies (AT) that enable them to access the computer due to limitations caused by their disability.

This study examines the process one PWD with a RMI goes through to select new AT for herself, a discovery of important quantitative and qualitative AT characteristics, and implications for improving AT selection for a general population of PWD are made.

In the first part of the study, a series of two different typing sessions were completed by three different AT: voice recognition (VRS), head tracker (HT), and brain computer interface (BCI)). The first session consists of a typing test and the second session is a journal response. In the second part of the study, only journaling sessions occur using VRS and the PWD's traditional typing method (stylus on a touch screen). Quantitative (typing speed and AT errors) and qualitative (types of frustrations) data was collected for both parts. AT errors were not corrected or collected in the data for the second part of the study. VRS had the fastest typing speed and the least occurring frustrations. HT had an average typing speed and the least frustrating cursor control. BCI had the slowest typing speed and caused the most frustrations. For the current PWD, she selected a combination of VRS and HT AT. Her results provide implication to the general population of PWD that when selecting AT, the AT should meet a specific set of requirements that are important to the PWD. Future studies can examine whether the requirements for the case study PWD are the same or similar to the requirements for the general population. *[Acknowledgement: This study was supported by an NSF IGERT grant awarded to Wright State University (WSU), P.I. Dr. John Flach, Department Chair of Psychology, Dayton, OH 2006.]*

Faculty Advisor: Dr. Wayne Shebilske, wayne.shebilske@wright.edu

GP #40
Sustainable Fleet Management Plan on NMSU Campus

German Reyes, New Mexico State University
Dr. Hansuk Sohn, New Mexico State University

A fleet management plan on university campuses has been a major issue in an ever tightening budget environment. We present an integer programming model which minimizes the net cost of the campus transit service system without compromising service quality. Our discussion also includes the sensitivity analysis which will help the fleet management planners to carry

out more flexible and effective decision making than have been previously possible. *[Acknowledgement: National Science Foundation]*

Faculty Advisor: Hansuk Sohn, hsohn@nmsu.edu

WATER

GP #41
Mass and Momentum Exchange Between Main Channel and Floodplains in Open Channels with Submerged Vegetation

Abdou Harissou Ouro Bang'na Nassam, University of New Mexico

Countless scientific studies have demonstrated that the presence of riparian and channel vegetation in streams has numerous positive impacts on the system. These include improved water quality, the creation of regions of minimal bed stress that favor promotion of sedimentation and particle retention, increased habitat diversity which in turn favors species diversity. However, there are limited studies within this field that show how channel and riparian vegetation can also have substantial impacts with respect to channel hydraulics due to increased flow resistance and reduced effective flow area. This results in a reduction in conveyance capacity, slowing of the passage of peak flows during flood events.

This research was undertaken to investigate the fluid mechanics of flow/vegetation interactions, with an emphasis on the main channel/floodplain boundary. The results of this work contribute knowledge to the hydrology community and increase understanding of the dynamics of streams, which help to resolve issues in river restoration, aquatic habitat management, and flood risk reduction. In addition, this project helps to characterize the interface between main channel flow and the floodplain.

The research was conducted in an 8m x 1m flume. Artificial vegetation elements with various geometric properties have been used to study bulk flow and turbulence characteristics using Acoustic Doppler Velocimeter measurements. A particular focus was placed on the creation of the shear-layer at the interface of the flow and floodplain because the shear layer once formed has tendency to create vortices by Kelvin-Helmholtz instability.

This study also sought to test the hypothesis that the penetration of the momentum into the floodplain will eventually reach an optimum length as the riparian zone on the floodplain gets denser which will eventually act like a wall. These vortices are a driving force for mass and momentum transfer phenomena as they travel in and out of the floodplain. All of these factors had a great deal of influence on stream hydraulics. The average velocities of all three dimensions were estimated. Turbulent kinetic energies as well as shear stresses were also characterized. Preliminary results show a formation of a variety of turbulent characteristics at the interface of the main flow and floodplain proving our hypothesis. *[Acknowledgement: Thanks to NSF/LSAMP BD VIII Program funds, University of New Mexico, USA for the support of this study.]*

Faculty Advisor: Mark Stone, stone@unm.edu

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A

B

C

Abstract Index

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

Y

Z

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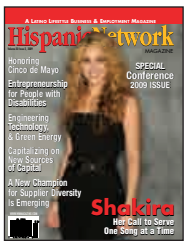

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SACNAS

Summer Leadership Institute

Postdocs and Professionals

The SACNAS Summer Leadership Institute provides premier training for motivated underrepresented minority (URM) scientists who wish to master the skills necessary to lead institutional transformation. Developed in collaboration with the American Association for the Advancement of Science (AAAS), the Summer Leadership Institute is an intensive five-day course featuring small group exercises, keynote speakers, leadership development planning, networking opportunities, and extensive community building among selected participants.

Participants will engage in a comprehensive curriculum led by the director of the institute, **Dr. Joseph Garcia**, Bowman Distinguished Professor of Leadership Studies and Director of the Karen W. Morse Institute for Leadership Western Washington University. Along with co-facilitators **Dr. Donna Blancero**, Associate Professor of Management, Bentley University and **Mr. Richard Weibl**, Director, Center for Careers in Science and Technology at the American Association for the Advancement of Science.

When: July, 2012
Where: Washington, DC
Who: 30 applicants
Online Application opens: January, 2012

Sample Sessions:

- Building and Maintaining High Performance Teams
- Challenges for People of Color in Leadership Roles
- Decisions Making and Delegation Skills
- Creating a Leadership Development Plan (LDP)
- Management and Conflict Resolution

Eligibility:

- Must be a SACNAS Member by the time of the institute
- PhD required, all STEM fields welcome (no graduate students)
- Postdocs and professionals in academia, corporate, government, and non-profits are invited to apply
- Must be in the United States at time of the Institute.

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For more information:
Yvonne Rodriguez, PhD, Director of Programs
yvonne@sacnas.org ■ http://sacnas.org/events/leadership
Tel. 831-459-0170 ■ Fax 831-459-0194
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