13th Annual Research Conference

Education and Research: Parallel Paths to Excellence

Holiday Inn Downtown
Knoxville, Tennessee
February 25-26, 2016

Program Book
The goal of the Tennessee Louis Stokes Alliance for Minority Participation (TLSAMP) program is to increase the enrollment and graduation rate of underrepresented ethnic minority students (Hispanic, African-American, American-Indian, Alaskan Native, and Pacific Islander) in science, technology, engineering and mathematics (STEM) by at least 100% at the end of the five-year period. The objectives to support the goal of the alliance are to:

I. recruit underrepresented students to pursue science or engineering as a career;
II. improve the quality of the learning environment for underrepresented science and engineering students at all schools; and
III. ensure that a larger number of undergraduate students are prepared to enter graduate programs.

The TLSAMP leadership team includes the following individuals:
Welcome Messages
 Lonnie Sharpe ................................................... 3
 Jimmy G. Cheek ................................................... 4
 Rickey Hall .......................................................... 5
 Carolyn Hodges .................................................. 6

Conference Schedule .......................................................... 7

Presenter Biographies
 Howard Adams .......................................................... 8
 Robert Nobles .......................................................... 8
 Carols Beane ........................................................... 9
 Regina Hairston ........................................................... 9
 Rickey Hall ............................................................. 9
 Carolyn Hodges ......................................................... 10
 Kelly Holley-Bockelmann ........................................ 10
 John Hopkins ........................................................... 11
 Sherry Painter ........................................................... 11
 Craig Pickett ............................................................ 11
 Masood Parang ......................................................... 12
 Ashley Redix ............................................................ 12
 Lonnie Sharpe ......................................................... 12
 Desmond Stubbs ......................................................... 13
 Mimi Thomas ............................................................ 13

Abstracts
 Fisk University .......................................................... 14
 LeMoyne-Owen College .............................................. 15
 Middle Tennessee State University ............................. 16
 Tennessee State University ......................................... 16
 Tennessee Technological University ........................... 19
 University of Memphis ............................................... 20
 University of Tennessee, Knoxville ............................ 21
 Vanderbilt University .................................................. 22

Networking/Graduate Fair Participants ................................. 24

Acknowledgements ......................................................... 25

Map ................................................................................. 26

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Dear 2016 TLSAMP Participants:

It gives me great pleasure to welcome you to our 13th Annual Research Conference, focusing on “Education and Research: Parallel Paths to Excellence.” As the Executive Director of the Tennessee Louis Stokes Alliance for Minority Participation (TLSAMP) program, I am pleased that you have decided to attend this memorial event. We honor the presence of each and everyone one of you; especially our student research presenters. We also have some special graduate students with us as well. TLSAMP has been fortunate in receiving our first Bridge-to-the-Doctorate (BD) award. Our BD is being hosted by Vanderbilt University. I also want to welcome these students as well.

Our students have put forth a tremendous amount of time and effort to make these presentations at this research conference. Some have worked at research laboratories over the summer, while others have worked directly with the faculty and graduate students at our institutions. Please give them your undivided attention. Additionally, please ask questions to learn more about research opportunities across the Alliance. I am sure that each of you will enjoy seeing and hearing about the work of our faculty and students. We urge all of you to consider participating in a research project and think about making a presentation next year.

As you know, one of our goals is to increase the number of students who attend graduate school. We urge you to visit with the graduate school representatives that are present at this conference. The institutions here today have fellowship, research, and teaching funds to support the students at the graduate level. Please seek them out and continue your life-long learning process.

We are grateful to the faculty, staff, and administrators of the University of Tennessee – Knoxville for hosting this event. We hope you have a great time at the conference and I personally want to thank you for your participation.

Sincerely,

Lonnie Sharpe, Jr., PhD, PE
Massie Chair of Excellence
TLSAMP Executive Director
Dean, Life and Physical Sciences
February 25, 2016

Dear Tennessee LSAMP Conference Participants:

On behalf of The University of Tennessee, Knoxville, it is my pleasure to welcome you to the National Science Foundation Tennessee Louis Stokes Alliance for Minority Participation 13th Annual Research Conference.

Here at UTK we are actively working to enhance our own institutional excellence and have embarked on a quest to become a top 25 public research university. We are not undertaking this quest for prestige or notoriety, but rather our objective is to expand the UTK contribution to state and national economic growth by enhancing the quality of our education and further developing our research capabilities. The payoff will be great as we progress toward top 25 status, but the most rewarding part will be the journey itself. The improvements we make, and what they mean to our students and our state, are far more important than where we end up on any ranking list.

As you know, the TLSAMP program you are participating in promotes research and interactive learning and helps to remove obstacles that impede the progress of minority students. The primary focus of this conference is to support our students to obtain undergraduate and graduate degrees in STEM disciplines. It will not only provide opportunities for you to explore new and emerging areas in STEM disciplines but it will also provide an important networking forum for the exchange of ideas.

I congratulate the young scholars who will be presenting their undergraduate research at this conference and extend my best wishes to all the attendees. As a fellow STEM major, I encourage you to pursue a graduate degree and hope you will have a positive experience at the conference.

Sincerely,

[Signature]

Jimmy G. Cheek
Chancellor
Welcome to the Tennessee Louis Stokes Alliance for Minority Participation 13th Annual Research Conference!

The University of Tennessee, Knoxville is pleased to collaborate with the nine other Tennessee colleges and universities involved in TLSAMP, and host the conference in Knoxville, Tennessee.

During this conference, participants will learn about student research projects, be exposed to STEM graduate programs, and have the opportunity to network with students, faculty, staff, administrators, and professionals in the areas of STEM.

We are honored to have Tennessee’s talented and capable STEM students in attendance.

While you are at the retreat we want you to:
  • Enjoy yourself!
  • Be an active recipient of information from presenters and STEM professionals.
  • Connect with peers at other Tennessee institutions.
  • Find graduate school programs that excite and interest you.

The University of Tennessee is committed to assisting in nurturing and identifying future leaders in the fields of science and engineering. Our support of the UT TLSAMP staff and this conference is one of the ways we show that commitment.

Best wishes for a stimulating conference and a successful academic year!

Sincerely,

[Signature]

Rickey Hall
Vice Chancellor for Diversity and Inclusion
Dear Conference Attendees,

I am delighted to extend to you my warmest welcome to the University of Tennessee Knoxville! Your participation in this research conference is an important step in your academic and eventual professional career, because it is just one of the many ways to plan for success. It is always a profound pleasure for me to meet and engage with so many bright and talented students who represent the next generation of researchers, teachers, and leaders in business and industry and whose creative thoughts and contributions will play key roles in our future.

I also want to welcome and thank all of those faculty and staff members, administrators, and other educational professionals who are participating in the conference to support the students and who have had a hand in guiding and shaping their dreams.

The Tennessee Louis Stokes Alliance for Minority Participation (TLSAMP) Program has an impressive history of success measured by the impact it has had over the years in broadening participation of underrepresented students in the STEM areas of science, technology, engineering, and mathematics. The TLSAMP collaborative demonstrates its commitment to continuing and enhancing that goal with this year’s conference theme, “Education and Research: Parallel Paths to Excellence.”

The conference offers a wealth of information and variety of speakers, posters, and demonstrations intended to heighten your interest and awareness about preparation for graduate education and professional opportunities to consider as you chart your future in a STEM discipline. I invite you to participate in as many events as possible; the activities will not only offer a great deal of useful information but also will provide an excellent opportunity for you to network. I wish all of you the very best in the future and am confident that you will gain insights that will even more strongly confirm your commitment to advanced study and research.

Sincerely,

Carolyn R. Hodges, PhD
Professor of German
University of Tennessee, Knoxville
Tennessee Louis Stokes Alliance for Minority Participation
13th Annual Research Conference
Education and Research: Parallel Paths to Excellence
Holiday Inn Downtown Knoxville, TN
February 25-26, 2016

Thursday, February 25, 2016

2:00–4:00 p.m.  Registration and Check-in
Luggage Bus Un-Loading

3:00 p.m.  Poster Presentation Setup (Grand Pavilion Ballroom)
Networking/Graduate School Fair Setup (Park View Lobby)

4:30 p.m.  Poster Presentation Judges Meeting (Parlour Room 6)

5:30–7:00 p.m.  Welcome Dinner (Grand Pavilion Ballroom)
   Moderator: Craig Pickett
   Conference Welcome: Dr. Lonnie Sharpe
   University Welcome: Vice Chancellor Rickey Hall
   Dr. John Hopkins
   Introduction of Speaker: Mimi Thomas
   Speaker: Dr. Desmond Stubbs
   International Research Highlight Presentation

7:00 - 8:30 p.m.  Networking/Graduate School Fair (Park View Lobby)
Engineering and Science Poster Session (Grand Pavilion Ballroom)
Judging for poster sessions starts at 7:30 p.m.

Friday, February 26, 2016

7:00–7:45 a.m.  Hotel Check-out/Luggage Bus Loading

7:30–8:30 a.m.  Breakfast (Grand Pavilion Atrium)

8:30–9:45 a.m.  Opening Plenary Session (Grand Pavilion Ballroom)
   Moderator: Dr. Carlos Beane
   Introduction of Plenary Speaker: Regina Hairston
   Opening Plenary Speaker: Dr. Robert Nobles
   Bridge to the Doctorate: Dr. Kelly Holley-Bockelmann

9:00–9:45 a.m.  Oral Presentation Judges Meeting (Parlour Room 7)

10:00–11:30 a.m.  Oral Presentations – Group 1 (Crystal Room)
   Science

10:00–11:30 a.m.  Oral Presentations – Group 2 (Parlour Room 6)
   Engineering

10:00–11:30 a.m.  Oral Presentations – Group 3 (Parlour Room 1)
   Science

11:45 a.m.  Group Picture (Knoxville Amphitheater)

Noon–2:00 p.m.  Closing Luncheon (Grand Pavilion Ballroom)
   Moderator: Dr. Masood Parang
   Conference Welcome: Dr. Carolyn Hodges
   Introduction of Keynote Speaker: Dr. Sherry Painter
   Keynote Speaker: Dr. Howard Adams
   Poster and Oral Competition Awards: Ashley Redix
   Closing Remarks: Dr. Lonnie Sharpe
Robert Nobles serves as the Assistant Vice Chancellor for Research at the University of Tennessee, Knoxville, and has a faculty appointment in the Department of Public Health within the College of Education, Health, & Human Sciences.

Nobles joined UT in 2013 with the intent of enhancing the research infrastructure to support faculty and students in their scholarly pursuit of research answers. In his current capacity, he leads efforts and oversees research compliance activities related to the responsible conduct of research, research with human subjects and animals, work with biological and radiological hazards, research conflicts of interest, export controls, and research misconduct.

Nobles also serves as the co-investigator on a 5-year $4.9 million NIH award for the Program for Excellence & Equity in Research (PEER); and chairs the UT institutional compliance committee, campus safety committee, and Commission for Blacks. Before coming to UT, Nobles served as the research compliance officer and public health faculty member at both Texas A&M University and the University of Texas Health Science Center in Houston. Prior to his career in academia, Nobles served as a public health prevention specialist for the Centers for Disease Control and Prevention (CDC) and as a program manager for the state of Florida’s Department of Public Health.

Nobles completed his Doctor of Public Health at the University of Texas Health Science Center in Houston with a triple major that included health policy & management, epidemiology, and health economics; and he received his master’s in Public Health specializing in epidemiology, and bachelor’s degree in molecular biology from Florida A&M University. Nobles is an avid educator and has taught on the collegiate level since 2001 in the areas of environmental biology, anatomy and physiology, public administration, health policy and management, health care finance, ethics, epidemiology, and responsible conduct of research.

Dr. Howard G. Adams is founder and president of H.G. Adams & Associates, Inc., a Norfolk, Virginia, based consulting company that provides human development services and products to educational, governmental, industrial, and non-profit organizations.

Adams is a leading expert on developing people through mentoring and strategic career/life planning and has spoken at over 650 colleges and universities. He has author or co-author fifteen self-help guides and handbooks. Among these are Mentoring: A How-To Guide for Those Interested in Initiating a Mentoring Relationship, 2002; Mastering the PhD Process: Tips for Surviving and Excelling in a Doctoral Program, 2002; The Internship Guide: A Blueprint for Successfully Managing the Internship Experience, 2003; Networking: The Art of Meeting and Greeting People, 2003 (co-authored); and The Undergraduate Research Experience: Examining Roles, Responsibilities, Strategies, and Actions for Forming Effective Mentorship Alliances, 2004.


Prior to becoming an entrepreneur, Adams served as executive director (1978-96), National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM), headquartered at the University of Notre Dame, Notre Dame; and served as vice president for student affairs (1974-77) and director of alumni affairs (1970-73), Norfolk State University.

Adams holds a BSc from Norfolk State University, 1964; MS from Virginia State University, 1968, and a PhD from Syracuse University, 1978. Adams is a proud husband and father to wife, Eloise Christine Davis Adams, PhD (retired); and daughter, Dr. Stephanie Glenn Adams, professor of engineering and Chair, Engineering Education, Virginia Tech University, Blacksburg, Virginia.
Session Presenters

Carlos Beane  
TLSAMP Director,  
Tennessee State University

Dr. Carlos D. Beane joined the Tennessee State University (TSU) Tennessee Louis Stokes Alliance for Minority Participation program in January 2013. He has been employed at the university for twenty years, with prior service in the Department of Electrical and Computer Engineering and the Center for Information Systems and Engineering Management.

As a faculty member, he has taught several courses and advised undergraduate and graduate students in research. His research interest are in Networked Control Systems, Signal Processing and Cyber Physical Systems. In his current role he serves as the Program Director for TSU and the Tennessee LSAMP Alliance. His focus is on recruitment, retention and graduate school preparation for science technology engineering and mathematics (STEM) students.

Beane received a BS degree in Electrical Engineering from Southern University and A & M College, a ME in Electrical Engineering and a Ph.D. in Electrical Engineering from Tennessee State University in 2010. He is a member of the Institute of Electrical and Electronic Engineers (IEEE) and an advisor for the National Society of Black Engineers (NSBE). He is a devoted husband to Alanna L. Beane, MD, and a loving father to their child, Maya A. Beane.

Regina J. Hairston  
Director of TLSAMP,  
University of Memphis

Regina J. Hairston has served as co-principal on several STEM related National Science Foundation grants during her seventeen years of employment at the University of Memphis. Currently she acts as director of TLSAMP, provides counseling for STEM students and assists with retention in STEM programs. She is a graduate of Cleveland State University in Cleveland, Ohio. She received her MS degree from the University of Memphis and obtained her MBA from The University of Memphis Fogleman School of Business.

Rickey Hall  
Vice Chancellor for Diversity,  
University of Tennessee

Rickey Hall is the University of Tennessee’s inaugural vice chancellor for diversity and inclusion. He is charged with enhancing the campus climate, leading diversity and inclusion efforts designed to enrich the learning environment, and serves as a part of the chancellor’s senior leadership group.

Vice Chancellor Hall came to UT after six years as the assistant vice president for equity and diversity at the University of Minnesota. He has nearly twenty years of experience in higher education, and serves as a regional coordinator for the APLU Commission on Access, Diversity, and Excellence.

Rickey Hall was recently awarded the 2015 Unity in the Community award from HoLa Hora Latina and selected as an American College Personnel Association Educational Leadership Foundation 2015 Diamond Honoree. The vice chancellor is a member of the UT System Diversity Advisory Council and a current board member of the Beck Cultural Exchange Center, Inc. and the Wartburg College National Diversity Advisory Board.

Vice Chancellor Hall earned a bachelor’s degree in American studies and a master’s degree in higher education, both from the University of Iowa. Currently, he is completing a Doctor of Education in organizational leadership at the University of Minnesota.
Carolyn Hodges
**Professor of German, University of Tennessee**

Dr. Carolyn R. Hodges has served as Vice Provost and Dean of the Graduate School at the University of Tennessee in Knoxville since January 2007 and is a professor of German in the Department of Modern Foreign Languages and Literatures.

She holds a BA degree in French from Arcadia University in Pennsylvania and MA and PhD degrees in Germanic Languages and Literatures from the University of Chicago. Before assuming her current position, she was head of the Department of Modern Foreign Languages and Literatures at UT and then went on to become the Associate Dean for Academic Personnel in the College of Arts and Sciences.

Hodges' academic focus displays a broad interest in interdisciplinary studies and a global approach to literary studies. Her teaching and research have emphasized three major areas: multicultural perspectives in modern German literature, comparative literature, and multicultural education. She has collaborated with university graduate programs to establish partnerships with universities in France, Italy, and China, and was a two-week guest administrator in 2011 at Wuhan University in China.

Selected examples of her institutional and professional service include: co-principal investigator and chair of the internal advisory board for the University of Tennessee Program for Excellence & Equity in Research (PEER), a training grant created to increase the number of accomplished and competitive underrepresented minority students who pursue PhDs in the sciences and attain careers in biomedical research; past member of the executive committee of the Conference of Southern Graduate Schools; participant in the HERS Bryn Mawr Summer Institute; past secretary-treasurer and past president of the Southern Comparative Literature Association (SCLA); member of the editorial boards for *The Comparatist* (SCLA) and UT Press; one of the founding members of the American Association of Teachers of German Alle lernen Deutsch Committee, which disseminates information about minorities in the teaching and learning of German in the United States and abroad.

Kelly Holley-Bockelmann
**Associate Professor of Astrophysics, Vanderbilt University**

Dr. Kelly Holley-Bockelmann is an associate professor of astrophysics at Vanderbilt University, where she joined the faculty in 2007. She received her BS in physics at Montana State University and her PhD in astronomy in 1999 at the University of Michigan. After her PhD, she did postdoctoral work at Case Western Reserve University and the University of Massachusetts.

In 2004, she joined the Center for Gravitational Wave Physics at The Pennsylvania State University, where she became a big fan of gravitational waves and attended many talks on loop quantum gravity that left her scratching her head.

Her main interests are in computational galaxy dynamics, black holes of all sorts, and gravitational waves. She is a recipient of a Faculty Early Career Development (CAREER) award from the National Science Foundation and her work also been supported by the NASA. Last year, Dr. Holley-Bockelmann was honored as a Chancellor Faculty Fellow. Her research on growing supermassive black holes and rogue black holes have both been featured in many online and print media outlets, though she still gets a bit nervous talking to the press.

As a first-generation college graduate within a family that sometimes lived below the poverty level, Holley-Bockelmann has a deep interest in broadening the participation of women, minorities, and first-generation college students in science. She is a co-director of the Fisk-to-Vanderbilt Masters-to-PhD Bridge Program, which is designed to mentor a diverse cohort of graduate students to develop the skills needed to succeed as a scientist.
**Session Presenters**

**John Hopkins**  
**Senior Project Controls Manager, Institute for Advanced Composites Manufacturing Innovation, University of Tennessee**  
John Hopkins is currently Senior Project Controls Manager for the Institute for Advanced Composites Manufacturing Innovation, one of the seven members of the National Network for Manufacturing Innovation. For the past five years, John Hopkins directed the Tennessee’s NSF EPSCoR Track I RII program—Tennessee Solar Conversion and Storage using Outreach, Research, and Education (TN-SCORE) while working out of the Office of the Executive Vice President of the University of Tennessee.

Hopkins was formerly vice president of the UT Research Foundation, which manages the technology commercialization activities stemming from the research performed at UT’s campuses, and prior served as a faculty member at the UT Space Institute.

As faculty researcher, he contributed to a number of innovative technologies, leading to 11 US patents, and directly assisted in their commercial success. He helped develop and license laser-manufacturing technologies that were used in the world’s first no-lube fifth wheel latches for over the road trucks and has been involved in more than ten start-up companies.

Dr. Hopkins received his BS, MS, and PhD degrees in mechanical engineering from The University of Tennessee and was a NASA pre-doctoral research associate during his graduate program while supporting both ground and flight experiments for the First International Microgravity Laboratory (IML-1) space lab mission.

Hopkins is a licensed engineer in Tennessee, has authored or co-authored more than fifty technical papers, and received his MBA from the Owen Graduate School of Management at Vanderbilt University.

**Sherry Painter**  
**Chair, Division of Natural and Mathematical Sciences, LeMoyne-Owen College**  
Dr. Sherry Painter, an organic chemist, serves as the Chair of the Division of Natural & Mathematical Sciences at LeMoyne-Owen College. In addition to teaching classes and administering grants in the division, her primary research area of interest is in science education. Painter is responsible for designing and implementing the “Science on Wheels” outreach project—the first mobile science lab in the Memphis, Tennessee, region, servicing K-12 students and teachers.

**Craig Pickett**  
**Coordinator for Student Life and Diversity Programming, College of Agricultural Science and Natural Resources, University of Tennessee**  
Craig Pickett Jr. serves as the coordinator for Student Life and Diversity Programming at the University of Tennessee, Knoxville, College of Agricultural Science and Natural Resources. He graduated from Davidson College in 2008 with a degree in Political Science, before obtaining a master’s degree in Student Affairs in Higher Education from Indiana University of Pennsylvania (2010). Craig is a strong advocate for self-exploration, career development and professional success. Before assuming his role at the University of Tennessee, he served as a Career Counselor/Specialist at several institutions. He helped undergraduate students, graduate students and alumni obtain internships, fellowships, and full-time jobs with non-profit agencies, health organizations, and federal organizations (including the FBI, the CIA, The White House, and the US Department of State). At the University of Tennessee, he manages all aspects of diversity programming for the College of Agricultural Sciences and Natural Resources, including the Intercollegiate Summer Bridge Program, the STEAM (Science, Technology, Engineering, Agriculture and Mathematics) Freshman Minority Mentoring Program and the UT Chapter of MANRRS (Minorities in Agriculture, Natural Resources and Related Sciences). In addition, he promotes leadership, student engagement and professional development by overseeing the college’s thirty-plus student organizations, managing the Living Learning community and teaching two classes each semester on teambuilding.
Ashley Redix currently serves as the coordinator for the Office of Engineering Diversity Programs within the College of Engineering at the University of Tennessee, Knoxville. Before assuming her role within the Office of Engineering Diversity Programs, Redix was a graduate advisor for the Black Cultural Programming Committee within the Office of Multicultural Student Life at UT. Redix came to UT with several years of experience in multicultural student affairs and program development, as well as experience in academic, college, and financial aid advising.

Redix is currently a doctoral candidate pursuing a PhD in higher education administration. Previously, she received a Master of Education in School Counseling from the University of Southern California in 2012, and a Bachelor of Arts in American Studies with a concentration in marketing from the University of California, Berkeley, in 2010. Her research interests include: access to higher education for underrepresented student populations, college student development, and retention of underrepresented student populations.

Dr. Lonnie Sharpe, Jr. is the Massie Chair of Excellence Professor at Tennessee State University (TSU), a program sponsored and funded by the Department of Energy to enhance the environmental science and engineering programs at the institution. He is also serving as the interim dean for the College of Life and Physical Sciences. He was appointed to this position in August 2015. Since joining TSU, Dr. Sharpe led the effort to facilitate $10.8 million from DOE and related agencies. An additional $9.5 million has been received from NSF for the Tennessee Louis Stokes Alliance for Minority Participation program and he serves as the Executive Director. He also served as the Interim Dean of Engineering in 2008 and 2009.

Sharpe has extensive industrial and governmental experiences with the National Aeronautics and Space Administration (NASA), the Environmental Protection Agency (EPA), Oak Ridge National Laboratory (ORNL), Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), Western Electric, and General Motors Corporation. Prior to joining TSU as the Massie Chair of Excellence, Dr. Sharpe spent over 20 years at NC A&T State University (A&T) as a faculty member and administrator.

Sharpe has been involved in many educational and research projects over the years. He secured millions of dollars of funding at both TSU and A&T and was named to the University's Million Dollar Researcher Program at each institution. Sharpe has authored or co-authored over 50 publications.

Sharpe received a BSME from North Carolina A&T State University in 1975, a MME from North Carolina State University in 1976 and a PhD in Mechanical Engineering in 1980. On a personal note, Sharpe is married to Davida Sharpe and they have one son, Lonnie “Tre” Sharpe, III.
Session Presenters

Desmond Stubbs  
Senior Project Manager,  
Oak Ridge Associated Universities

Dr. Desmond Stubbs received a BS degree in chemistry from Morris Brown College, Atlanta, Georgia in 1997. He later received his MS in chemistry from Georgia Tech in 1999. After working in Georgia Tech’s School of Chemistry as a demonstrations teacher for two years, he re-entered the doctoral program at Georgia Tech where he co-authored twelve journal articles and earned his doctoral degree in May 2006. One of the highlights of his graduate career was a publication in *Analytical Chemistry* entitled “Investigation of a Cocaine Plume Using Surface Acoustic Wave Immunoassay Sensors.” The paper was then flagged by the American Chemical Society and later featured on in *Time* Magazine’s news series *Innovators Highlighting the “dog-on-a-chip” a Chemical Sensing Electronic Device.*

Stubbs currently serves as the Senior Project Manager and Diversity Lead in the Science Assessment and Workforce Development division of Oak Ridge Associated Universities (ORAU). ORAU is a 501(c)(3) non-profit corporation and a university consortium leveraging the scientific strength of 114 major PhD-granting institutions to advance science and education by partnering with national laboratories, government agencies, and private industry.

In this capacity, more than half of Stubbs time is allocated toward developing data-driven strategies to support the recruitment and grow the competitive pool of underrepresented student researchers. Other responsibilities include program design and implementation, budget planning and reporting, team management, subject matter expert recruitment, and program promotion and evaluation. The competent and efficient execution of these activities is vital to the overall success of ORAU’s large portfolio of over 300-sponsored research participation programs. The goal is to strategically align talent to a client’s scientific needs in an effort to strengthen research in the life and physical sciences, health, energy, and a variety of high-priority STEM fields.

Stubbs is the recipient of many awards including the FACES Postdoctoral Fellowship—a program managed jointly by Emory University and Georgia Tech—and the Senator Sam Nunn Fellowship, a prestigious award given to highly accomplished science and engineering doctoral students with a keen interest in science and technology policy. As a Sam Nunn Fellow, Stubbs studied the role of science and technology in homeland defense.

Stubbs is also an entrepreneur and currently serves as the CEO of Zen Sensing LLC—a minority owned biotechnology company that provides solutions for global threat detection markets. He currently holds three US patents.

Mimi Thomas  
Director of TLSAMP,  
Middle Tennessee State University

Mimi Thomas is director of the Tennessee Louis Stokes Alliance for Minority Participation at Middle Tennessee State University—a post she has held since 2008. She received her Bachelor of Business Administration, and her Master of Arts both from Middle Tennessee State University. She has been employed at the university for twenty years, with prior service in the Career Center and Student Affairs.

Thomas is married and has three children. She and her family reside in Murfreesboro, Tennessee.
Investigating the Effect of Caenorhabditis elegans dat-1(ok157) and rnt-1(vt34) Mutations on Locomotor Behavior

Terrica Bass
Junior in Biochemistry & Molecular Biology, Fisk University
Professor: Dr. Sarah Robinson

Dopamine (DA) plays a central role in humans through coordination of movement, attention, and the recognition of reward. DA neuronal dysfunction has been associated with several neurobehavioral disorders, such as Parkinson’s disease. The human body is very complex with millions of neurons, making it difficult to study. Alternatively, the nematode C. elegans has only 8 DAergic neurons. C. elegans are an exceptional model system due to its short generation time, cost effectiveness and ease of genetic manipulation. Dat-1 encodes a plasma membrane dopamine transporter that regulates dopaminergic neurotransmission via reuptake of dopamine into presynaptic neurons. A mutation in dat-1 is known to cause a phenotype identified as Swimming Induced Paralysis (Swip), in which worms paralyze when placed in water, as a result of extra synaptic DA signaling. In our experiment, we studied rnt-1, a gene encoding a transcription factor homologous to mammalian RUNX. The mutation we investigated, rnt-1(vt34), is a point mutation that is predicted to result in a truncated protein. The objective of the experiment was to investigate the Swip phenotype in this mutant and compare the results to those of the wild type and dat-1 mutant animals, to determine the role of RNT-1 in DA signaling pathways. The results obtained showed that the wild type swam, whereas the rnt-1(vt34), dat-1(ok157), and double mutants all showed paralysis. In conclusion, rnt-1(vt34) animals were not able to effectively remove DA from the synaptic cleft, leading to paralysis, possibly due to an inhibition of a gene that is essential for presynaptic dopamine signaling.

Ross Pair filters for the Kirkpatrick-Baez Microscope

Zachary M. Dickerson
Senior in Physics, Fisk University
Professor: Dr. Arnold Burger

The National Ignition Facility (NIF) has developed an x-ray imaging system based on Kirkpatrick-Baez Optics (KBO) for self emission imaging of Inertial Confinement Fusion (ICF) implosions. I have developed an array of Ross-pair filters to complement the KBO images with time integrated pinhole images. The KBO will have a narrow band (-2keV) energy response centered at 10.2keV. The Ross pairs are chosen to approximate the energy response of the KBO. The filters will be fielded on experiments that use a Ge dopant in the capsule shell with a pre imposed divot. The aim is to launch a ‘meteor’ that will emit a strong He-alpha line as it mixes in the hot spot.

Electrospinning of Poly(vinylidene) Fluoride (PVDF) Nanofibers for Energy Conversion and Sensing

Tecia Grier
Master’s Student in Chemistry, Fisk University
Professor: Dr. Richard Mu

Electrospinning is one of the easy and established ways to produce thin nanofibers due to electric force. The effect of the electrospinning parameters and solution preparation on the morphology, diameter, and molecular orientation of the polyvinylidene fluoride (PVDF) nanofibers are being systematically investigated. The PVDF solutions were prepared with pure N,N-dimethylformamide (DMF) and DMF/acetone mixtures with different ratios. The solvent ratio, polymer concentration, and voltage were systematically changed with the experiments studied and resulted in thinner nanofibers with an increase in DMF for the preparation of the polymer solution. The optical images show an increase in the diameter of the nanofibers when the polymer concentration is increased. The effect of the voltage did not show a significant diameter change on the nanofibers. The concentration of PVDF has significant effects on diameter, proportionally increasing the diameter of the nanofibers. Further study with SEM and Raman will provide more concrete information on aforementioned effects and PVDF structural information.

Invasive Potential of Echinacea pallida in Western Minnesota

Taylor Harris
Sophomore in Biology, Fisk University
Professor: Dr. Stuart Wagenius

Tallgrass prairie of Western Minnesota has been reduced to less than 1% than it was originally. Restorations have been planted to re-establish the prairie. In 2007, a restoration was planted near a study site for the Echinacea project; instead of containing the native Echinacea angustifolia (narrow-leaved purple coneflower), the restoration was planted with non-native Echinacea pallida (pale purple coneflower). Though E. pallida look similar to E. angustifolia, this non-native species appears to grow faster and larger. E. angustifolia are self-incompatible, but the two species are able to hybridize, which may threaten the native species by genetic swamping (a process that occurs when the genes of a dominating species overshadow those of a smaller populated species as a result of being crossed). Hybrids and non-hybrids planted in 2013 in an adjacent restoration were investigated by measuring the survival, leaf count, and longest leaf length of each plant. Both hybrid crosses (angustifolia x pallida and pallida x angustifolia) along with the pure E. pallida had higher survival rates, higher leaf counts, and longer leaf lengths than the pure E. angustifolia species. If the hybrids and E. pallida continue to persist, they could invade native prairie and threaten nearby populations of E. angustifolia.

Understanding the molecular basis of high affinity Mn2+ binding by calprotectin

Joshua Haynes
Graduate Student in Biology, Fisk University
Professor: Dr. Steven Damo

Manganese (Mn2+) serves a critical role as an enzymatic or structural cofactor in essential biological processes. However, despite the importance of Mn2+, Mn2+ metalloproteins are understudied. The ultimate goal of this work is to establish a rationale and reveal the molecular mechanisms of high affinity Mn2+ binding to the protein calprotectin (CP). CP is a member of the S100 class of the EF-hand calcium binding proteins, comprised of the heterodimer of S100A8 and S100A9 subunits. CP has two distinct transition metal binding sites, each located at opposite ends of the dimer interface. Site 1 can bind either Zinc (Zn 2+) or Manganese (Mn 2+) with high affinity; site 2 can only bind Zn 2+. Site 1 forms a unique octahedral coordination sphere comprised of six histidine residues and represents an ideal model system for understanding Mn2+ coordination in proteins. We conducted a mutational analysis together with biophysical measurements to identify a point mutation in Site 1 that drastically reduces its Zn2+ affinity without adversely affecting its Mn2+ affinity. Additionally we have generated crystals of this CP mutant with Mn2+ for x-ray crystallography studies. In total these data represent important steps towards understanding the basis of CP’s high affinity for Mn2+.

The Effects of Rapid Thermal Treatments on CdZnTe Gamma Detectors

Stephanie Morris
Junior in Physics, Fisk University
Professor: Dr. Arnold Burger

Bulk leakage and surface leakage current remain issues for the deployment of CdZnTe gamma detectors. Electronic noise dominates at important low gamma energies, and surface and bulk leakage current limits the performance of the coplanar grid readout. Through the use of PN and PIN diodes, both surface and bulk leakage currents can be reduced. This was observed through the doping of a CdZnTe gamma detector with Aluminum and Phosphorus by means ion implantation at elevated temperatures. The goal of this work, however, was to examine the effect of rapid thermal treatments without doping. And in doing so, we found that annealing CZT for very short times at high temperatures increases the dark current, which is likely due to a reaction between the CdZnTe gamma detector and the contact metal of the detector.
Expression of Chicken FNDC5/FNDC4 in cultured embryonic muscle cells
Martina Tatiana Ratliff
Junior in Biology Pre-Pharmacy, Fisk University
Professor: Dr. Maggie Zilbut

In this research project we had two main goals to obtain knowledge of establishment of embryonic muscle cell culture system and to also obtain knowledge about the R-T PCR detection of muscle specific expression in culture cells. Fibronectin type III domain contains protein 5 and has been said to secrete upon exercise.

Initial studies suggest that Irisin, which is what FNDC5 is, as a treatment option for obesity and associated things such as type II diabetes. It is composed of a single peptide, a fibronectin II domain and a hydrophobic C-terminal domain. The link between the actual muscle and FNDC: Irisin as a novel myokine encoded by FNDC5 gene, attracts much attention for its critical roles in the browning of white adipose tissue. In this study FNDC5 CDNA was cloned in chickens. RT-PCR showed that it is widely expressed in nearly all tissues; The brain, muscle, etc. Chick embryos are easier to dissect, as they are larger than that of a mouse, because of their larger size it is easier to dissect out organs to generate specific cell types; Hepatocytes, Cardiac Muscle, and Lung epithelium. Working with embryos that are more than ½ life may require a license.

LeMoyne-Owen College

Chili extract (Capsaicin) Modulates Methionine Cotransport in enterocytes
Cameron Hill and Jessica Santiz-Lopez
Sophomores in Biology, LeMoyne-Owen College
Professor: Dr. Jamil Talukder

Background: Intestinal absorption of nutrients is a vital mechanism that depends essentially on the function of intestinal mucosa. Food-borne phytochemicals or bioactive compounds can play an important role in the mediation of Na+-dependent nutrient transport from the gut lumen. The effect of chili extract (capsaicin) on absorption of essential amino acids is unknown. Aim: To determine the effect of capsaicin on Na+-dependent Met cotransport in enterocytes. Methods: Capsaicin was extracted from Cayenne (chili) powder using ethanol as a solvent in a Soxhlet extractor. Rat intestinal epithelial cells (IEC-6) grown on plates were treated with capsaicin. Initially, dose response and time course experiments were performed for Met uptake using [3H]-Met. Cytosolic Ca2+ was measured using Flu 3AM and Caspase-3 activity was determined using a kit. RTQ-PCR and Western blot analyses were performed to determine SNAT2 mRNA abundance and protein levels, respectively. Results: Capsaicin treatment decreased Na+-dependent Met uptake dose dependently in IEC-6. Kinetic studies demonstrated that capsaicin inhibits Met uptake by decreasing the number of Met cotransporters (Vmax). Capsaicin treatment increased cytosolic Ca2+ levels and Caspase-3 activity. Preliminary data of molecular studies showed that SNAT2 mRNA abundance and SNAT2 protein levels on apical membrane were down regulated by capsaicin. Conclusion: These studies revealed that capsaicin inhibits Met cotransport, SNAT2 in enterocytes.

Reactions of some hydroxy carboxylic acids with Cu2+, and Cr3+ in aqueous solutions.
Darius Small
Chemistry in Senior, LeMoyne-Owen College
Professor: Dr. Yahia Z. Hamada

Over the past decade we have studied variety of low-molecular-mass...
ligands with many metal ions in aqueous solutions using various spec-

trophotometric techniques (IR and UV-Vis) and electromotive force

determinations. Herein, we are reporting the interaction of lactic acid, 

malic acid, and citric acid as examples of hydroxy carboxylates with

Cu2+, and Cr3+. We are reporting the equilibrium behavior for newly 
discovered metal-complexes as well as their spectroscopic absorption
spectra in aqueous solution at room temperature.

**Middle Tennessee State University**

**The Effect of Herbal Extract Used in Traditional Chinese Medicine on Breast Cancer Cells**

Christopher Adereti, Justice Adewumi, Brittnie Miles, and Arol Zague

Professors: Dr. Daniel B. Erenso

Juniors in Biology, Middle Tennessee State University

In this study we examined the effects of Traditional Chinese Medicine (TCM) on the BT20 line of breast cancer. Cells were seeded and cul-
tured in a 96 well plate 24 hours before each treatment, then treated 
with Paonia suffruticosa plant extract every morning and were harvest-
ed after 2, 6, and 24 hours for testing, as well as untreated samples for 
comparison. We first analyzed each treated cell’s viability and toxicity 
by detecting live and dead cells using a fluorescence plate reader. We 
then conducted a study in the general physical properties and also 
mechanical properties using an infrared laser (1064nm) trap by treap-
tonizing the treated cultured cells.

The results in cell viability measurements show that the percentage 
of dead cells increases with time (60-70% of dead cancer cells in 24 
hours at the concentration tested). Results for the physical properties 
show that treatment may have resulted in damaging internal structures 
of the cells, causing the spherically shaped cells to flatten as the aver-
age diameter increased with the duration of treatment. Results in the 
relative change of the average diameter of the cells before and after 
being treated indicates that treatment may have also increased the 
cancer cells sensitivity to radiation.

**Terpene Emissions from Cedar, Redbud, and Pine Trees.**

Ashley Caldwell

Senior in Biochemistry, Middle Tennessee State University

Professors: Dr. Ngee S. Chong and Dr. Beng Guat Ooi

Terpenes, which are known for their fragrances, are a group of volatile 
hydrocarbons found in the essential oils of plants. They are emitted as 
a defense mechanism against predators and in response to stresses 
due to high temperature. The objective of this project is to determine 
the types of terpenes released from Cedar, Redbud, and Pine trees 
using Gas Chromatography-Mass Spectrometry (GC-MS) analysis. A 
branch from each plant is placed in separate flasks connected to an 
air sampling canister. The setup was placed in sunlight and samples 
collected during the hottest time of the day. Terpenes such as limo-
nene, camphene, thujone, β-phellandrene, α-phellandrene, α-pinene, 
and γ-terpinene were detected in the emission profile of Cedar. No 
terpenes were detected in the sample from Redbud, probably due to 
the fact that the Redbud is about to shed its leaves in the fall season. 
In general, the types and amounts of terpenes emitted are dependent 
upon the plant, temperature, and season.

**Comparative Spectroscopic Analysis of Nitroaniline Isomers via Their Surface Enhanced Raman Scattering (SERS) Signals**

Yvonne Ejorh

Senior in Biochemistry, Middle Tennessee State University

Professors: Dr. William Isley and Dr. Beng Guat Ooi

Nitroanilines are used as chemical intermediates in the manufactur-
ing of dyes, pesticides, gasoline, and specific pharmaceuticals. These 
chemicals can cause severe human health issues via the contamination 
of groundwater, soil, and air. The three isomeric forms of nitroaniline, 
namely 2-nitroaniline, 3-nitroaniline, and 4-nitroaniline, are distinguish-
able by Raman spectroscopy. The sensitivity of Raman measurement 
of nitroanilines can be increased by the use of gold or silver nanopar-
ticles in a technique known as Surface Enhanced Raman Spectroscopy 
(SERS). In this project, colloidal gold nanostars and Klarite™ substrates 

based on the nanoscale patterning of a gold-coated silicon surface

were used for SERS analysis of the three isomers. Even though the 
three nitroaniline isomers have similar structures, their SERS spectra 
were readily distinguishable from one another and from aniline and 
nitrobenzene. The degree of Raman signal enhancement was of the 
order of 2-nitroaniline > 3-nitroaniline > 4-nitroaniline for the colloidal 
gold. Klarite™ signal enhancement of the analytes was 10 to 100 fold 
that of gold colloid. The Klarite™ technique is also more sensitive, 
requiring only 1 mL of sample. Computational modeling based on Density 
Functional Theory (DFT) was also conducted to study the adsorption 
characteristics of the analytes on gold colloid and Klarite™ substrates.

**Tennessee State University**

**Growth Analysis Of Lung Cancer Cell Line A549 After Exposure To Phytochemicals Extracted From Fennel Plants**

Latriana Boone

Junior in Biology, Tennessee State University

Professor: Dr. Elbert Lewis Myles

Cancers is the second leading causes of death in men and women, in 
the United States. Complementary and alternative medicines are typi-

cally herbal or mineral supplements used by greater than 80% cancer 
patients regardless of lack of research proving safety and efficacy for 
many of these products. Fennel is a medicinal plant that commonly 
used in spices. Fennel use is in soups and salads. Experiments have 
shown it has antioxidant, anti-inflammatory and cancer chemopreven-
tive properties. It has is suggested that a small protein made inside 
cells acts as an antioxidant. Our study concentrates on the activity of 
secondary compounds. Methanolic leaf and bark extracts in a series of 
concentrations were taken from the previously stated plants and 
exposed to lung cancer cells for 24 hours. Growth analysis is detern-
ined using a cell viability indicator Alamar blue. Studying the lung 
cancer cell lines we found that Fennel extract inhibited the growth at 
five serial dilute diluted concentrations.

**Constitutive Activation of the STAT3 by the Human Serotonin 2C Receptor (5-HT2CR)**

Marybeth Curtis, Letimicia Fears, and Ashley Hicks

Seniors in Biology, Tennessee State University

Professors: Dr. Hugh M. Fentress and Dr. Michael Ivy

The serotonin 2C receptor (5-HT2CR), a 7-transmembrane spanning 
G protein-coupled receptor (GPCR), is involved in neuronal excitabil-
ity, spatial learning, mood, and appetite. Therefore it is important to understanding the receptor’s downstream signaling pathways. A structurally similar family member, the 5-HT2AR, can activate the G protein-independent JAK/STAT pathway. The purpose of this study was to see if the 5-HT2CR can activate the JAK/STAT pathway. Human Embryonic Kidney (HEK) 293 cells were transfected with the human 5-HT2CR and stable cell lines were generated. Cell lines were stimulated with 5-HT, olanzapine or SB206553. Lysates were made and proteins were separated by SDS-PAGE gel electrophoresis. Phosphorylation states of JAK2 and STAT3 were examined by western blotting. We found that the 5-HT2CR constitutively phosphorylates STAT3 and incubation with 5-HT enhances this activation. However, this phosphorylation is independent of JAK2 phosphorylation. This evidence suggests that the 5-HT2CR may be involved in cell differentiation, growth, the immune response, and transcription of other genes since activation of the JAK/STAT pathway leads to these responses. Future studies will examine the ability of natural occurring single nucleotide polymorphisms in the human 5-HT2CR to alter activation of the JAK/STAT pathway as well as other G protein-independent and dependent pathways.

The Distribution of Calcium Binding Proteins in the Frontal Cortex
Kiona Coleman
Senior in Chemistry, Tennessee State University
Professor: Dr. Lisa A. de la Mothe

In order to comprehend sensation and behavior a framework of the neuroanatomical and neurochemical organization of the brain must first be established. In light of findings reported from Kubota et al. (1994), which examined the distribution patterns of several calcium binding proteins (CBP) in frontal cortex, previous work from our lab examined the expression of two of these CBP, calbindin and calretinin, both of which facilitate calcium uptake, and their expression in the frontal cortex of marmoset monkeys. The current study examined the expression patterns CBP, including calbindin, calretinin, and parvalbumin, in the frontal cortex of mice. Kubota et al. (1994) reported distinct population of calbindin and calretinin in superficial layers as well as very little co-localization within the infragranular layers of the GABAergic (GABA) population. In order to examine consistencies with their findings multi-fluorescence immunohistochemistry was performed in order to visualize the calbindin, calretinin, and parvalbumin in the same tissue section within the frontal cortex of mice. Samples of frontal cortex spanning cortical layers were examined and the X-Y location of tissue section within the frontal cortex of mice. Kubota et al. reported distinct population of calbindin and calretinin in superficial layers as well as very little co-localization within the infragranular layers of the GABAergic (GABA) population. In order to examine consistencies with their findings multi-fluorescence immunohistochemistry was performed in order to visualize the calbindin, calretinin, and parvalbumin in the same tissue section within the frontal cortex of mice. Samples of frontal cortex spanning cortical layers were examined and the X-Y location of CBP and those cells that co-expressed multiple proteins were identified. Results indicate varying overlapping population between Calretnin and Parvalbumin depending on part on the location of the tissue samples.

Work supported by: National Institutes of Health MARC-USTAR grant 2T34GM007663-32.

Occurrence of Extended-Spectrum β-Lactamase- and AmpC-Producing Enterobacteriaceae from Poultry Farms and Raw Chicken Sold in Local Markets
Kourtney Daniels
Junior in Agricultural Sciences, Tennessee State University
Professor: Dr. Agnes Kilonzo-Ntenghe

Antibacterial resistant Enterobacteriaceae in foods of animal origin can be a potential risk to the public health. With the steady occurrence of ESBL and AmpC producing Enterobacteriaceae over the past few decades, there is an imperative need to evaluate their prevalence in the food chain and the environment. The objective of this study is to determine the prevalence of ESBL- and AmpC producing Enterobacteriaceae from poultry farms and raw chicken sold in Tennessee local markets. Chicken and poultry manure are currently collected for isolation of ESBL and AmpC producing Enterobacteriaceae. After collection, samples are pre-enriched in double strength peptone water and EE broth followed by plating onto CHROMagar™ ESBL, MacConkey, and VRBG agar. Enterobacteriaceae isolates are then confirmed using a biochemical API20E test. Identified Enterobacteriaceae are stored in glycerol at -80°C for further analysis of ESBL gene blac CTX-M-1 and pAmpC gene blac CMY-2. Our results indicate that 120 samples were contaminated with antibiotic resistant Enterobacteriaceae. Our results show that chicken from Tennessee is contaminated with ESBL and AmpC producing Enterobacteriaceae. To control its spread, more communication on antibiotics use on animal farms is needed between Tennessee policy makers and animal producers.
for achieving only aerial missions while navigation, tentacles enable manipulating system in general and multiple tentacle aerial vehicles in scaled aerial robots. The most meaningful implication of the mobile design and uncultivated aspects of operational applications of small-on the stability and control of manipulators and floating platform, the base and multiple of 2 or 3 DOF (degrees of freedom) small tentacles ations. In the future, the aerial platform would consist of a quadcopter unmanned aerial vehicles (UAVs), to be used for various possible oper-
ations. In this research authors present preliminary and developmental stages of design and operation of a mechanical tentacle system for small un-
manned Aerial Vehicles
Michael P. Harrigan and Donald S. Toohey Juniors in Mechanical Engineering, Tennessee State University Professor: Dr. W. Yeol Joe
In this research authors present preliminary and developmental stages of design and operation of a mechanical tentacle system for small unmanned aerial vehicles (UAVs), to be used for various possible operations. In the future, the aerial platform would consist of a quadcopter base and multiple of 2 or 3 DOF (degrees of freedom) small tentacles attached. Unlike mobile manipulating research, which focuses more on the stability and control of manipulators and floating platform, the multiple tentacle system presented in this research introduces a new design and uncultivated aspects of operational applications of small-sized aerial robots. The most meaningful implication of the mobile manipulating system in general and multiple tentacle aerial vehicles in this research is its extended locomotion. Unlike the flying-only vehicles that currently exist and the current trends of unmanned aerial vehicles for achieving only aerial missions while navigation, tentacles enable vehicles to interact with the environment. Some of the mechanisms include object pickup/release, landing on irregular surfaces, perching, and even additional propulsion force for taking off. These concepts are easily observed by almost all types of animals including humans.

An Investigation of Mentoring Practices of Graduate STEM Programs
Germysra Little Junior in Biology, Tennessee State University Professor: Dr. Lesia Crompton-Young
In the past decade, the proportion of undergraduate students from underrepresented groups pursuing degrees in STEM fields has only increased 3%, with several groups experiencing no growth at all. To address the significant need in our country for supporting students in their journey to completing a degree in STEM fields, efforts to develop effective mentoring practices should be undertaken. Researchers from the Center for Advancing Faculty Excellence performed a descriptive research investigation aimed at identifying best practices and lessons learned strategies that can be employed within STEM mentoring pro-
grams to broaden participation while ensuring student success. This research project is focused on describing the current best practices of individuals participating in nationally recognized mentoring programs, the institutions’ policies, procedures and practices were explored through survey instruments, focus group discussions, document content review analysis, historical records, and other sources of informa-
tion. Most of the participants reported having a mentor. Out of that, 85% that reported having a mentor, 57% stated that their mentor was a formal mentor; the mentor was assigned by the university. Participants reported that mentors were beneficial providing guidance through these programs, support of different ideas and topics, advice on deci-
sions after graduate school, and professional development guidance.

Cube Satellites: “Small But Universal”
Denise Nicole McGarity Junior in Aeronautical and Industrial Technology, Tennessee State University Professor: Dr. Matthew Mutterspaugh
CubeSats are considered the next futuristic observers to change the way we think of air and space. A CubeSat is a small satellite with the shape of a 10-centimeter cube and weighs 1 kilogram (the length and weight are 4 inches and 2 pounds). The design has also over the years has been simplified so almost anyone can build the satellite. In addition, there are instructions provided online to show an individual how to build a CubeSat. The average cost for these satellites are less than $50,000. This cost is relatively cheap compared to an average size satellite (51 million per launch). CubeSats are carried into space on a Poly-Pico Satellite Orbital Deployer (P-POD). The standard P-POD can hold up to 3 CubeSats and has the ability to fit almost any rocket. The CubeSats were introduced in 1999 at the California Polytechnic University (CalPloy). In addition, there have been over 100 CubeSats launched into space since the introduction. Therefore, CubeSats have the capabilities of being a great observer that can help with the ad-
vancement of future technology.

Weed Management Potential of Various Mulches on Organically Grown Japanese Purple and Centennial Sweetpotato Varieties
Taqiyyah Muhammad Junior in Plant Science, Tennessee State University Professor: Dr. Dilip N
Weeds are a nuisance to organic agriculture due to the restrictions on synthetic herbicides and chemical applications. A variety trial of organic sweet potatoes conducted in summer 2014 at the certified organic farm of the Tennessee State University and various mulches evaluated for weed control. Treatments used include wheat straw, pine needle, plastic mulch and no mulch (control). Centennial and Japanese Purple varieties of sweet potatoes were planted on the mulch beds in a 48 inches wide bed with 12 inch in-row spacing, drip irrigated with four replications. The data was collected weekly in the last three weeks prior to harvesting on the number of weeds that emerged by a quad-
rate (1 sq. ft.), the fresh and dry weight. The highest total weed count recorded in the no mulch treatment. The total dry weight in gm/bed was noticed in wheat straw at 4.53 gm/bed. The greatest fresh weight of weeds 10.67 g/plant was recorded in the control treatment for the

Abstracts

acetaminophen, triclosan and hydrocortisone.

MACF1 expression of in glioblastomas
Rashunda Hackett Junior in Biology, Tennessee State University Professor: Dr. Quincy Quick
In the last thirty-five years primary malignant brain and central nervous system tumors have had an ~25% relative survival rate of five years post-diagnosis, suggesting that current clinically used treatment protocols for these diseases are marginally effective in curing this disease. A caveat associated with current clinically used agents to treat malignant gliomas are the adverse effects they pose to normal tissue, making it imperative to identify new therapeutic targets in these cancers that will have the highest clinical benefit during treatment and minimize treatment associated toxicities as a consequence of sparing normal cells and tissue. To this end we are investigating the therapeu-
tic potential of inhibiting the function of the spectraplakin protein, Mi-
crotubule Actin Cross-Linking Factor 1, in these neoplasms. Our initial experimental approach has been to characterize the expression and localization of MACF1 in several GBM cell lines using immunofluores-
cence labeling. Data from our studies have revealed that MACF1 is ex-
pressed throughout the cytoplasm and nucleus of several established GBM cell lines and have provided a foundation for further evaluation of MACF1 as a target in glioblastomas.

Dibutyltin Alters Secretion and Production of Interleukin 6 in Human Immune Cells
Nafisa Hamza Sophomore in Chemistry, Tennessee State University Professor: Dr. Margaret Whalen
Dibutyltin (DBT) is used as a stabilizer of plastics and de-wormer of poultry and is found in human blood. Interleukin 6 (IL-6) is a cyto-
kine which regulates the function of many cells including tumor cells. Recent studies in our lab have shown that DBT alters the secretion of IL6. The current study aims to determine whether alterations in IL-6 secretion are accompanied by changes in the intracellular production of IL-6. Lymphocytes were exposed to DBT at concentrations of 5 to 0.05 QM for 24 hours. Results indicated that secretion of IL-6 by lymphocytes was blocked by exposure to 5 and 2.5 QM DBT and was generally increased following exposures to 1-0.05 QM DBT. Intracellu-
lar levels of IL-6 from these same cells were unchanged compared to control cells with exposure to all concentrations of DBT. Secretion of IL-6 was completely blocked by 5 and 2.5 QM DBT but the intracellular levels remained at control levels indicating that intracellular produc-
tion of IL-6 was inhibited by DBT at these concentrations. At DBT concentrations of 1-0.05 QM, IL-6 secretion was increased. However, IL-6 levels remained at control levels after these exposures indicating a DBT-induced increase in production of IL-6. Supported by NIH grant 5U54CA163066.

Design and Operation of a Mechanical Tentacle System for Small Un-
manned Aerial Vehicles
Michael P. Harrigan and Donald S. Toohey Juniors in Mechanical Engineering, Tennessee State University Professor: Dr. W. Yeol Joe
In this research authors present preliminary and developmental stages of design and operation of a mechanical tentacle system for small unmanned aerial vehicles (UAVs), to be used for various possible opera-
tions. In the future, the aerial platform would consist of a quadcopter base and multiple of 2 or 3 DOF (degrees of freedom) small tentacles attached. Unlike mobile manipulating research, which focuses more on the stability and control of manipulators and floating platform, the multiple tentacle system presented in this research introduces a new design and uncultivated aspects of operational applications of small-sized aerial robots. The most meaningful implication of the mobile manipulating system in general and multiple tentacle aerial vehicles in this research is its extended locomotion. Unlike the flying-only vehicles that currently exist and the current trends of unmanned aerial vehicles for achieving only aerial missions while navigation, tentacles enable vehicles to interact with the environment. Some of the mechanisms
Centennial var. and 1.4 g/plant in the pine needle for the Japanese purple variety. Sedges observed in the wheat straw and pine needle treatment for the Centennial variety. In the Japanese purple variety sedges observed in wheat straw and no mulch treatments. Broadleaf weed occurrence was highest in the wheat straw for the Centennial variety and in the Pine needle for the Japanese Purple. The plastic mulch provided improved control of weeds and the Japanese purple has lower occurrence of weed biomass in its growth.

**Cloning the Full-Length cDNAs of Chicken FNDC5 and FNDC4 Genes and the Construction of Their Plasmids**

Kallyn Parks
Sophomore in Biology, Tennessee State University
Professors: Dr. Yajun Wang, Dr. Juan Li, and Dr. Xiaofei Wang

Irisin, a proteolytic cleavage product of fibronectin domain-containing [protein] 5 (FNDC5), is a novel myokine that is secreted by contracting muscle cells. Irisin mediates possibly some exercise health benefits, causing significant increases in energy expenditure, oxygen consumption, pronounced expression of thermogenic uncoupling protein1. Despite the recent progress made towards understanding the role of irisin. Much remains to be learned about the protein distribution, tissue specificity and their specific role in other animal species. The project was designed to analyze the structure and expression FNDC5 and its homology FNDC4 in chickens. Gene-specific primers were designed and used to amplify the mRNA of FNDC5 and FNDC4.

In this experiment, the cDNA of FNDC5 and FNDC4 was successfully amplified, and cloned in an expression vector. The cloned inserts of FNDC5 and FNDC4 were analyzed by restriction enzyme digestion, and sequenced. Results of the restriction digestion and sequencing indicated that the cDNA was successfully cloned in the vector.

**Assessment of the Feeding Behavior of Sea Anemones Abstract**

Chase Richard
Sophomore in Biology, Tennessee State University
Professor: Dr. Michael Ivy

Nematostella vectensis, known as the sea anemone, is an evolutionary ancient organism relative to fundamental cellular organization, development and regeneration among invertebrates. This animal was studied to characterized feeding behavior in two media cultures/ groups, the control group at 7.4 pH and experimental group at 7.2 pH (low pH). Brine shrimp, the food source, are maintained in a hatchery with the control 7.4 pH. The control shrimp are placed in test tubes to be prepared for the sea anemone feeding in the control media. For the low pH group, the shrimp are maintained at this lesser than control alkaline solution and are prepared to feed the experimental sea anemones. After each sea anemone from the two groups has been transferred to an observation dish of appropriate medium solution (20mL) and equilibrate for ten minutes, we begin the feeding. Comparative observation indicated, the experimental group captured with their tentacles more Brine shrimp than the 7.4 pH specimens (control), and consumed them in 1/3 of the time appropriately versus controls. We observe how the sea anemones behave based upon feeding reaction time, length, and any extra activity in the presence of the Brine shrimp.

**The Role of Protease-Activated Receptor -4 in Vascular Smooth Muscle Cells**

Jordan A. Spencer
Freshman in Biology, Tennessee State University
Professor: Dr. Carla D. Gardner-Jones

Studies have shown that thrombin stimulates the activation of extracellular regulated kinase (ERK 1/2) and Rho/Rho Kinase, which are associated with cellular proliferation and migration in vascular diseases such as hypertrophy and atherosclerosis. Thrombin activates these kinases through protease activated receptors (PARs). PARs are a subfamily of G-protein coupled receptors activated by proteolytic cleavage, PAR-1, the prototype receptor, is known to mediate vascular smooth muscle cell (VSMC) migration, the hallmark of atherosogenesis. However, little is known in regards to PAR-4 function in VSMCs. To elucidate a role for PAR-4 in VSMCs, we utilized PAR-4 activating peptide AYPGKF to probe receptor function. AYPGKF induced approximately a 4-fold increase in migration of VSMCs. We also observed rapid phosphorylation of a Rho kinase substrate, myosin light chain phosphatase (MYP), and sustained phosphorylation of ERK.

**Characterization of the Effects of Violacein on the Human Serotonin 2C Receptor**

Kiara Williams
Junior in the Department of Agriculture, Tennessee State University
Professor: Dr. Hugh Fentress

Serotonin (5-HT) is a neurotransmitter involved in mental disorders such as depression, PTSD, OCD, and anxiety. The 5-HT2C receptor, a 7-transmembrane G protein-coupled receptor, is involved in neuronal excitability, spatial learning, mood, executive function, glucose, and appetite. This receptor activates signaling pathways downstream of the Gαq/11 protein, as well as other intracellular proteins that activate G protein-independent pathways. Violacein, a violet pigment extracted from Chromobacterium violaceum, is similar in structure to 5-HT and exhibits bactericidal, tumoricidal, and trypanocidal activity. However, violacein has not been reported to have activity at 5-HT receptors. The purpose of this study is to investigate the effects of violacein at 5-HT2C receptor signaling. To determine if violacein is involved in the JAK/STAT pathway, HEK 293 cells expressing fluorescently tagged 5-HT2C receptor were treated with water, vehicle, violacein, or 5-HT, fixed and visualized by fluorescent microscopy. Violacein treatment did not cause receptor internalization. Phosphorylation states of JAK2 and STAT3 were examined by immunoblotting. Preliminary data suggests that violacein may hinder activation of STAT3 but further study is required. We will also investigate the effect of violacein on G-protein activation by measuring phosphoinositide hydrolysis. Affinity for violacein at the 5-HT2C receptor will be investigated by competition binding.

**Porous Silicon Templated Nanoporous Carbon for Tunable Li-S Battery Electrodes**

Dennis Chinedum Ejoh
Junior in Electrical Engineering, Tennessee Technological University
Professor: Dr. Cary L. Pint, Vanderbilt University

Lithium-ion batteries have proven to be the universal standard for commercial battery technology. However, materials that comprise conventional lithium-ion battery electrodes are expensive and environmentally scarce (e.g. lithium, cobalt, etc.). Lithium- Sulfur batteries are currently viewed as the likeliest potential replacement for conventional lithium-ion electrodes, boasting high theoretical capacity about 6 times higher than conventional lithium-ion. In this work, we aim to promote an economically innovative means of fabricating high-performance electrode material, through the implementation of scalable processes and utilization of low-cost process materials: Silicon and Carbon. With fabrication of mesoporous carbon by means of Chemical Vapor Deposition on a highly controllable template such as nanoporous Silicon and subsequent Sulfur penetration, a high-quality cathode material is made; furthermore, the mesoporous nanostructure serves to improve cycle performance (the current focus in Li-S batteries) by preventing irreversible electrochemical reactions through encapsulation of sulfur atoms (allowing volumetric expansion of lithium-polysulfides) within the network formed by carbon meso-pores. Optimal device performance results of ~1360 mAh-gsulfur-1 (at a ~1A/g current loading) upon initial charge/discharge cycling and subsequent cycle capacities of ~1000 mAh-gsulfur-1 have been shown; thus validating the feasibility of future industrial translation.

**An Evaluation of Simultaneous Biological Nitrogen and Phosphorus Removal in Full Scale Wastewater Treatment Facilities**

Rachel Stewart
Junior in Civil and Environmental Engineering, Tennessee Technological University
Professor: Dr. Tania Datta

Eutrophication, the enrichment of a surface water body with excess nutrients such as nitrogen (N) and phosphorus (P), has become a fore-
front environmental issue faced by the world today. Point source discharges, such as those from wastewater treatment facilities (WWTFs), can reduce the ecological impacts of eutrophication by reducing the concentration of N and P loads through biological nutrient removal (BNR). The process of BNR utilizes several different groups of microorganisms that are able to remove N and P from wastewater under specific reaction conditions. Conventional BNR design requirements are difficult to implement on existing facilities that are not designed for nutrient removal. Currently the City of Cookeville WWTF uses an oxidation ditch where microorganisms remove only organic carbon compounds and ammonia. The primary objective of this research is to evaluate simultaneous N and P removal under anoxic-aerobic conditions using full-scale wastewater secondary treatment processes already in place, and to investigate possible operational changes and new configurations of existing infrastructure. Phase I of the research involves sampling different areas of the oxidation ditch and analyzing the various operational parameters. Following in phase II, possible process optimizations will be strategized to accommodate simultaneous N and P removal. Similar chemical and biological analysis will be conducted as previously discussed.

Mechano-stimulation of cell seeded scaffold for improve tendon repair
Mamadou Diallo
Senior in Biomedical Engineering, University of Memphis
Professor: Dr. Jessica A. Jennings

The incidence of tendon injury is growing, making tendon repair strategies among the most researched fields within orthopedics. Synthetic fibers, such as Polyethylene-Terephthalate (PET), are currently used in tendon repair, which offer mechanical property similar to native tendon with limitations, such as biocompatibility of the material.

The goal of this project is to analyze the matrix production activity of cells seeded on representative scaffolds, especially NIH3T3 fibroblast cells, in response to an applied cyclic strain within the PET fabric scaffolds. A bioreactor was redesigned to provide cyclic strain in physiologically relevant ranges with a contamination-free cell culture environment. We hypothesized that cells seeded on scaffolds and exposed to cyclic strain would produce more matrix, glycosaminoglycans (GAG) and collagen, than those in static environment or in the bioreactor without strain.

NIH3T3 fibroblast cells and MC3T3 osteoblast cells were seeded on different regions of the scaffold (Figure 1) before clamping the scaffolds on in the bioreactor (Figure 2). A cyclic mechanical strain was applied on the NIH3T3 region of the scaffold for 5 hours daily for 7 days. A picogreen live/dead staining, alcian blue DNA quantification and red collagen assay were performed to determine number of cells, GAG, and collagen production, respectively. Live/dead staining showed more living cells on the stimulated versus the non-stimulated scaffolds. GAGs production were also higher on the stimulated than the non-stimulated cell-seeded scaffolds. However, collagen was higher on the bioreactor with fluid-flow only than stimulated and the petri-dish, which may be due to early point studied at which cells might be in proliferative phase and not producing collagenous matrix. Cell-seeded scaffolds under cyclic strain produce more GAG than those in static conditions and with fluid-flow only environments, and combination of cell seeding with polymer fabrics could improve therapy for tissue repair with minimal inflammation.

Ankle dorsiflexion in relation to ACL injury
Branden Keys
Senior in Biomedical Engineering, University of Memphis
Professor: Dr. John Williams

Every year approximately 200,000 people in the United States tear their anterior cruciate ligament (ACL). The treatment of choice is to have ACL reconstructive (ACLR) surgery. Despite this more than half of those treated develop post-traumatic osteoarthritis (OA) and only 60% return to their preinjury level of activity. The reasons for this are unclear and the rehabilitation methods and decision criteria for allowing patients to return to sports activities are therefore largely based on qualitative measures. There is a need to develop objective quantifiable methods to identify ACLR patients at risk for early onset OA and of re-injury of their reconstructed ACL or the ACL in their other knee. The goal of this research is to determine if subjects with a reconstructed ACL have different ankle motion compared to healthy subjects while walking and going up and down stairs. A total of ten subjects (five healthy controls and five patients who have had ACL reconstructive surgery) will be recruited from the UM student body following IRB approval and each subject’s written consent. Inertial sensors, consisting of three-axis accelerometer, gyroscopes and magnetometers will be used to measure joint motion in real time at the ankle and knee in both healthy subjects and ACLR subjects. Joint motions will be compared within each subject (left to right side for the control group, ACLR to unjured side for experimental group) and between controls and ACLR subjects. It is hypothesized that ACLR subjects will have altered ankle motion compared to healthy subjects and in particular will have reduced ankle dorsiflexion motion during weight-bearing activities of walking and stair climbing. The results of this experiment may help develop novel measures to identify ACLR subjects in need of further rehabilitation to avoid additional ACL related injuries and/or early-onset osteoarthritis.
Reconfiguring a Portable Mapping System for Electrophysiological Characterization of Tissue Engineered Cardiac Patches

Reginald Pruitt
Senior in Biomedical Engineering, University of Memphis
Professor: Dr. Amy L de Jongh Curry

The long-term goal of this research is to evaluate the preclinical significance of the electrical characteristics of tissue-engineered cardiac patches designed to restore normal function of heart tissue damaged by myocardial infarction. Electrophysiological characteristics of tissue-engineered patches are currently evaluated using data acquisition components on a large rack system. We are developing a portable system to measure electrical activity induced by electrical pacing stimuli using a modular data acquisition system configured for various numbers of recording and stimulation sites. Our system will ensure that the cardiac patches conduct electrical activity normally and do not create a pro-arrhythmic substrate that could ultimately lead to lethal cardiac rhythms.

Loss of GALNT3 Induces Epithelial to Mesenchymal Transition in Trophoblast Stem Cells

David Ray
Senior in Biology, University of Memphis
Professor: Dr. Amy Abell

How do cells change their phenotype? Epithelial-mesenchymal transition (EMT) is a fundamental, cellular process that converts epithelial cells into motile, invasive mesenchymal cells. This process is vital during development and is reactivated during cancer metastasis in adult tissues. Murine trophoblast stem (TS) cells isolated from pre-implantation blastocysts have been used to study the molecular mechanisms responsible for EMT regulation. We have recently found that loss of the O-glycosylase Galnt3 in epithelial TS cells induced a mesenchymal morphology. To determine if loss of Galnt3 induced other features characteristic of mesenchymal cells, we examined the expression of Vimentin, a key, intermediate filament protein found mainly in mesenchymal cells. Vimentin protein levels were measured by western blotting, and cellular localization of Vimentin was examined by immunofluorescence. We found that expression of the mesenchymal marker Vimentin was induced by the loss of Galnt3 in TS cells. This data suggests that loss of Galnt3 induces EMT. These findings indicate that Galnt3 is a key protein required to prevent epithelial cells from converting into mesenchymal cells.

Implementation of the hardware encryption algorithm SIMON on an FPGA

Miles Gepner
Junior in Computer Science, University of Tennessee
Professor: Dr. Garrett S. Rose

In today’s world, overall resource utilization for a hardware encryption implementation is an important factor to consider when the same encryption algorithm is implemented over different hardware sets. A light-weight and flexible algorithm made by the NSA, SIMON is a Feistel block cipher that requires a very small area footprint when implemented on hardware. A Feistel block cipher is a block cipher where the encryption and decryption operations are very similar, they can even be identical. SIMON offers five different block sizes (block sizes being the size of bits being encrypted or decrypted at one time) to encrypt, from 32 bits to 128 bits. The block size implemented in this project was the 32 bit block size, and it was implemented on an Xilinx Artix-7 Field Programmable Gate Array (FPGA) using the hardware description language VHDL. SIMON was implemented to encrypt and decrypt images, using images fed through a USB port on a PC to the FPGA. The result of this project was successful in the case that the images were intact going through the encryption and decryption process.

Reduction of Cronobacter sakazakii by Grape Seed Extract in Milk and Apple Juice

Amber M. Link
Senior in Food Science and Technology, University of Tennessee
Professor: Dr. Doris D’Souza

Cronobacter sakazakii is a gram-negative pathogenic bacteria associated with dry foods, particularly powdered infant milk formula. C. sakazakii commonly cause illnesses that are fatal in infants. Grape seed extract (GSE) is known to be an effective antimicrobial. Therefore, the objective of this study was to determine the application of GSE in model food systems for the reduction of Cronobacter over 24 h at 37°C. Washed overnight cultures of C. sakazakii were treated with 8 mg/ml GSE in phosphate buffered saline (PBS), milk or apple juice and PBS control. Recovered bacteria were enumerated by standard plate count on tryptic soy agar.

University of Tennessee, Knoxville
Observing the Mechanism of pHILP through pH Titrations
Martina Little
Senior in Biochemistry Cellular and Molecular Biology, University of Tennessee
Professor: Dr. Francisco Barrera

Vast advancements have occurred in cancer research over the past twenty years. However, finding a consistent cancer biomarker for diagnosis has been problematic. Although there still hasn’t been success in finding a universal biomarker for cancer, over the years researchers have noticed a slight difference in pH between normal and tumors. The difference in pH is caused by tumor acidosis which is caused by the acidic microenvironment on the solid surface of tumors. The discovery of a pH-sensitive peptide called pHILP (pH-Low Insertion Peptide) has shown promising results with the treatment of human cancer tumors because of its ability to identify pH low tumor tissues. The peptide exists in three distinctive states.

1. (State I) In the absence of lipids and in a neutral or slightly basic pH the peptide exist as an unstructured monomer.
2. (State II) In the presences of a lipid membrane at neutral or slightly basic pH the peptide lies on the membrane surface.
3. (State III) At low pH the structured pHILIP inserts spontaneously (Andreev et.al. 348).

Through pH titration with pHILP, our research group has observed with the use of the fluorescence emission scan how the peptide enters and exits lipids.

Assembly and characterization of polymeric model membranes.
Ashley Lipford
Senior in Mechanical, Aerospace, and Biomedical Engineering, University of Tennessee
Professor: Dr. Andy Sarles

Technological advancements that allow for the reconstitution and engineering of cells and their components have aided in the creation of novel bio-inspired materials that mimic structure and functionality of a cell. For example, phospholipids have been utilized in the formation of giant unilamellar vesicles (GUVs), which serve as models of 5nm-thick cell membranes. Like cells, spherical GUVs enable the internal compartmentalization of contents and provide controlled uptake and release of small molecules including water, ions, and, in pharmaceutical applications, drugs. Most GUVs are assembled with phospholipids, but these lack durability and rapid self-assembly. We propose that this divide can be bridged with the use of synthetic block copolymers as substitutes for the phospholipids, and our goal is to develop methods for quickly assembling and characterizing the stability and transport properties of polymeric vesicles. Thus, the objective of this work is to establish methods for utilizing synthetic copolymers in place of natural phospholipids for constructing GUVs as models of cell membranes. Tests reveal that copolymers improve the longevity of GUVs and quicken the self-assembly process of the membranes.

Resolving Volcanism on Io with Aperture Mask Interferometry
Chima McGruder
Junior in Physics, University of Tennessee, Knoxville
Professors: Dr. Anand Sivaramakrishnan and Dr. Alexandra Greenbaum

James Webb Space Telescope (JWST) is due to launch in October 2018. However, much preparatory work is needed to ensure JWST’s effective use. One major issue is to ensure that data taken by JWST can be properly analyzed. I worked on developing methods for data analysis of simulated images of Io, Jupiter’s closest moon. These images will come from JWST’s instrument, the Near InfraRed Imager and Slitless Spectrograph. Io is extremely volcanically active, shining brightly in the infrared during its volcanic outbursts. Currently, ground based telescopes can’t resolve volcanism on Io because of atmospheric turbulence. This is why using JWST to observe Io’s volcanoes would be extremely beneficial. The most relevant parameters are the position of volcanic eruptions, the flux of those eruptions, and the surface brightness of Io itself. Simultaneously, finding both the positional parameters of Io’s volcanoes and the flux parameters of Io’s volcanoes was inefficient. Instead, I found it best to acquire the positions of the volcanoes first, then fixing these positions to fit for the flux of the volcanoes and the brightness of Io. In addition, I found that with just an assumption of Poisson noise affecting the image, the correct fluxes and brightness could be measured within 3% error.

Electrochemical Evaluation of Non-precious Metal Catalysts for Fuel Cell Applications
Samantha Medina
Junior in Material Science and Engineering, University of Tennessee
Professor: Dr. Thomas Zawodzinski

Proton exchange membrane fuel cell (PEMFC) and anion exchange membrane fuel cells (AEMFCs) are devices that generate electricity by means of a chemical reaction. Both PEMFCs and AEMFCs provide an environmentally friendly alternative to oil-derived fuels with higher efficiency than that of the combustion engine. They can be used to power cars, and for other portable applications. However, one of the major disadvantages of PEMFCs and AEMFCs is the high cost associated with using platinum group metals (PGMs) as the catalyst for the reactions taking place on both the anode and cathode electrodes. Replacing platinum at the cathode and anode electrodes with non-precious group metal (NPGM) catalysts would significantly decrease the cost of fuel cells. The purpose of our research is to determine the optimal parameters affecting the catalytic performance of NPGM catalyst for the oxygen reduction reaction (ORR) taking place at the cathode. We synthesized NPGM catalysts using various Cu and Fe salts, nitrogen precursors (rich sources) along with a carbon support. The as prepared catalyst show very low ORR activity, but after thermal activation under inert atmosphere the catalytic activity was significantly improved. Electrochemical activity was measured by the rotating ring disk electrode (RRDE) technique in both alkaline and acidic electrolytes. The iron sulfate catalyst heat-treated at 900 oC showed the best catalytic activity in acidic and alkaline environments. The iron sulfide catalyst performance was tested in both PEM and AEM fuel cell.

Quantitative Assessment of GW9662 Drug Release in Regenerative Bone Implants
Dennis Andre Norfleet II
Senior in Biomedical Engineering, University of Tennessee
Professor: Dr. Roland. Kaunas

Current methods for healing non-union defects in bone have displayed clinical success but there are still remaining challenges in the field or orthopedics. Limited graft materials, additional surgeries, and poor biocompatibility have mainly caused failures in bone implants. These issues led to the conceptualization of an injectable composite sphere scaffold, composed of GW9662-loaded poly(lactide-co-glycolide) biodegradable microspheres encapsulated in poly(ethylene glycol) diacrylate spheres, to provide the necessary biochemical stimuli and biocompatible materials to ensure patient safety. GW9662 concentration and drug release, originally quantified using mass spectroscopy, was measured in this case using the alternative method of ultraviolet-visible spectroscopy and the feasibility of this method was tested using standard samples. These samples, containing GW9662 dissolved in dimethyl sulfoxide, were placed in deionized water and the absorption spectra of each sample obtained from the spectrophotometer. The calibration curves derived from the absorption spectra yielded standard deviations in measurement error of 0.500, 0.158, and 0.371 %, showing that this method could feasibly be used for quantification. Drug release kinetics of the GW9662-loaded microspheres displayed the expected linear behavior over the 6 day observation period but the measured percent cumulative drug release at days 2, 4, and 6 were 6.41%, 28.7%, and 39.6 %, respectively.

Bone Implants
Dennis Andre Norfleet II
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Current methods for healing non-union defects in bone have displayed clinical success but there are still remaining challenges in the field or orthopedics. Limited graft materials, additional surgeries, and poor biocompatibility have mainly caused failures in bone implants. These issues led to the conceptualization of an injectable composite sphere scaffold, composed of GW9662-loaded poly(lactide-co-glycolide) biodegradable microspheres encapsulated in poly(ethylene glycol) diacrylate spheres, to provide the necessary biochemical stimuli and biocompatible materials to ensure patient safety. GW9662 concentration and drug release, originally quantified using mass spectroscopy, was measured in this case using the alternative method of ultraviolet-visible spectroscopy and the feasibility of this method was tested using standard samples. These samples, containing GW9662 dissolved in dimethyl sulfoxide, were placed in deionized water and the absorption spectra of each sample obtained from the spectrophotometer. The calibration curves derived from the absorption spectra yielded standard deviations in measurement error of 0.500, 0.158, and 0.371 %, showing that this method could feasibly be used for quantification. Drug release kinetics of the GW9662-loaded microspheres displayed the expected linear behavior over the 6 day observation period but the measured percent cumulative drug release at days 2, 4, and 6 were 6.41%, 28.7%, and 39.6 %, respectively.

A software pipeline for the rational design of soft materials
Trevor Jones
Junior in Chemical Engineering, Vanderbilt University
Professors: Dr. Peter T. Cummings and Dr. Clare McCabe

1) Department of Chemical and Biomolecular Engineering, 2)Vanderbilt Facility for Multiscale Modeling and Simulation (MuMS), 3) Institute for
Software Integrated Systems, 4) Department of Chemistry, Vanderbilt University, Nashville, Tennessee 37235, United States

Spurred by the Materials Genome Initiative (MGI), there has been substantial effort to harness the power of supercomputing to accelerate the development of novel materials. Both the MIT Materials Project [1] and Harvard Clean Energy Project [2] have successfully leveraged molecular simulation to begin developing databases for crystalline structures and candidate molecules for organic electronic materials. However, to harness the power of molecular simulation on a scale required by the MGI for soft materials requires a different approach due to the added requirement of sampling systems in configurational space. To run automated, large-scale molecular dynamics simulations of arbitrary soft materials, system initialization is a current stumbling block. In order to use molecular dynamics for automated screening of soft material, a robust set of tools is required to automate the initialization of simulations in arbitrary chemical configurations and produce runnable input files for simulation engines.

Here, we present a suite of tools developed to create and parameterize such arbitrary systems and enable large scale parameter screening of soft materials. Although the biophysics simulation community has put considerable effort into developing software tools and databases for creating and parameterizing biological structures, these tools do not allow users to easily generate arbitrary structures. To this end, we have developed mBuild [3], a hierarchical component based molecular building tool that aims to simplify the constructions of complex initial configurations in a programmatic way to facilitate MGI screening. Users can then create parameterized input files for the GROMACS [4], LAMMPS [5], or Desmond [6] simulation engines by utilizing mBuild, accessing foyer [7], an atomtyping and forcefield parameterization tool, and InterMol [8], a molecular dynamics input file conversion tool. We demonstrate the efficiency of using these tools by generating an ensemble of 42 alkylsilane and 42 polyethylene glycol monolayers attached to a silica substrate with varying surface densities and chain lengths in the matter of minutes on a conventional workstation. Adjusting the chemical composition in mBuild, such as the monomer length used, requires modification of a single argument, which can easily be embedded in a loop to facilitate screening. Simulations of the monolayers at steady state were performed using the GROMACS simulation engine to explore the nematic ordering of the systems and establish trends. The workflow presented here serves as a stepping stone towards the automated screening of soft materials using molecular simulation.

High Performance C/PVDF Nanofiber Anodes for Li-ion Batteries using Particle Polymer Electrospinning

Emily McRen
Sophomore in Chemical Engineering
Vanderbilt University
Professor: Dr. Peter Pintauro

Particle/polymer electrospinning is used to prepare high performance C/PVDF nanofiber anodes. Nanofiber mat stacking and compaction is used to achieve high areal and volumetric capacities. Compared to conventional slurry cast anodes, nanofiber electrodes achieve high capacities (gravimetric, volumetric, and areal) at fast charge/discharge rates. The excellent performance of the nanofiber anodes is attributed to the efficient Li+ transport pathways due to: (i) submicron fiber diameters and (ii) interfiber void space.

Investigating the Influence of BDNF rs6265 on BMI in Early Stage Parkinson's Disease

Sarah H. Milian
Senior in Biology, Vanderbilt University
Professor: Dr. David Charles

BACKGROUND: The functional single nucleotide polymorphism (SNP) in Brain Derived Neurotrophic Factor (BDNF) rs6265 occurs in 40% of the general population and is associated with increased obesity risk. Deep brain stimulation (DBS) for Parkinson's disease (PD) is also associated with weight gain in some patients. This study analyzes whether rs6265 influences Body Mass Index (BMI) of early stage PD patients treated with optimal drug therapy (ODT) or DBS plus ODT (DBS).

METHODS: Twenty-eight subjects from the DBS in early PD trial (NCT00282152, IDEG050016) were genotyped for rs6265. BMI was calculated at each study visit and analyzed after study conclusion.

RESULTS: There was no significant between-group difference (DBS vs. ODT) for BMI change over 24 months when comparing all subjects (p=0.52; DBS=-0.17; ODT=-0.89). The between-group difference doubled (1.63) when only subjects without the SNP (val/val) were compared (DBS=+0.22; ODT=-1.41). The met groups had minimal BMI reduction (DBS=-0.96; ODT=+0.83).

CONCLUSION: This analysis suggests that, while associated with obesity in the general population, it is the absence of the BDNF SNP that may be one of the factors that contributes to the weight changes associated with PD and its therapies.

Sensitizers

Professor: Dr. Peter Maraccini

Sensitizers

Photoinactivation of Bacteria with Dark Preincubation of Exogenous Sensitizers

Shanna Rucker
Senior in Civil Engineering, Vanderbilt University
Professor: Dr. Peter Maraccini

Bacterial contamination in recreational waters poses a significant threat to public health. To best access risk to public health, more knowledge about the underlying mechanisms affecting bacterial growth and survival is needed. To do this, we mixed gram-positive and gram-negative bacteria with different photosensitizers and exposed growth and survival is needed. To do this, we mixed gram-positive and gram-negative bacteria with different photosensitizers and exposed growth and survival is needed. To do this, we mixed gram-positive and gram-negative bacteria with different photosensitizers and exposed growth and survival is needed. To do this, we mixed gram-positive and gram-negative bacteria with different photosensitizers and exposed growth and survival is needed.
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Acknowledgements

13th Annual Research Conference

Tennessee Louis Stokes Alliance for Minority Participation would like to thank everyone who contributed to the success of our conference

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Faculty, Staff and Students who served as volunteers
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<table>
<thead>
<tr>
<th>Poster Presentation</th>
<th>Thursday, February 25, 2016</th>
<th>7:00 PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A software pipeline for the rational design of soft materials</td>
<td>Presenter: Trevor Jones</td>
<td></td>
</tr>
<tr>
<td>Institution: Vanderbilt University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. An Evaluation of simultaneous Biological Nitrogen and Phosphorus Removal in Full</td>
<td>Presenter: Rachel Stewart</td>
<td></td>
</tr>
<tr>
<td>Scale Wastewater Treatment Facilities</td>
<td>Institution: Tennessee</td>
<td></td>
</tr>
<tr>
<td>Technological University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Ankle dorsiflexion in relation to ACL injury</td>
<td>Presenter: Brandon Keys</td>
<td></td>
</tr>
<tr>
<td>Institution: University of Memphis</td>
<td></td>
<td></td>
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<tr>
<td>4. Assembly and characterization of polymeric model membranes.</td>
<td>Presenter: Ashley Lipford</td>
<td></td>
</tr>
<tr>
<td>Institution: University of Tennessee, Knoxville</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Cube satellites</td>
<td>Presenter: Denise McGarity</td>
<td></td>
</tr>
<tr>
<td>Institution: Tennessee State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Design and Kinematic Analysis of a Mechanical Tentacle System for Small Unmanned</td>
<td>Presenter: Donald Toohey</td>
<td></td>
</tr>
<tr>
<td>Aerial Vehicles</td>
<td>Institution: Tennessee</td>
<td></td>
</tr>
<tr>
<td>State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. High Performance C/PVDF Nanofiber Anodes for Li-ion Batteries using Particle</td>
<td>Presenter: Emily McRen</td>
<td></td>
</tr>
<tr>
<td>Polymer Electrospinning</td>
<td>Institution: Vanderbilt</td>
<td></td>
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<tr>
<td>University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Photoinactivation of Bacteria with Dark Preincubation of Exogenous Sensitizers</td>
<td>Presenter: Shanna Rucker</td>
<td></td>
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<tr>
<td>Institution: Vanderbilt University</td>
<td></td>
<td></td>
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<tr>
<td>9. Porous Silicon Templated Nanoporous Carbon for tunable Li-S Battery Electrodes</td>
<td>Presenter: Dennis Ejorh</td>
<td></td>
</tr>
<tr>
<td>Institution: Tennessee Technological University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Processing Large Datasets of Truck Probe Vehicles Using Geographical Information</td>
<td>Presenters: Herve Aniglo</td>
<td></td>
</tr>
<tr>
<td>System and Database Management Software</td>
<td>Alejandra Arriaga</td>
<td></td>
</tr>
<tr>
<td>Institution: University of Memphis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. The Design of a Microfluidic Platform for the Evaluation of a Nanopore Device</td>
<td>Presenter: Tina Anjonrin-Ohu</td>
<td></td>
</tr>
<tr>
<td>Institution: University of Tennessee, Knoxan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Developing rich and interactive user Interfaces for the Analysis of strategic</td>
<td>Presenter: Daniel Enciso</td>
<td></td>
</tr>
<tr>
<td>materials</td>
<td>Institution: University of</td>
<td></td>
</tr>
<tr>
<td>Knoxville</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Implementing Simon on FPGA</td>
<td>Presenter: Miles Gepner</td>
<td></td>
</tr>
<tr>
<td>Institution: University of Tennessee, Knoxan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Characterization of the Effects of Violacein on the Human Serotonin 2C Receptor</td>
<td>Presenter: Kiara Williams</td>
<td></td>
</tr>
<tr>
<td>Institution: Tennessee State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Chili extract (Capsaicin) Modulates Methionine Cotransport in enterocytes</td>
<td>Presenters: Cameron Hill</td>
<td></td>
</tr>
<tr>
<td>and Jessica Santiz-Lopez</td>
<td>Institution: Lemoyne-Owen</td>
<td></td>
</tr>
<tr>
<td>College</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lines</td>
<td>Institution: University of</td>
<td></td>
</tr>
<tr>
<td>Tennessee, Knoxan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Constitutive Activation of the STAT3 by the Human Serotonin 2C Receptor (5-HT2CR)</td>
<td>Presenters: Marybeth Curtis,</td>
<td></td>
</tr>
<tr>
<td>Institution: Fisk University</td>
<td>Letimicia Fears, Ashley</td>
<td></td>
</tr>
<tr>
<td>Hicks</td>
<td>Institution: Tennessee</td>
<td></td>
</tr>
<tr>
<td>State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Elucidating the Role of the Novel Transcription Factor FKH-8 in Regulating</td>
<td>Presenter: Quzonna Reed</td>
<td></td>
</tr>
<tr>
<td>Dopaminergic Signaling</td>
<td>Institution: Fisk University</td>
<td></td>
</tr>
<tr>
<td>19. Growth Analysis of Lung Cancer Cell Line A549 After Exposure to Phytochemicals</td>
<td>Presenter: Latriana Boone</td>
<td></td>
</tr>
<tr>
<td>Extracted From Fennel Plants</td>
<td>Institution: Tennessee</td>
<td></td>
</tr>
<tr>
<td>State University</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
<td>Presenter</td>
</tr>
<tr>
<td>------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>20</td>
<td>Invasive Potential of Echinacea Pallida in Western Minnesota</td>
<td>Taylor Harris</td>
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<td>21</td>
<td>Investigating the Effect of Caenorhabditis elegans dat-1(ok157) and rnt-1(vt34) Mutations on Locomotor Behavior</td>
<td>Terrica Bass</td>
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<td>22</td>
<td>Investigating the Influence of BDNF rs6265 on BMI in Early Stage Parkinson’s Disease</td>
<td>Sarah Millan</td>
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<td>23</td>
<td>MACF1 expression of in glioblastomas</td>
<td>Ra'Shunda Hackett</td>
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<td>24</td>
<td>Observing the Mechanism of pHILP through pH Titration</td>
<td>Martina Little</td>
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<td>25</td>
<td>Cloning the full-length cDNA of chicken FDNC5 and FDNC4 and construction of their expression plasmids</td>
<td>Kalynn Parks</td>
</tr>
<tr>
<td>26</td>
<td>Tissue Expression of FNDC5 in Chickens</td>
<td>Ciara Young</td>
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<td>27</td>
<td>Effect of Human Liver Microsomes on the Metabolism of Polycyclic Hydrocarbons</td>
<td>Alekzander Garcia</td>
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<td>28</td>
<td>Reactions of some hydroxy carboxylic acids with Cu2+ and Cr+ in aqueous solutions</td>
<td>Darrius Small</td>
</tr>
<tr>
<td>29</td>
<td>Differentiating Morphologically Similar Lichens By Sterol Composition</td>
<td>Hannah Houle</td>
</tr>
<tr>
<td>30</td>
<td>Effect of Rapid Thermal Treatments on CdZnTe Gamma Detectors</td>
<td>Stephanie Morris</td>
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<tr>
<td>31</td>
<td>Ross Pair filters for the Kirkpatrick-Baez Microscope</td>
<td>Zachary Dickerson</td>
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<td>32</td>
<td>Studying the Death of Sun-like Stars in the Era of Large Scale Surveys</td>
<td>George Vejar</td>
</tr>
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<td>33</td>
<td>Electrospinning of Poly(vinylidene) Fluoride (PVDF) Nanofibers for Energy Conversion and Sensing</td>
<td>Tecia Grier</td>
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<tr>
<td>34</td>
<td>An Investigation of Mentoring Practices of Graduate STEM Programs</td>
<td>Germysa Little</td>
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<tr>
<td>35</td>
<td>Terpene Emissions from Cedar, Redbud, and Pine Trees</td>
<td>Ashley Caldwell</td>
</tr>
<tr>
<td>36</td>
<td>The Effect of Herbal Extract Used in Traditional Chinese Medicine on Breast Cancer Cells</td>
<td>Christopher Adereti, Justice Adewumi, Brittmie Miles, and Arol Zague</td>
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<tr>
<td>37</td>
<td>Reduction of Cronobacter sakazakii by Grape Seed Extract in Milk and Apple Juice</td>
<td>Amber Link</td>
</tr>
<tr>
<td>38</td>
<td>Weed management potential of various mulches on organically grown Japanese purple and Centennial Sweet Potato varieties</td>
<td>Taqiiyah Muhammad</td>
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<tr>
<td><strong>Science Presentations (Group 1- Crystal Room)</strong></td>
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<tr>
<td>Assessment of the Feeding Behavior of Sea Anemones</td>
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<tr>
<td>Presenter: Chase Richard</td>
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<tr>
<td>Expression of Chicken FNDC5/FNDC4 in cultured embryonic muscle cells</td>
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<td>Presenter: Martina Ratliff</td>
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<tr>
<td>Loss of GALNT3 Induces Epithelial to Mesenchymal Transition in Trophoblast Stem Cells</td>
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<tr>
<td>Serotonergic Influences on Multisensory Processing in Feline Superior Colliculus</td>
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<td>Presenter: Forest Ogunyankin</td>
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<tr>
<td>The Role of Protease-Activated Receptor -4 in Vascular Smooth Muscle Cells</td>
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<td>Presenter: Jordan Spencer</td>
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<tr>
<td>Understanding the molecular basis of high affinity Mn2+ binding by calprotectin</td>
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<td>Presenter: Joshua Haynes</td>
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<tr>
<th><strong>Engineering Presentations (Parlour Room 6)</strong></th>
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<tr>
<td>Design and Operation of a Mechanical Tentacle System for Small Unmanned Aerial Vehicles</td>
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<tr>
<td>Presenter: Michael Harrigan</td>
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<tr>
<td>Mechano-stimulation of cell seeded scaffold for improve tendon repair</td>
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<tr>
<td>Presenter: Mamadou Diallo</td>
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<tr>
<td>Optimization of Flagellum Propulsion for Submersible Robots</td>
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<tr>
<td>Presenters: Robert Turner and Darrah Timothy</td>
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<tr>
<td>Preparation of a Solid State Reference Electrode</td>
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<tr>
<td>Presenter: Kasey Chatman</td>
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<tr>
<td>Quantitative Assessment of GW9662 Drug Release in Regenerative Bone Implants</td>
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<tr>
<td>Presenter: Andre Norfleet</td>
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<tr>
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<tr>
<td>Reconfiguring a Portable Mapping System for Electrophysiological Characterization of Tissue Engineered Cardiac Patches</td>
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<tr>
<td>Presenter: Reginald Pruitt</td>
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<tr>
<td>Electrochemical Evaluation of Non-precious Metal Catalysts for Fuel Cell Applications</td>
</tr>
<tr>
<td>Presenter: Samantha Medina</td>
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<tr>
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<tr>
<th><strong>Science Presentations (Group 2- Parlour Room 1)</strong></th>
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<tr>
<td>Occurrence of Extended-Spectrum β-Lactamase- and AmpC-Producing Enterobacteriaceae from Poultry Farms and Raw Chicken sold in Local Markets</td>
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<tr>
<td>Presenter: Kourtney Daniels</td>
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<tr>
<td>Dibutyltin Alters Secretion and Production of Interleukin 6 in Human Immune Cells</td>
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<tr>
<td>Presenter: Nafisa Hamza</td>
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<td>The Distribution of Calcium Binding Proteins in the Frontal Cortex</td>
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<tr>
<td>Presenter: Kiona Coleman</td>
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<td>Resolving Volcanism on Io with Aperture Mask Interferometry</td>
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<tr>
<td>Presenter: Chima McGruder</td>
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<tr>
<td>Comparative Spectroscopic Analysis of Nitroaniline Isomers via Their Surface Enhanced Raman Scattering (SERS) Signals</td>
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<td>Presenter: Yvonne Ejorh</td>
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<td>Institution: Middle Tennessee State University</td>
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