14th Annual Research Conference

Investing in Tomorrow through Innovative Research and Education

February 23-24, 2017

http://guidebook.com/g/tlsamp - download conference booklet app to your mobile device - 2017TLSAMP

Embassy Suites by Hilton   Nashville Airport
10 Century Boulevard, Nashville, Tennessee, 37214
**TENNESSEE LOUIS STOKES ALLIANCE FOR MINORITY PARTICIPATION**

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:

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<tr>
<th>TENNESSEE STATE UNIVERSITY</th>
<th>MIDDLE TENNESSEE STATE UNIVERSITY</th>
<th>UNIVERSITY OF MEMPHIS</th>
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<td>Principal Investigator</td>
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<tr>
<td>Mark Hardy</td>
<td>Robert Fischer</td>
<td>Richard Sweigard</td>
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<td>Executive Director</td>
<td>Site Coordinator</td>
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<tr>
<td>Lonnie Sharpe Jr.</td>
<td>Mimi Thomas</td>
<td>Regina Hairston</td>
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<td>TLSAMP Director</td>
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<td>Dee Green</td>
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<th>LeMOYNE-OWEN COLLEGE</th>
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<td>Principal Investigator</td>
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<td>Sherry Painter</td>
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<td>Arnold Burger</td>
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<td>Site Coordinator</td>
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<td>Principal Investigator</td>
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<td>Ronald Davis</td>
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<td>Barbara Roseborough</td>
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<td>Site Coordinator</td>
<td>Tony Marble</td>
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<td>Masood Parang</td>
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<td>Site Coordinator</td>
<td>Travis Griffin</td>
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<td>Principal Investigator</td>
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<td>K. Art Overholser</td>
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<td>Site Coordinator</td>
<td>Burgess Mitchell</td>
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February 1, 2017

Dear Tennessee LSAMP Conference participants:

On behalf of Fisk University, it is my pleasure to welcome you to the National Science Foundation Tennessee Louis Stokes Alliance for Minority Participation 14th Annual Research Conference!

Here at Fisk University we place great emphasis on early engagement of students in research activities, including the sharing and dissemination of their results with their peers. Empirical research and scholarship are grounded in our academic curriculum, campus support services, and community activities and we are particularly proud of our STEM programs who contributed to Fisk being ranked at the top of liberal arts universities in the nation, as measured by our research expenditures and student transition to the PhD.

I congratulate the young scholars who will present their research at this conference and I encourage you to pursue graduate degrees. The student projects represent a culmination of academic journeys facilitated on campus by faculty advisers and, through research internships, at our partnering institutions. I am thankful to all for achieving our most prominent goal – the cultivation of scholars and leaders, one-by-one.

To all the attendees, I extend best wishes and a wonderful experience!

Sincerely,

Frank L. Sims
President
February 1, 2017

Dear TLSAMP Students, Faculty and Administrators:

Welcome to the TLSAMP 14th Annual Research Conference.

It is with great pleasure that I welcome you to TLSAMP 14th Annual Research Conference bearing the theme of Investing in Tomorrow through Innovative Research and Education.

Fisk and our partners in the TLSAMP community are committed to engaging students in research and scholarly activities. Empirical research and scholarship are grounded in our academic curriculum, campus services, and community activities. Our students, faculty and administrators emphasize the discovery and advancement of knowledge through research in the natural and social sciences, business and the humanities.

This conference is a time for celebrating our STEM research accomplishments; it is a venue to showcase, disseminate, and share scholarly contributions with other researchers and scholars. The poster presentations and dialogue with the researchers emphasize the commitment to critical thinking and inquiry-based learning and reinforces our trust that the students receive the tools, techniques and skills essential to their intellectual growth.

We highly appreciate the dedication and commitment of the TLSAMP leadership and the support from the National Science Foundation.

Best wishes for a stimulating conference and I congratulate all students for your achievements, as you plan and pursue your future in a STEM discipline. I also wish continued success to faculty advisers, administrators, and staff in your efforts and contributions to the TLSAMP 14th Annual Research Conference. This event is a great opportunity to celebrate our scholarly achievements!

Yours sincerely,

Rodney S. Hanley, Ph.D.
Provost and Vice President for Academic Affairs
February 1, 2017

Dear TLSAMP Participants:

It gives me great pleasure to welcome you to our 14th Annual Research Conference, focusing on “Investing in Tomorrow through Innovative Research and Education.” 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.

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 Fisk University 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
## Thursday, February 23, 2017

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<tr>
<th>Time</th>
<th>Event Details</th>
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<tr>
<td>1:00–5:30 pm</td>
<td><strong>Graduate School Fair Setup</strong> <em>(Ballroom Foyer)</em></td>
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<td><strong>Poster Presentation Setup</strong> <em>(Carolina Ballrooms)</em></td>
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<tr>
<td>3:00–9:00 pm</td>
<td>Hotel Check-in</td>
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<tr>
<td>3:30–5:30 pm</td>
<td>Conference Registration <em>(Atrium)</em></td>
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<tr>
<td>5:30 - 8:30 pm</td>
<td><strong>Graduate School Fair &amp; Networking</strong> <em>(Ballroom Foyer)</em></td>
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<tr>
<td>6:00–7:15 pm</td>
<td><strong>Dinner with Program</strong> <em>(Grand Ballroom)</em></td>
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<td>Conference Welcome: <strong>Dr. Lonnie Sharpe</strong></td>
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<td>University Welcome: <strong>Provost Rodney Hanley</strong></td>
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<td>Moderator and Speaker Introduction: <strong>Dr. Don Brunson</strong></td>
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<td>Keynote Speaker: <strong>Dr. Dina Myers Stroud</strong></td>
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<td>7:30 - 9:00 pm</td>
<td><strong>Engineering and Science Poster Session</strong> <em>(Carolina Ballrooms)</em></td>
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<td><em>Judging for poster sessions starts at 7:30 p.m.</em></td>
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## Friday, February 24, 2017

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<th>Time</th>
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<tr>
<td>6:30–11:00 am</td>
<td>Hotel Check-out</td>
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<tr>
<td>6:30 am - 2:30 pm</td>
<td><strong>Luggage Storage</strong> <em>(Georgia)</em></td>
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<tr>
<td>7:00–2:30 am</td>
<td>Judges Meeting Office <em>(Embassy Boardroom)</em></td>
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<td>8:30–9:30 am</td>
<td><strong>Plenary Session</strong> <em>(Grand Ballroom)</em></td>
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<td>Moderator and Speaker Introduction: <strong>Dr. K. Art Overholser</strong></td>
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<td>Opening Plenary Speaker: <strong>Dr. Ifeoma Nwankwo</strong></td>
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<tr>
<td>9:30–9:45 am</td>
<td>Break <em>(Ballroom Foyer)</em></td>
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<td>9:45–12:00 pm</td>
<td><strong>Oral Presentations</strong> <em>(North &amp; South Carolina Ballrooms)</em></td>
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<td>Science &amp; Engineering</td>
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<td>12:00–12:15 pm</td>
<td><strong>Group Photo</strong> <em>(Atrium)</em></td>
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<td>12:15–2:00 p.m.</td>
<td><strong>Luncheon and Closing Address</strong> <em>(Grand Ballroom)</em></td>
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<td>Moderator and Speaker Introduction: <strong>Mimi Thomas</strong></td>
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<td>Keynote Speaker: <strong>Charles Story</strong></td>
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<td>Poster and Oral Competition Awards: <strong>Dr. Arnold Burger</strong></td>
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<td>Closing Remarks: <strong>Dr. Lonnie Sharpe</strong></td>
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<td>2:00–2:30 p.m.</td>
<td><strong>Pick up Luggage</strong> <em>(Georgia Room)</em></td>
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DINA MYERS STROUD  
Executive Director of the Vanderbilt TLSAMP Bridge to the Doctorate Program  
Executive Director, Fisk-Vanderbilt Masters-to-PhD Bridge Program  
Fisk University  
Vanderbilt University  

Dina Myers Stroud is a Research Assistant Professor in the Department of Physics and Astronomy and the Department of Medicine, Division of Clinical Pharmacology. She currently serves as the Executive Director of the Vanderbilt TLSAMP Bridge to the Doctorate and the Fisk-Vanderbilt Master’s to PhD Bridge Program. In both programs, Dr. Stroud strives to advocate and mentor students from underrepresented groups into and through STEM PhD programs. Recently, she has also stepped into an additional role, as program coordinator for a new AGEP project hosted at Vanderbilt intended to use the Fisk-Vanderbilt Bridge Program model to improve fellow to faculty transition with a focus on women of color. Dr. Stroud is active in the National Research Mentoring Network, specifically as part of the team behind the development of mentor-mentee supportive technology known as MyNRMN.

Following her undergraduate work at Ohio Wesleyan University, where she earned B.A. degrees in Zoology /Genetics and Women’s Studies, Dr. Stroud moved to Vanderbilt for graduate work in developmental biology. She earned her PhD in Molecular Biology in 2001 and began her work in cardiovascular genetics, first in zebrafish and then using mice during post-doctoral fellowships at UCLA and NYU. Her current research investigates the mechanisms underlying dilated cardiomyopathy formation.

IFEOMA NWANKWO  
Associate Professor  
Vanderbilt University  


Dr. Nwankwo’s innovative interdisciplinary projects use community-engaged research methodologies alongside literary critical ones to analyze and advance intercultural and intergenerational relations. These projects include Voices from Our America™, an
international public scholarship and digital humanities project that uses interviews, autobiography and art production, along with archival research to uncover new aspects of communities’ histories then draws on those new sources to develop digital and print publications as well as workshops and other educational programs for K-12 teachers, older adults, and youth. Dr. Nwankwo’s projects also include The Wisdom of the Elders, an initiative focused on revealing and recognizing older adults’ life- and soul- sustaining wisdoms and productively incorporating them into K-12, undergraduate, graduate and health professional education.

In her recently appointed role as Associate Provost, Dr. Nwankwo promotes interdisciplinary learning by finding innovative ways to build bridges between seemingly disparate academic traditions, such as STEM and the humanities, as well as assessing Vanderbilt’s existing partnerships with local colleges and universities and identifying potential partnerships to be made with other national institutions.

**CHARLES STORY**  
President  
Exceptional Coaching Solutions

Charles is the president of ECS (Exceptional Coaching Solutions) Group, Inc. ECS provides coaching solutions to businesses that want to develop and retain a strong base of executive talent. In today’s highly competitive environment, business values executives who can think strategically, execute operationally, hold themselves accountable, work productively with a team, and develop succession talent. ECS Group can provide that extra resource to help business build a competitive people advantage.

Charles has over 35 years of experience in the career development arena. He served almost 13 years as president and CEO of INROADS, one of the largest career and leadership develop organizations in the country. He has worked with executives at all levels and understands the wide array of skills and competencies required to excel short-term and long-term. In addition, he cumulatively has more than 30 years of experience as a corporate director with Briggs and Stratton and ChoicePoint (1997-2008). This gives Charles a particularly unique, practical, and business-specific view that adds significant value to the work with his clients.

**Coaching Style:** Listen first. Talk second. Always be candid. Maintain confidentiality regarding coach/coachee discussions. As a coach, work to be a partner with my client and to never be condescending. It is important to facilitate a process of self-discovery, which is always more lasting and powerful than being told what to do or given the answer.
**Frank L. Sims**  
Interim President  
Fisk University

Frank L. Sims recently retired from Cargill, Inc. where he led major strategic business segments both in the United States and internationally. He retired as Corporate Vice President, and as a distinguished member of the Corporate Management Team. As President of Cargill’s North American Grain Business, Sims was responsible for the oversight and management of a $6 billion annual operation with 3,000 employees.

In addition to his service on the Fisk University Board of Trustees for the past three years, Sims' previous board and related experience includes service as Chairman of the Board, Minneapolis Federal Reserve Bank; Advisory Committee to the U.S. Secretary of Transportation; Advisory Committee to the U.S. Secretary of Agriculture; and a fifteen-year member of the Chicago Board of Trade.

He currently serves on the Board of South Jersey Industries, Inc. Sims serves as a member of the non-profit boards of United Theological Seminary (Minnesota) and PACT, Inc. (Washington, DC) and Forum for Theological Exploration (Atlanta, GA).

He is a 1972 graduate of Paul Quinn College where he earned his B.A. in Business Administration, cum laude. The College honored him with an Honorary Doctorate in 2013. He and his wife, Robyn, a Fisk alumna, have three children Bradford, Leigh-Kirstin and Franklin, also a Fisk alumnus. His mother-in-law, Zenobia Bracy Jefferson, and two of her sisters are also Fisk alumnae.

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**Rodney S. Hanley**  
Provost and Vice President for Academic Affairs  
Fisk University

Rodney Hanley joined the Fisk Family as Provost and Vice President for Academic Affairs on September 15, 2014. Dr. Hanley is a seasoned academic administrator and faculty member with more than 13 years of experience in higher education. Dr. Hanley joins the Fisk Family as a dynamic academic leader with a strong record of building the organizations of which he is a member.

Dr. Hanley previously served as the Provost and Vice President (Academic) and Professor of Biology at Lakehead University in Thunder Bay, Ontario. In addition, Dr. Hanley served as Department Chairman and Associate Professor at the University of North Dakota and then as Dean of Science and Professor of Biology at the University of Winnipeg.

Dr. Hanley began his research career studying biodiversity, especially insects, and later became interested in environmental sustainability and biogeography. Some of Dr. Hanley’s major projects include: the establishment of a research center to provide decision support systems for agriculture, natural resource management, and educational communities from Earth observations; operating NASA’s DC-8 research jet; the design and installation of a specialized camera on the International Space Station;
the establishment of the Prairie Isotope Production Enterprise-a non-profit corporation that brings together the university researchers, private industry, and medical services to produce medical isotopes, which are critical in the early detection of cancer; the development of the first new Law School in Ontario in 44 years; and the discovery of numerous new species of insects, found mainly in Central and South America.

**DON C. BRUNSON**
Assistant Dean of the Graduate School Office of Diversity
Director of VU-EDGE Program

Don Brunson is a native of Baltimore, Maryland. After graduating from Morgan State University, he attended the Massachusetts Institute of Technology (MIT) on a MARC graduate fellowship and became the first African-American to earn a Ph.D. in Toxicology from MIT. His professional appointments have included Assistant Director of the MIT Office of Undergraduate Admissions, Special Assistant in the Office of the President of Morgan State University, and Director of the Morgan State University Honors Program.

He currently serves as the Assistant Dean of the Vanderbilt University Graduate School and the Director of the Graduate School's Enhancing Diversity in Graduate Education Program where he is responsible for leading recruitment and retention efforts for underrepresented minority Ph.D. students in all fields and women Ph.D. students majoring in science, technology, engineering, and mathematics. His other Vanderbilt responsibilities include advisor to the Organization of Black Graduate and Professional Students, co-representative to the National Association of Multi-Cultural Engineering Program Advocates, and university representative to the following consortia: The Leadership Alliance, the National Name Exchange, and The National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc.

**KNOWLES ARTHUR OVERHOLSER**
Senior Associate Dean of the School of Engineering
Vanderbilt University

Knowles Arthur "Art" Overholser serves as senior associate dean of the School of Engineering. He is a 1965 chemical engineering graduate and earned his doctorate in chemical engineering at the University of Wisconsin and a post-doctoral appointment at Imperial College in London.

Overholser joined Vanderbilt in 1971 as an assistant professor. During his career, he served as a visiting scientist at the University of California at San Francisco. He then joined Vanderbilt's Department of Biomedical Engineering, where he pursued research in quantitative cardiovascular physiology. He has been with the Engineering Dean's Office since 1999, where he has administrative responsibility for the undergraduate educational functions of the school.

Overholser is a celebrated member of the engineering community, having received numerous awards and recognitions at the university and national levels. At Vanderbilt, he received the Ellen Gregg Ingalls Award for Classroom Teaching and the Thomas Jefferson Award for Distinguished Service. At the national and state levels, he is a leader in a number of professional organizations and is dedicated to engineering education.
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.
FISK-VANDERBILT MASTERS-to-PhD BRIDGE PROGRAM

University of Memphis
Graduate School

TENNESSEE STATE UNIVERSITY
School of Graduate Studies and Research

TENNESSEE TECH UNIVERSITY
Graduate School

VANDERBILT UNIVERSITY
Department of Chemistry

VANDERBILT UNIVERSITY
College of Engineering

VANDERBILT UNIVERSITY
Graduate School

UNIVERSITY OF TENNESSEE, Knoxville
Graduate School

Founded in 1866, Fisk University is Nashville’s first institution of higher education and currently ranks in the top 20% of all liberal arts institutions in the nation according to The Washington Monthly. According to the American Physical Society, Fisk is the number one producer of underrepresented minority Master’s in Physics degrees. Fisk is ranked in the top 15 institutions for awarding the Master’s in Physics degree for all students, and tied for fourth place for Master’s degrees awarded to women. Fisk has earned 4 R&D 100 Awards, the only HBCU to do so. For more information about Fisk University, please visit www.fisk.edu.
The Etiology of Cancer and Its Overall Effects on the Adult Communities in the United States of America

Background: An elevated number of adults in the United States of America have active views concerning cancer correction and preventive measures. It is believed that alarming studies show that many adults are apprehensive about preventive measures that involve prescreening, screening and post screening as the normal course for identifying and maintaining preventive care that can reduce the adverse effects of cancer. Minimal research knowledge is documented about between cancer volunteer cancer prevention among adults and other preventive measures. Our team has examined socio-correlations of these practices and their connections with continuous exercise, nicotine intake, and a quality diet has prescribed by the Food and Drug Administration and The Centers for Disease Control.

Methods: Controlled data were evaluated from assessment one (1) of nutrition intake and overall population trends among adults in the United States of America. Americans adults (\(N = 2340\))

Results: Nearly fifty percent of individuals participating in the study accepted the fact that after reading food labels and environmental warning facts, it is believed nearly everything have underlying cancer causes and 20% agreed that “Many individuals do not participate in daily observation of food intake,” and 70% stated that “There many adults have maintained diet preference and intake according to like and childhood indoctrination, It is a very difficult task to know what recommendations are effective measures, according to the diet of the general population which influences, in many cases, impact relating to cancer. It’s hard to know which ones to follow.” These diet influences had a greater negative impact among individuals who were less informed according to geographical location and education, with a minimal effect according to race and age.

Conclusions: Adults in America who possess personal views about cancer correction and prevention may be at increased risk for the onset of cancer, due to the fact, they are less prone to participate in cancer prevention programs promoting prevention and correction

Results: Education in the general community is required on social as well as educational levels in order to derive at an acceptable rate for an impact on lowering cancer rates.
Management of Hypertension at the level of Families in the United States of America

Hypertension remains a disease that has become a problem in the United States of America and is one of the leading causes of cardiovascular problems, which filters into disabilities in children and adults. It is believed this problem has a direct relationship to how we live in the twenty first century. The epidemic of hypertension resides in genetic factors, diet, exercise and environmental stress. This disease is a that is far into the stages of progression upon being diagnosed by an attending physician or other health professionals.

The education of hypertension lies in connecting communities in terms of education to control the epidemic of hypertension and this involves connecting families to organizations, institutions and corporations that promote good health practices.

The pointer cannot be applied to a small class of people nor a sample age group, in order to derive at an acceptable level in terms of lowering the rate of hypertension. In controlling the disease, it has been documented that a hypertension management program has to be implemented among families within a community, thus connecting to the general communities in order to lower the rate of the disease. The overall purpose of our research team is to survey and identify causes of the disease, methods of treatment and results involving nontraditional and traditional treatments centered in diet, medicinal treatment and exercise.

Results: In evaluating the outcome of our study five hundred (500) studies were identified using social media and traditional and it has been identified that diet and exercise play a key role in diagnosing the outcome of hypertension

Investigations to Improve Pilot Performance

An aircraft catastrophic event is one that involves the loss of life. This research investigates the causes of military and commercial aircraft catastrophic events due to pilot error, mechanical error, weather, sabotage and other human error for validation that pilot error is the most common cause for aircraft catastrophic events. The research then identifies and categorizes reasons for pilot error such as fatigue, over-confidence, poor communication, etc. It finally presents approaches across different science, technology and engineering domains to improve pilot performance with the potential impact to reduce the number of aircraft catastrophic events due to pilot error. The presented approaches will serve as possible topics for student project designs.
Utilizing GPU Parallel Processing to Analyze 2015 K-12 Student Achievement and Teacher Survey Response Data from the Tennessee Department of Education

Education in Tennessee has consistently ranked below the 25th percentile when compared to the other 49 states in the country. An individual’s level of education is known to directly correlate with job satisfaction, lifetime earnings, level of health, and many more things. Attempting to find relevant factors that are at play in Tennessee’s education skills and tools necessary to do the job. In this system would be a daunting task without the right skills and tools necessary to do the job. In this research, we present a novel method for analyzing four different Tennessee education data sets with a combined total of approximately 87,000 data points. The data sets are comprised of the 2015 Tennessee Value-Added Assessment System, 2015 state-wide attendance and graduation rates, the 2015 Educator Survey, and 2015 ACT scores by district. The parallel computing platform chosen for the task is the NVIDIA Jetson TK1 Development Board, allowing us to harness the computing power of 192 CUDA cores. The board will require initial configuration before use, and we are developing a portable package so that anyone can harness the power of parallel computing in a plug-and-play fashion. The goal of this research is twofold: First, find correlations between unknown factors and the level of education in Tennessee; and second, to increase the availability and reduce the complexity of high performance data analysis tools. The background, methodology, approach, and results will be detailed in our presentation.

Genetics and its Impact on Hypertens

Hypertension has been defined as a disease that was discovered during an earlier study according to epidemiological analysis and its correlation to cerebral vascular accidents (strokes) and cardiovascular accidents (Heart Attacks) that individuals with elevated systole and diastole rates opposed to normal pressure increased the chances of the body reacting in an abnormal manner due to the negative manipulation of the blood vessels in the body. In analyzing normotensive patients versus hypertensive patients, it was found that treatments over a normal period of time due to medication and exercise, resulted in impressive outcomes, but it was also found in hypertensive patients, the rate of coronary artery disease (CAD) opposed to the recent discovery of individuals with elevated blood pressure and immediate stress or environmental Influences discovered that hereditary syndrome plays a vital role in manifesting the disease. It is also believed individuals with the syndrome can develop cardiovascular risk factors before hypertension is expressed through normal channels in terms of medical evaluations. Results also denote that simple treatment does not give physiological stability to the disease but an aggressive management of the syndrome is required and not just an isolated treatment that lowers the numbers in terms of the diastole and the systole rates of targeted individuals for treatment.
Linking the Cytosolic Phenylalanine Pathway, and the Auxin Biosynthetic Pathway

The shikimate pathway is a biosynthetic pathway that leads to the production chorismate, the precursor of the aromatic amino acids. In production of phenylalanine (Phe) and tyrosine (Tyr), chorismate is first converted to prephenate by the enzyme chorismate mutase. The predominantly expressed isoform of chorismate mutase (CM1) is located in the plastids; however, a second isoform (CM2) is present in the cytosol, but the role of this cytosolic isoform in plants is still unknown. Preliminary results from Petunia hybrida, cv Mitchell flowers that overexpress CM2 suggest a possible decrease in plastid content. As auxin is known to inhibit the formation of leucoplasts and amyloplasts, we hypothesize a metabolic link between cytosolic Phe production via CM2 and the tryptophan-dependent auxin biosynthetic pathway. In this study, CM2 expression in the previously developed overexpression lines was analyzed by qRT-PCR. Despite confirmed overexpression of the gene, downstream products Phe and total anthocyanins were decreased. In contrast, there was a significant increase of phenylpyruvate, the immediate precursor of Phe and an amino-acceptor in auxin biosynthesis. Plastid content was quantified by starch assays and found to be decreased in flowers of CM2 overexpression lines. Finally, the auxin indole-3-pyruvic acid (IPA) and indole-3-acetic acid (IAA) were increased as compared to the wildtype. Our results demonstrate a connection between the tryptophan-dependent auxin biosynthetic pathway and the CM2-dependent cytosolic Phe biosynthetic pathway.

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The Negative and Positive Drug Influence of Clonidine on the Muscular and Nervous System of the Human Body

Clonidine is a drug that was synthesized during the early section of the 1960s and that time served as a nasal congestant. In the United States of America, it later became a drug of choice for the treatment of hypertension and serves to also treat neuropsychiatric disorders with a target assignment that works on the nerve cells located within the brain.

This study was conducted to analyze the effects of both normotensive and hypertensive patients with forty days of treatment using the drug clonidine on blood pressure (BP) and the nervous system. Fifty (50) normotensive patients were matched according to medication free baseline analysis and fifty (50) patients with significant hypertension .. The normotensive subjects were analyzed under medication-free baseline conditions; the hypertensive patients were then administered the drug clonidine 0.1 mg twice daily. Baseline plasma NE and DBH levels were showed a significification correlation between the two groups forty days of clonidine regimen. In the same groups, there was a significant reduction in the sample group and the blood pressure in both groups showed a significant correlation. However, in the group treated with clonidine some patients complained of the following: blurred vision, muscle aches and pain and dizziness. Results: The drug was successful in treating the hypertensive patients, but created negative effects as it related to the nervous system and the muscular system.
Caleb Scholl
Freshman
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Margarita Peete
Senior
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Evaluation of Exposures to the Environmental Contaminant DDT on Interleukin 6 Secretion from Human Immune Cells

Dichlorodiphenyltrichloroethane (DDT) is an organochlorine insecticide that is used to combat malaria, typhus, and other insect-borne human diseases. It was banned for agricultural use in the United States in 1972, but is still used in some countries. DDT has been linked to a range of human health issues: many types of cancers, birth defects, infertility, and nervous system damage. Interleukin-6 (IL-6) is a cytokine that promotes antibody secretion to fight off bacteria. It also helps stimulate and organize the pro-inflammatory actions of cells throughout the body. IL-6 has many important roles in the human body besides immune regulation including tissue reconstruction and cell growth. Given the significance of IL-6, there needs to be an understanding of how DDT influences IL-6 secretion from human immune cells. In previous studies, DDT has been found to interfere with lymphocyte cell-surface protein expression and to increase IL-1beta (β) secretion. Thus, we hypothesize that DDT may also influence IL-6 secretion from human immune cells. Peripheral blood mononuclear cells (PBMCs) and monocyte-depleted PBMCs were isolated from human blood and exposed to concentrations of DDT ranging from 2.5 μM to 0.025 μM for 24 h, 48 h, and 6 days. Levels of secreted IL-6 were measured using enzyme-linked immunosorbent assay ELISA. Initial results indicate that a 24 h exposure to 2.5 μM DDT diminishes the ability of PBMCs to secrete IL-6. This effect was seen in PBMCs isolated from four unique blood donors. These data suggest that DDT may interfere with the ability of human immune cells to secrete this important cytokine. Supported by NIH grant U54CA163066.
Development of Drug Compounds targeting Human Receptor Folate Beta in Patients with Rheumatoid Arthritis

Disease Modifying Anti-Rheumatic Drugs (DMARDs) or slow acting anti-rheumatic drugs are a class of drugs often used in the treatment of rheumatoid arthritis. Methotrexate (MTX) is one of the most utilized DMRDs on the market. However, the toxicity of disease modifying anti-rheumatic drugs is a concern among the rheumatology community. There is a great need to develop DMARD the can be given in higher doses since approximately 0.05-1% of the adults in the United States will be affected by rheumatoid arthritis. Rheumatoid arthritis (RA) can be classified as an autoimmune disease that causes inflammation in the synovial tissue, causing pain, stiffness and degeneration of joints. The goal of this study is to identify the target sites for methotrexate analogues, generate new methotrexate analogues that will have an increased binding affinity with the FLOR2; thus, increasing efficacy of RA therapies through docking studies. Molecular docking will aid in predicting the most stable confirmation of the ligand substrate complex. The data acquired in the docking study will be used to propose a lead compound for synthesis. Once a lead compound is selected a synthetic plan will be designed.

Cytocompatibility study of magnetic nanoparticle loaded chitosan- PEG beads in cancerous fibroblasts

The use of magnetic nanoparticle-loaded chitosan/ polyethylene glycol (PEG) cross-linked beads have been developed for stimuli-responsive drug delivery. Because these beads are intended for implantation, they must be cyto-compatible. Beads with low compatibility could result in low cell survivability which could halt cell growth, causing increased inflammation. In this study we evaluated two forms of chitosan PEGDMA microbeads, magnetic nanoparticle (MNP), and non MNP, and compared to silicone controls and controls with no biomaterial beads added. Beads were added to cultures of fibroblast cells (NIH3T3) in 24 well flat bottom plates at bead concentrations of 5 and 10 mg/ml. After overnight incubation, wells were imaged using a microscope and viability was quantified compared to controls using CellTiter-glo. Results indicate that different bead types showed varying cell viability. For MNP beads, cells showed similar viability to the control beads in that both displayed images of cells spread out healthily underneath the beads. This result helps support the idea of MNP-loaded chitosan-peg microbeads being a safe biomaterial for antibiotic drug delivery.
Tyree Javon Morris  
Senior  
Chemistry  
The University of Memphis, Dr. Nathan J. DeYonker

The Elk River Spill: Environmental Fate, prediction of solubility utilizing dipole estimates, and Conformational averaging

Accurate computational estimates of fundamental physical properties can be used as input in the myriad extant models employed to predict toxicity, transport, and fate of contaminants. However, as molecular complexity of contaminants increases, it becomes increasingly difficult to determine the magnitude of the errors introduced by ignoring the 3D conformational space averaging within group-additivity and semi-empirical approaches. The importance of considering 3D molecular structure is exemplified for the dipole moments of cis and trans isomers of (4-methylcyclohexyl)methanol (4-MCHM). When 10,000 gallons of 4-MCHM was spilled into the Elk River in January 2014, a lack of toxicological data and environmental partitioning coefficients hindered the immediate protection of human health and the local water supply in West Virginia, USA. Post-spill analysis of the contaminants suggested that the cis and trans isomers had observably different partitioning coefficients and solubility, and thus differing environmental fates. Obtaining high-quality dipole moments using ab initio quantum chemical methods for the isomeric pair was crucial in validating their experimental differences in solubility [Environ. Sci. Technol. Lett., 2, 127 (2015)]. The use of first principles electronic structure theory is further explored to obtain accurate conformer relative energies and dipole moments of cis- and trans-4-MCHM. Overall, the MP2 aug-cc-pVDZ level of theory affords the best balance between accuracy and computational cost.

Chavez Nelson  
Senior  
Biomedical Engineering  
The University of Memphis, Dr. Jessica A. Jennings

Alginate Coatings Applied to Silver-decorated Calcium Phosphate Nanoparticles Decrease Release of Ionic Silver

Implants and coatings made from calcium materials are often used in orthopedic applications because they support bone growth and function. Though implants are useful in restoring function to tissue, they can also be easily infected. Calcium phosphate nanoparticles coated with silver have been shown to kill microorganisms but free silver ions may also be harmful to human cells. One way to contain the harmful effects of silver released in ionic form is to coat the nanoparticles with a sodium alginate solution to act as a barrier to release. Because alginate cross-links into a hydrogel form in the presence of calcium, methods have been developed to apply a thin sodium alginate coating to the surface of silver-decorated calcium phosphate nanoparticles through dispersion and centrifugation. It is predicted that the gel layer that the alginate coating forms around the nanoparticles reduces the elution of silver, thus decreasing the harmful effects silver can have on healthy cells. Calcium phosphate nanoparticles coated with 50% silver were coated with a 1% sodium alginate solution. The zeta potential for alginate coated particles was -17.19mV, compared to -4.62mV for uncoated controls, which supports the theory that the sodium alginate layer has been successfully applied. A silver elution study in 0.5% acetic acid also demonstrated 0.06% silver release for coated nanoparticles, compared to a 5.13% silver release for the uncoated nanoparticles. For future work, these silver-decorated nanoparticles will be used in chitosan implant coatings and evaluated for antimicrobial and cytocompatibility responses.
An Exploration of Tropical Agriculture and Evaluation of the Viability of a Native American Grape Variety in Honduras

Students visited and worked with the faculty and staff of the Instituto Nacional de Formación Profesional (INFOP), a residential school and research center located in La Paz, Honduras over the month of July, 2016 as part of their Study Abroad TLSAMP experience. INFOP is a research partner with this year’s TLSAMP Study Abroad leader on a project to evaluate the viability of growing a native American grape variety known to be highly resistant to most molds and mildews (Vitis aestivalis) and conducts teaching and research on the production of both temperate and tropical fruit and vegetable crops. Students were introduced to Honduran agriculture through visits to coffee production and processing facilities, agricultural research being conducted at INFOP and at Zamarano University (Zamarano, Honduras), and organic and biodynamic farms in Honduras. Students also encountered Honduran culture by living with a Honduran citizen and through visits to the UNESCO World Heritage Site at Copán, numerous towns and cities across the country, and contact with numerous Hondurans. Each student also worked with a different researcher on projects under way at INFOP to further comprehend the unique requirements associated with agricultural production in Honduras.

Abdullah Bahour
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Spark Flow Footwear

Medial tibial stress syndrome, more commonly known as MTSS or shin splints, is an injury that affects a significant portion of the population. It is characterized by microcracks in the tibial region that result in discomfort while performing daily activities. If left untreated, the minor cracks can develop into a debilitating fracture in the bone. Three types of MTSS exist: bone stress, periostitis, and a third type which is a combination of the first two. MTSS is most common among athletes, females, soldiers, and people with high BMI. Current treatment options include pharmaceuticals, electroshock therapy, injections, physical therapy, orthotic use, stretching, bracing devices, acupuncture, shock absorbers, and surgery. Despite the variety of treatment options available, none are completely effective at repairing the damage caused by MTSS. Motivated by a need to improve upon the existing techniques used to treat shin splints, we present our solution, Sparkflow Footwear. Sparkflow Footwear combines the three most effective treatments for MTSS: electroshock therapy, bracing devices, and shock absorbers, to create a functional and contemporary prototype of the device.
**Free Swell Impact on the Atterberg Limits of a Tunable Clay Polymer Composite**

Engineered soils are designed to address specific needs or alter soil properties. The purpose of this study is to investigate the influence of free swell potential on the Atterberg limits of a newly derived engineered material, “tunable” clay-polymer composite. This composite is composed of montmorillonite clay and a responsive polymer, polyacrylamide. The swell factor, liquid limit, and plastic limit of clay and clay-polymer composite samples were measured in varying pH and ionic concentration conditions (pH 3, 6, 11.5, and 0.3 M [NaCl]). The results show that the pure clay has a higher swell factor than the composite in all cases. The plastic and liquid limits of the composite are higher than those of the pure clay, regardless of the test solution used. Thus, the clay-polymer composite requires additional moisture to reach the plastic and liquid behavioral states compared to the pure clay. Thus, the swell factor is positively correlated with the plastic and liquid limits for the composite.

**Evaluation of Storage Oil Moisture Content for Strontium Iodide and other Hygroscopic Crystals**

Many of the existing high performance inorganic scintillators are hygroscopic and so are typically stored in oil to avoid interaction with moisture. However, it has been found that over time crystals that are stored in oil deteriorate due to moisture within the oil. The goal for this research project is to measure the moisture content in light mineral oil, heavy mineral oil, silicone oil, and paraffin oil typically used to store crystals, as well as to analyze the effect of these various types of oil on the optical transmission of strontium iodide crystals. To measure the moisture content in the oils, a Water Test Kit from Sandy Brae Labs was used with a modified procedure to insure saturation. A treatment was developed to significantly reduce the innate moisture in the oils. Heavy mineral oil was found to have the lowest innate moisture content, but with the use of the developed oil treatment we were able to reduce the moisture content of light mineral by 86% to a final value of 18 ppm (treated heavy mineral oil had 38 ppm moisture). This study is still in progress and future work includes evaluating the effects of the oil on the crystals. Based on preliminary results, it appears that the treated light mineral oil will cause the least amount of deterioration in the crystal's optical transmission.
**Poster Presentation Abstracts**

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**Integrating Food Science into High School Agricultural Education**

Approximately 48 million Americans are affected by foodborne illnesses each year. Approximately 128,000 of these people are hospitalized and 3,000 die. *Salmonella* and *Campylobacter* pathogens are in the top five lists of pathogens that cause foodborne illness. Raw and undercooked poultry and eggs are often associated with *Campylobacter* and *Salmonella* illnesses. Consumers can reduce their risk of foodborne illness from these pathogens by safely purchasing, storing, handling, and preparing these products.

Educators can help prevent these illnesses by making sure consumers know the science behind their food. The Poultry and Egg Education Project (PEEP), funded by a USDA National Food and Agriculture Institute (NIFA) Agriculture and Food Research Initiative (AFRI) grant, conducts bench science research on best practices for safe handling and use of such products and creates science-based educational programming for consumers.

Historically, youth were taught new agricultural practices through FFA and 4-H with the goal to bring that knowledge to their parents and adult farmers. In this study, the same concept is being implemented through high school agricultural education and food safety. Students in agricultural education can bring food safety knowledge and practices home to their families and other adults. Survey research was used for this descriptive study. A total of 89 educators completed the survey. Findings regarding teacher interest, intentions, current food science food safety integration, knowledge and training priorities will be presented.

**Renas Barzanji**  
Senior  
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Dr. Lonnie Sharpe, Jr., & Tom Byl

**Groundwater Hydrology in a Karst Aquifer at Tennessee State University**

The term karst refers to carbonate bedrock with fractures, caves, sinkholes and complex hydrology. The objective of this project was to characterize the hydro-geology of the karst groundwater aquifer at Tennessee State University (TSU) research farm in Nashville. This will allow us to determine if there is adequate water for irrigation, and, if there is a potential for contamination. There are 9 wells drilled into bedrock (depth ranging from 175 to 250 feet below ground surface). The westerly groundwater flow was calculated using the triangulation method and water level measurements. The transmissivity and storage capacity of the bedrock aquifer were also evaluated by conducting an aquifer pump test. (T = 317 sq ft / day; S = 0.0002 to 0.0003 gal/cubic ft) During the same aquifer pump test, measurements were taken and found that the cone-of-depression radiating from the pumping well extended approximately 350 meters from the pumping well. It also appears that some of the wells are hydraulically connected to the Cumberland River, over a quarter mile away.
Animals That Are Needed to Find Cures in Physiology and Medicine According to Similarities in Humans

The purpose of this study is to acquaint the global community with the studies conducted in reference to physiological and or medical research. The animals that are used are genetically bred in order to secure the maximum outcome in reference to the research findings. Researchers are deemed with the responsibility of choosing animals that are bred and developed specifically for the area of physiological/medical research.

In this study, we will name some of the research animals, findings and results that serve as models for quality research outcomes. For example, hamsters, guinea pigs, rabbits, rats and farm animals like pigs, sheeps and cows are research models that are used for the purpose of studying osteoarthritis, geriatric evaluations, inflammation of joints pertaining to the skeletal system and skin problems. Also, in our study, we will discuss specific animals that are used for specific purposes and the overall outcome of the study to date. There is also a dependability of mechanisms including fruit flies, worms and zebra fish, not widely used, along with cats and dogs that serve a minimized purpose in terms of studying heart diseases and the ebola virus.

Stimulation and Inhibition of Seedling Growth by Groundwater Rich in Sulfide

Previous research found sterile water artificially enriched with sulfide stimulated plant biomass. This study's objective was to determine if groundwater from Tennessee State University's farm wells, naturally rich in sulfide, stimulated plant growth. Lettuce, radish and oat raised using waters from a well containing high sulfide (65-115 mg/L) were compared to groundwater with no sulfide. Seeds were germinated in tissue soaked in the experimental waters and raised in a growth chamber at 20°C. The oat plants raised in sulfur-water had 3x more lateral roots and 18% greater biomass than plants raised in fresh-water. Lettuce and radish plants raised in sulfur-water were 35% and 13% larger than those raised in fresh-water, respectively. Plant peroxidase activity increased in plants exposed to sulfide, giving them stronger, more compact cell. Oat plants raised in sulfide-water had more efficient photosynthesis capacity as compared to oat plants raised in freshwater.
Synthesis of 7-(trifluoromethyl)-7,8-dihydroquinolin-5(6H)-one: A New Trifluoromethyl Building Block for the Synthesis of Biologically Active Compounds

Previous studies have shown that fluorinated drug molecules possess more stability, lipophilicity and bioavailability compared to similar unfluorinated compounds. Well studied examples include anticancer docetaxel and artemisinin, where the presence of a trifluoromethyl group led to enhanced bioavailability and in vivo survival rate. Moreover, several nonsteroidal antiinflammatory drugs (NSAID), such as celecoxib and rofecoxib contain fluorine moiety. Celecoxib was found to be more selective for cyclooxygenase 2 (Cox-2), and less toxic than rofecoxib. The primary objective of this work is the synthesis of novel 7-(trifluoromethyl)-7,8-dihydroquinolin-5(6H)-one, as trifluoromethyl building block for the synthesis of potential biologically active compounds.

The synthesis of the above compound involves a mild and efficient method, using ethanol and copper(II)nitrate as the solvent and catalyst respectively. The catalyst played a vital role in the cyclization of the vinylogous amide intermediate to get 75% of the product. The stable intermediate 3-(prop-2-ynylamino)-5-trifluoromethyl)cyclohex-2-enone was prepared by reacting 5-trifluoromethylcyclohexane-1,3-dione with 3-amino-1-propyne in 83% overall yield. Functionalization of the 5-carbonyl furnished the amino, chloro, and hydroxyl derivatives. The synthesis and characterization (IR, NMR, and GC/MS) will be presented.

An Exploration of STEM Student Experiences at HBCUs

In an attempt to maximize the completion of STEM (Science, Technology, Engineering, Mathematics) degrees at Historically Black Colleges and Universities (HBCUs) it is critical to assess the perspectives and experiences of students at these institutions nationwide. Analyzing the policies and procedures of these programs will provide a comprehensive framework that will broaden participation and guarantee success for students pursuing a STEM degree at a HBCU. In the preliminary round of data collection, a survey instrument was completed by sixty-three student participants at one HBCU. Results indicate that students are confronting several barriers. For example, most participants selected “strongly agree” for the following survey item: Students encounter language difficulties with foreign faculty or TAs. The results also demonstrate that most participants agreed to the following survey item: Students lose interest in STEM majors. These two survey items received the highest average, above a 3.5 mean score in agreement. The findings of this research will be used to broaden participation and to increase student persistence by developing supportive STEM programming and policies at HBCUs and disseminating information nationally.
Juvenile Diabetes and Its Overall Effects on American Youth

Background: Type 1 diabetes (T1D) is defined as an auto-immune problem that limits the production of insulin at the level of the pancreas, thus limiting the production of beta cells within the pancreas which was derived from a genetic predisposition occurring due to environmental factors or genetic problems of younger individuals. The escalating numbers over recent years find there is an increase in infant rates in terms of type 1 diabetes with a list of speculative explanations with no concrete evidence to validate the proposed findings. The task of identifying infants with T1D in early years is believed to have derived from increased genetic rates and have become an increasing problem in terms of statistics.

Range of assessment: Etiological studies relating to juvenile diabetes identified the most concentrated location for genetic adherence in reference to type 1 diabetes (T1D) is in the pancreas. At a genetic level, on chromosome six (6), the leukocyte antigens make up approximately a 50% contribution to determining type 1 diabetes with the remaining 50% comprised of multiple genes with each contributing individual showing an altering of leukocyte antigen genes on chromosome six (6);

Range of dissension: According to history, there have been many correlations in terms of T1D, In most cases, the correlations stem from studies that are monitored according to case by case studies, but at this point is showing a decrease in frequency outcome

Range of development: The overall active effect of designated genes relating to T1D must be researched and observed over a period of time in order to validate risk in terms of gene assessment and as a method for identifying the target. There is also a number of locations according to timely research and development that give rise to understanding the epigenetic modification of the genes.

Canine Distemper Outbreak Modeled in an Animal Shelter

Canine distemper virus (CDV) is a highly contagious virus that can cause outbreaks, specifically in crowding situations, such as an animal shelter, in which a large number of susceptible dogs are brought together. Introduction of this virus into a shelter can have devastating effects, potentially resulting in shelter canine depopulation. Motivated by recent outbreaks in Tennessee, a mathematical model was constructed to find relevant factors that could assist in preventing or reducing outbreaks. A system of ordinary differential equations was derived to represent the spread of CDV through susceptible, exposed, infected and recovered (S–E–I–R) classes as well as a vaccinated (V) class. Our model was adapted to represent a local Knoxville shelter. The effects of various control methods, both preventative and corrective, on disease spread were investigated.
Standardization of Cottonseed Gossypol Estimation through FTIR and HPLC

Gossypol plays an important part in biological activities, and is quantified by using different methods. Gossypol serves in plant defense but also can cause unwanted side effects when cotton seeds are used in livestock fed. This is due to the nature of Gossypol. Gossypol is found as +/- isomers and the percentages of each play roles in the effects of Gossypol. In this study, we will compare two methods of quantification of gossypol; High Performance Liquid Chromatography (HPLC) and Fourier Transform Infrared Spectroscopy (FTIR). 19 cotton seed lines were compared for gossypol content in 17 cotton chromosome substitution lines and their two parental lines. Seeds were plucked off of all 19 strains by hand and the fiber was removed with tweezers. The seeds were then dehulled using a wet process, then the hulls and seeds were stored separately and freeze dried for two days. The seeds were then stored at -80 degrees Celsius until used. Sample preparations were determined by the protocols set forth by the HPLC and FTIR methods. The peaks generated by chromatography (HPLC) and spectroscopy (FTIR) were used to compare the efficiency of both methods. The FTIR method was found to be less desirable for quantifying gossypol content because it only detects the presence of gossypol and lacks of ability to quantify total gossypol. However, HPLC is able to quantify total gossypol and makes it a more precise method.

The Adverse Effects pf Diabetes Mellitus and the Influence of Cardiac Remodeling on the Extracellular Matrix

Diabetes mellitus is a disorder that is responsible for a vast number of complications that affect many organs and systems within humans. The onset of each diabetic development is multifunctional with gradual outcomes leading to necrosis of tissues within the human body. This study will place emphasis on one targeted component that shares common outcomes in many diabetic outcomes, etiology of innate immune quality that is associated with a gradual decrease of the immune response and the elevation and inflammatory development. Elevated high glucose levels by way of the polyol pathway are responsible for the following: An increase in diacylglycerol which is responsible for generating the activation kinase C, which stimulates the release of electrons combining with oxygen molecules and creating what is known as an over action of oxides and glycosylation. An elevation of high glucose output has been defined as a determinant of cells within the pathway, thus triggering the glycation and product endpoints. Many physiological factors at a biochemical level is introduced, along with activating transcription and translation interference. The results of this activity can lead to compromising of the immune response, which is validated by, what is known as antioxidants and cytokine stop points.

Keywords: Glucose, pancreas, skeletal system, glycation, Inflammation, immune, circulation, enzymes
Phytochemical profiles and antioxidant activity of different tomato cultivars under organic management system

**Introduction:** Tomato (*Lycopersicum esculentum*) is a widely grown and versatile vegetable throughout the world for taste, color, high nutritive value and diversified use. Color is the most important quality indicator of tomato fruit which is related to the synthesis of carotenoids, lycopene and β-carotene. Intense red color tomato indicates predominant amounts of lycopene and high levels of antioxidants, which prevents cancerous and cardiovascular diseases. However, the data on organic tomatoes and their corresponding color and nutritional traits are very sparse.

**Objectives:** The objectives of this study were to compare the fruit quality of 22 tomato varieties grown under organic management system, and try to understand the correlation among fruit color, phytochemical level and antioxidant activities.

**Significance:** The current study used 22 tomato cultivars grown under the organic certified land in Tennessee State University to understand the relationship between cultivar, color, phytochemical content, and antioxidant activities.

**Methodology:** TPC was determined by Folin-Ciocalteu method. Total lycopene and total carotenoids have followed the method described by Barros et al. (2010), which is based on the method by Nagata and Yamashita (1992). DPPH free radical scavenging assay and reducing power assay were used for antioxidant activity measurement. Color measurement was performed following the method described by Khairi et al. (2015) using a Minolta CR 300 Chroma portable Colorimeter with C illuminant expressed as $L^*$, $a^*$ and $b^*$ and $\Delta E$.

**Results:** The results showed that TPC ranged from 82.48 to 95.81 mg/100g fw. Significant difference in lycopene and β-carotene were detected among different tomato varieties ($P<0.05$). Some tomato cultivars exhibited significantly lower ($P<0.05$) DPPH scavenging activities. The Black Cherry tomato, a purple colored cultivar, exhibited a much lower $\Delta E$ value and a higher $a^*/b^*$ value compared to the other red colored cultivars. Correlation study has revealed that $\Delta E$ was significantly correlated to lycopene content ($P<0.01$), β-carotene ($P<0.01$), and reducing power ($P<0.01$). The parameter $a^*/b^*$ value was also significantly correlated to lycopene content ($P<0.01$) and reducing power ($P<0.01$). Lycopene content was negatively correlated to DPPH ($P<0.05$).
Tributyltin (TBT) is a toxic compound that has industrial uses, such as slime control on masonry, wood preservation, and disinfection of circulating industrial cooling water and is most frequently used in antifouling paints on the hulls of ships. As a result of TBT’s lipophilic character, it absorbs readily into organisms and contaminates the environment and is found in human blood in concentrations as high as 261 nM. TBT decreases the lytic function and secretion of interferon gamma (IFNγ), tumor necrosis factor alpha and interleukin 1 beta (IL-1β) from human lymphocytes. (IL-6) is a cytokine which regulates the function of many cells including tumor cells. Recent studies in our lab have shown that TBT alters production of IL-6 by lymphocytes. The current study aims to determine whether TBT utilizes MAPK signaling pathways (ERK 1/2, p38) to cause alterations in IL-6 production. TBT-induced production of IL-6 in human lymphocytes was measured in the presence and absence of ERK1/2 pathway (PD98059) and p38 (SB202190). Results indicated that the stimulation of IL-6 production by TBT decreased in the presence of each of the MAPK pathway inhibitors. These data suggest that TBT may be causing increased IL-6 production by activating ERK1/2 and p38 MAPKs.

Apolipoprotein A1 (APOA1) is a major protein component of high density lipoproteins (HDL) in plasma. APOA1 aids in maintenance of structural integrity, solubility of lipoproteins, and participates in reverse transport of cholesterol from tissues to the liver for excretion by promoting cholesterol efflux of fat molecules from tissues. Previous reports have shown that APOA1 gene expression were higher in fat line than lean line chickens, confirming its lipid transport role. APOA1 is involved in transport of fatty acids synthesized in the liver, for incorporation into very low density lipoprotein before their secretion into plasma. Correlations between expression of APOA1 and fatness in chickens has been reported, however, its full function in mammalian and other avian species such as the guinea fowl is still obscure. The objective of this study was to characterize APOA1 in guinea fowl and determine its function in various mammalian species. Unlike chicken, APOA 1 gene expression was higher in lean than obese guinea fowl. Peptide sequences of APOA1 from chickens, turkey, duck, and mouse were aligned using TBLAST database of NCBI to generate a consensus sequence and determine sequence similarity among species. Between mouse and avian species there was a 50% variance of the amino acid composition. The dissimilarities may reflect some differences in function of the APOA1 protein.
Brittaney Hogan  
Calandrea Williams  
Sophomores  
Agricultural Sciences  
Tennessee State University  
Dr. William Sutton

**Streamside Salamanders as Indicators of Environmental Stress: Impacts of Acid-Rock Drainage on Headwater Stream Integrity**

Globally, amphibian populations are declining at alarming rates. Multiple factors, including pathogens, environmental pollution, climate change, and habitat destruction play major roles in these declines. Environmental pollution in the form of acid runoff through road construction (i.e., Acid Rock Drainage [ARD]), serves as an important, but understudied threat to stream integrity. We completed streamside salamander surveys on two streams (Carter’s Creek Tributary and Wolf Creek tributary) impacted by ARD in middle Tennessee (Williamson and Fentress Counties). We monitored streamside habitats upstream and downstream of ARD disturbances via two 1m² quadrats and one 15m X 3m transect at each sampling location. We used a combination of rock turning and dipnet surveys to capture adult and larval salamanders. Collectively, these data can be used as a proxy of stream quality and conservation in the face of rapid urbanization and habitat alteration.

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**Application of Support Vector Machine to Classify Data Sources for Transportation Electrification**

Dynamic wireless charging has the potential to increase drive range, reduce cost, size, and weight of electric vehicles (EVs), as well as reduce greenhouse gas effects. The idea of charge-in-motion can make energy demand varying over time and across locations. One way to estimate energy demand of charge-in-motion, a transportation electrification problem, is applying traffic assignment method. Traffic data is required for solving traffic assignment problem. While needed traffic, data is not always available, an automated approach to predict missing data required data sources to be classified correctly. A support vector machine (SVM) approach is proposed here to classify data sources, i.e. where the loop detectors were located. We studied two SVM parameters with a given traffic dataset for optimal classification performance. Traffic volume, occupancy, and direction were selected from the traffic dataset to train, validate, and test the SVM model. The testing results showed 80-85% classification accuracy. The application of the SVM model on classifying the traffic data sources shows that we can now know where a data source was located, which is essential to predict missing signal.

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Hydrology and Water Quality in Tennessee State University’s Wetland

The 500-acre Tennessee State University campus is not only home to thousands of students, but also to a unique biodiversity of ducks, turtles, and beavers that thrive at a wetland located in the northern section of the campus. The landscape began as a down-gradient urban watershed draining 2.3 square miles of northern Nashville. The wetland area on TSU’s property was modified in 1996 due to the implementation of new roads (Ed Temple Blvd and Walter Davis Blvd) and drainage system. The wetland was formed after persistent beavers moved into the area and built several dams along a drainage ditch that flooded the lowland. The objective of this study was to illustrate the transformation from storm-drainage ditch to marsh wetland using GIS, and evaluate the hydrology and water quality. Orthophotos from 2008 to 2016 were obtained and analyzed using Google Earth Pro. The watershed grew from a 4-foot wide drainage ditch to a 26-acre wetland, filled with standing water, wetland flora and fauna. Water quality was monitored with in situ instruments and showed variability with seasonal rains. As the storm water from north Nashville flows through the wetlands, it tends to improve. This wetland has eco-system value as a habitat for many species and also improved water quality.

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Interactions Between Bacteria and Geochemistry in Sulfide-Rich Groundwater, Nashville, TN

The main campus for Tennessee State University is located in Nashville, TN. Despite being an urban campus, it is a land-grant college and has an active research farm with 9 irrigation and research wells, tapping into freshwater and sulfide waters. The close proximity of the freshwater and sulfide waters is puzzling. The objective of this research was to characterize the geochemistry and microbiology of the groundwater to determine if the sulfide waters and freshwater are inter-connected. Sulfide concentrations ranged from 3 to 127 mg/L in the sulfur waters. The pH ranged from 6.8 to 7.3 for all the wells. Sulfur-reducing bacteria and sulfur-oxidizing bacteria were plentiful in the sulfur groundwater. Heterotrophic aerobic bacteria dominated the microbial community in the freshwater system. The sulfur-oxidizing bacteria in the sulfur groundwater transformed the sulfide into a yellow sulfur compound, and subsequently transformed it into calcium sulfate (gypsum). Understanding the geochemistry and microbiology of the two systems provides useful information about the nutrient cycling and water quality in the aquifer below Nashville, TN.
Identification and Characterization of Vimentin in the Guinea Fowl (*Numida meleagris*)

Vimentin is a type III intermediate filament protein that in humans is encoded by the VIM gene. It is usually attached to the nucleus, endoplasmic reticulum, or mitochondria and is responsible for maintaining cell shape, integrity of the cytoplasm, and stabilizing cytoskeletal interactions. Vimentin is also involved in the immune response, and controls the transport of low-density lipoprotein (LDL)-derived cholesterol from a lysosome to the site of esterification form cage-like structures around the nascent lipid droplets and play a supporting role to lipid droplet formation. Even though there are reports on vimentin and its possible function in adipogenesis in cell cultures and human models, its function in fat accretion in poultry is not well understood. The aim of this study was to identify and characterize vimentin in chickens and guinea fowl. Three isoforms of vimentin were identified in chickens using the western blot and polymerase chain reaction. To further characterize vimentin in other avian and mammalian species, vimentin gene will be sequenced, compared using NCBI blast and expressed.

Examination of Feeding Behavior in Sea Anemone

One sea anemone, *Nematostella vectensis*, is an evolutionary important organism relative to fundamental cellular organization, development and regeneration among invertebrates. This organism is called commonly, the sea anemone. *Nematostella* has a simple structure that includes an outer epidermis which is transparent, and an inner gastrodermis layer with a mesoglea area located between two cellular layers. The sea anemone was examined to characterize feeding behavior in two groups, the control and experimental. Two media cultures are set up with 3-5 sea anemones in each at a 7.4 pH (control). One sea anemone (control) culture was fed with a couple drops of Brine shrimp (1-5) from a 7.4 pH medium. The other culture of sea anemones was fed with the low pH (experimental) media solution of 7.3 pH Brine shrimp. The Brine shrimp 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 experimental group, the shrimp are diluted with 7.3 pH solution and are prepared to feed the experimental sea anemone dish. After each sea anemone from each of 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 monitored how the sea anemones behave based upon feeding reaction time, length, and any extra activity in the presence of the Brine shrimp.
Implementation of Cancer Cell Necrosis by individualizing and organizing Nanostructures for the Activation of an Immunosuppressive Drug Called Mustargen

Nanotechnology supports a specialized delivery expression for cancer treatment. Recent advances of nanoscale molecular platforms provide improved pharmacokinetic tools and deletion of cancer causing agents and advances of medical treatments in abnormal cell growth in a confined space, and advance treatment methodologies that enhance bioactivity of a specific drug called Mustargen. At this point, the overall implementation of recent advances in terms of double molecule attraction codes for rearrangement as nanostructures for intracellular delivery of certain cytotoxic amino acids. Specifically, hydrophilic amino acids that trigger cancer cell necrosis by interference of the cell membrane and develops an assimilation into amino acid adhesion (AAA) that combines into active, elongated, microfibers. Hydrophilic amino acids are of a hydrophobic and hydrophilic nature with specific emphasis on the fact that bioactive amino acids display a hydrophilic arrangement and rests on the external location of the micro or nanofiber after independent-aggregation. Microfibers or nanofibers that include apoptotic liposomes were evident in expressing the activity of prostate cancer. In contrast, independent activity of the cell was cell permeable with nanostructures and the peptides alone, also increased activity for prostate malignant cell necrosis by implementation of independent mechanisms identified with membrane interference. Importantly, nanostructures contributed significantly to necrosis more aggressively in re-programming cellular activity and proposing a measurement of tumor selectivity. Our results provide proof-of independent assimilation of these cells and expresses the ability to create nanostructures or microfibers that can effectively generate and deliver cytotoxic amino acids to targeted cancer cell locations. **Key Words:** Mustargen, Nanoscale, Cytotoxic Amino acids, liposomes, pharmacokinetic, and prostate gland.

Viability Analysis of Adenocarcinogenic Cell Lines After Exposure to Natural Compounds

The word “cancer” is now considered as describing hundreds of diseases. It is the most common disease that increases mortality around the world. Regardless of the advances that have occurred for the treatment of cancer, there is still more research needed. Chemotherapy sometimes causes undesirable side effects. Therefore, it might be helpful to use natural therapies to treat cancer patients, as such natural compounds might reduce tumor growth or reduce the adverse side effects of chemotherapy. In this study, we determined the effects of crude methanolic extracts of Propolis and Guava leaves. In the current cancer investigations, after tumor cell lines exposure to serially diluted concentrations of Propolis and Guava showed reduced growth. Our results indicate that both extracts significantly reduced the viability of various cancer cell lines.
Agricultural Education and Mathematics Performance among Youth

Mathematics and science achievement of United States students continues to lag behind other developed nations. The research shows that agricultural education has a positive impact on student achievement in science, but what about math achievement? Several studies concluded that there is a correlation between agricultural based math learning and increased student achievement in mathematics. However, studies were limited concerning mathematics performance of high school students and the associations of math achievement with FFA and SAE participation. The purpose of this study was to compare the mathematics achievement of high school agricultural education students with those not in agricultural education, and determine if participation in the total program of agricultural education would improve their math performance. This research used a posttest-only causal-comparative control group research design and a convenience sample. There were 139 ethnically diverse respondents between the ages of 14 and 18 years. Students taking agricultural education courses were in the treatment group, and non-ag students were in the control group. We developed our own instrument to measure math achievement competency on Mathematics Standards of the Common Core State Standards Initiative. We also collected demographics and provided detailed instructions on rating involvement in SAE and FFA. Students scored the highest in Algebra and lowest in Statistics and Probability. Agricultural education students outscored non-agricultural education students. It appears that there is a relationship between number of agriculture courses, FFA membership, and SAE participation and math achievement.

Agricultural Literacy Among Youth in Agriculture

Millennial students in 2016 are woefully unaware of agriculture and its impact on their lives. The Tennessee Soybean Association has the same concern, and they funded a one-year project to officially gauge the agricultural literacy of youth in Tennessee. Through survey research we administered a questionnaire through a convenience sample of Tennessee youth leaders at an annual conference. The initial questionnaire was developed from the pillars of agriculture literacy from the American Farm Bureau. This data was also used to develop a stronger, more reliable instrument for future studies. Tennessee youth leaders in agriculture were literate in each of the following constructs: Environment, Food, Fiber, Energy, Animal, Lifestyle, Technology, Economy, and Soybean. Perceptions of Agriculture held by youth were positive but varied among each concept. Youth leaders were most positive in the construct of agriculture and economy, but were least positive in the construct of Animals. Overall, these leaders in an agricultural organization were literate in the constructs. This study will be replicated with a revised instrument among youth leaders that are more representative of the population, and not students who are members of an agricultural youth organization. We must continue to improve this study so that there will be a better understanding of the perceptions of agriculture held by youth. To increase positive perception, we must create more creative opportunities for students to get involved in agriculture.
Localized drug delivery of Simvastatin from hollow calcium phosphate nanoparticles for bone repair

Localized drug delivery is an advantageous method of administering drugs to surgical/wound sites to promote regeneration and repair of non-healing bone. Simvastatin is commonly used for lowering cholesterol however; we are testing it for its application in promoting bone regeneration. Simvastatin provides an alternative to growth factors like BMP-2 for stimulating bone formation. Hollow calcium phosphate nanoparticles have similarity to bone composition and may provide a promising means of delivering simvastatin. The aim of this study was to determine the elution profile of Simvastatin from CaP nanoparticles over a seven day period. Simvastatin was dissolved in absolute ethanol at 1 mg/mL concentration. The nanoparticles were immersed in the Simvastatin-ethanol solution overnight to allow the nanoparticles to be loaded with the drug. The loading solution was removed after 24 hours and the nanoparticles were dried in a vacuum oven. The nanoparticles were placed in phosphate buffer solution and elution samples were taken every day for 7 days. The Simvastatin content in the samples was taken using HPLC with UV detection. Our results showed a burst release of the original form of Simvastatin on the first day. However hydrolyzed Simvastatin showed an extended elution profile over the 7 day period. Future studies may include test particles containing antimicrobial silver as an antimicrobial.

Using Small Devices to Enhance Epileptic Healthcare

Every day, millions of Americans suffer from untreated epilepsy due to the unfeasibility of epileptic healthcare. This is due to the fact most insurance plans don’t cover prescription medicine that treats their condition and other forms of treatment often costs thousands of dollars and require surgery. It’s safe to say that the epileptic healthcare landscape is undeniably inhospitable. Current efforts to use electronics to treat epilepsy are based on consistent stimulation of the wearer’s vagus nerve to keep seizures at bay. Unfortunately, the available solutions tend to cause varying levels of sleep apnea and all of them require surgery. This research is focused on lowering the cost of epileptic healthcare by creating a solution that doesn’t need to be surgically implanted and is cheap to manufacture. A prototype was created based on an Arduino microprocessor that successfully detected symptoms of a Tonic-Clonic Seizure using sensors that cost $8 per unit to buy and a Bluetooth transmitter that only costs $15. All in all, the prototype cost $115 to make compared to the $10,000 it cost for a surgically implanted solution.
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**Increasing Quality of Life for Patients with Chronic Illnesses**

The overall goal of this project is to help patients with chronic illness require frequent and avoidable house visits by using wireless patch sensors. We will use these patch sensors to monitor a variety of physiological signals and to track where the patient is. This will empower users to access population health status and help identify potential individual and community actions to achieve improvement in health status. The patch sensors will be a low-cost, disposable and battery-less so they can be easy to work with and we will also have an app that goes along with it to make it even more convenient. My objective in this project is to help relay that information that we get from the patch sensors and analyze it and conform it into graphs so we can view the population health status and what actions to take from there.

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**Development of a GIS tool for truck trip generation**

In the United States (US) economy, the importance of freight transportation is increasingly recognized by public and private agencies at the federal, state and local levels. Growth in freight movement for the past two decades increased at a faster rate than overall growth in the economy. As a result, freight volumes have doubled and coupled with aging of the infrastructure, has led to concerns over future performance of the national freight network. Current transportation reauthorization, Moving Ahead for Progress in 21st Century (MAP-21) recognizes the importance of freight and advocates for a national and state strategic freight plans to assess the condition and performance of the national, state, local and regional freight networks. Adequate disaggregate data and appropriate methods of analysis are paramount to develop such performance measures. In 2016, a report published by the Transportation Research Board, that provides transportation planners and modelers with a number of truck trip generation models (TRGM). The scope of this project is to automate the usage of these models within a GIS environment. The proposed research will develop tools that will foster the use of the TTGM and substantially reduce the effort requirements. A case study for Shelby County in TN, will be developed to showcase the use of the developed tool. The proposed tool will be intuitive and user friendly. A dynamic communications concept, user manual and videos that could be widely distributed to keep practitioners will also be developed as part of this project.
Reactions of Cu$^{2+}$ with the aromatic amino acid Phenyl alanine in aqueous solutions

Phenylalanine is the forerunner of neurotransmitter tyrosine. It appeared that the database of International Union of Pure and Applied Chemistry (IUPAC) showed few studies were conducted with Phenylalanine and copper. To mimic the combination of Cu$^{2+}$ and Phenylalanine in the blood stream, we studied the interaction of Cu$^{2+}$ with Phenylalanine in aqueous solutions under ambient conditions. We have used standard spectroscopic techniques such as IR and UV-Vis spectroscopy to monitor the Cu$^{2+}$ with Phenylalanine reactions. We also gathered the potentiometric graphs for this system at 25°C and in 0.1 M ionic strength, NaNO$_3$. It appeared that no matter the copper to phenylalanine molar ratio (1:1, 1:2 or 1:3 molar ratios), we are forming the same type of species. It turned out that it was the ternary [Cu$^{2+}$ (phenylalanine)(hydroxo)] complex. The detailed data will be presented.

A Secure Framework for mHealth Data Analytics with Visualization

Mobile technology is changing the data collection and analytics in traditional healthcare practice. The distributed and real-time nature of the operation brings security challenges in the gathering, processing, and analysis of personal biometrics data gathered by various wearable health monitoring devices. We present a security framework which identifies the anomalies not only based on the range of bio-metric parameters but also the history and the context. The values of the bio-metric parameters are used to construct the matrices to define the events. The matrices are de-noised using Random Matrix Theory. The correlation between different parameters is captured by the Pearson correlation. A canonical database, populated over time, of the vital signs of the patient and the values of the related biometric parameters through correlation network provide the history and context to detect anomalies. The security of the data collected in real-time is very critical in establishing if an event is an anomaly. Our security framework ensures user authentication, confidentiality using encryption, confirms source device identity and packet level data validation. We provide a fully functional centralized visualization system to keep track of both patient and the doctors involved during any event of interest/concern.
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Interleukin-2 therapy attenuates hypertension in an experimental model of systemic lupus erythematosus

Systemic lupus erythematosus (SLE) is a complex multisystem autoimmune disorder that predominantly affects women of reproductive age. Patients with SLE are more likely to have hypertension and renal injury. Immune system dysfunction is implicated in the pathogenesis of hypertension in SLE. Interleukin-2 is a Cytokine that is often referred to as a T cell growth factor. The dominant role of IL-2 is to support the maintenance and growth of TREG cells. Low dose IL-2 therapy has been shown to boost numbers of TREG cells in humans and mice. This study was aimed at investigating the effects of Interleukin-2 therapy on hypertension in an experimental model of systemic lupus erythematosus. Interleukin-2 therapy showed attenuated mean arterial pressure (MAP) in Systemic Lupus Erythematosus Mice. It is concluded therefore that IL-2 therapy may have benefit in SLE patients by helping to control blood pressure.

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An Exploration of Tropical Agriculture and Evaluation of the Viability of a Native American Grape Variety in Honduras

Students visited and worked with the faculty and staff of the Instituto Nacional de Formación Profesional (INFOP), a residential school and research center located in La Paz, Honduras over the month of July, 2016 as part of their Study Abroad TLSAMP experience. INFOP is a research partner with this year’s TLSAMP Study Abroad leader on a project to evaluate the viability of growing a native American grape variety known to be highly resistant to most molds and mildews (Vitis aestivalis) and conducts teaching and research on the production of both temperate and tropical fruit and vegetable crops. Students were introduced to Honduran agriculture through visits to coffee production and processing facilities, agricultural research being conducted at INFOP and at Zamarano University (Zamarano, Honduras), and organic and biodynamic farms in Honduras. Students also encountered Honduran culture by living with a Honduran citizen and through visits to the UNESCO World Heritage Site at Copán, numerous towns and cities across the country, and contact with numerous Hondurans. Each student also worked with a different researcher on projects under way at INFOP to further comprehend the unique requirements associated with agricultural production in Honduras.
Characterization and Performance Analysis of Organic Photovoltaic Devices

As the race for energy independence intensifies whilst also being placed in conjunction to “clean-energy” goals and heightened environmental consciousness, solar cells have emerged as one of the main forms of alternative energy. Currently, silicon-based solar cells are the current standard for solar energy, boasting silicon – an element with controllable electrical properties and proven reliability in the electronic industry. Due to expensive fabrication processes associated with silicon-based solar cells, organic solar cells have been isolated as a promising alternative with impactful potential such as flexibility, processability, low material cost, and all while being solution-based in development. In this work, we aim to promote the novel low-bandgap FTAZ polymer material and CIS/ZnS (zinc-sulfide coated copper-indium-sulfide nanoparticles) quantum dots in usage for fabrication of high-performance organic solar cells. Additionally, we highlight our native RIR-MAPLE in use in depositing material with uniform and repeatable morphology for more consistent robust device.

Spark Flow Footwear

Medial tibial stress syndrome, more commonly known as MTSS or shin splints, is an injury that affects a significant portion of the population. It is characterized by microcracks in the tibial region that result in discomfort while performing daily activities. If left untreated, the minor cracks can develop into a debilitating fracture in the bone. Three types of MTSS exist: bone stress, periostitis, and a third type which is a combination of the first two. MTSS is most common among athletes, females, soldiers, and people with high BMI. Current treatment options include pharmaceuticals, electroshock therapy, injections, physical therapy, orthotic use, stretching, bracing devices, acupuncture, shock absorbers, and surgery. Despite the variety of treatment options available, none are completely effective at repairing the damage caused by MTSS. Motivated by a need to improve upon the existing techniques used to treat shin splints, we present our solution, Sparkflow Footwear. Sparkflow Footwear combines the three most effective treatments for MTSS: electroshock therapy, bracing devices, and shock absorbers, to create a functional and contemporary prototype of the device.
Cherokee Character Classification and Neural Network Reduction for MrDANNA

In neuromorphic computing, we aim to perform computations using networks built to emulate brain activity, with structures serving as neurons and synapses. We utilize neuroscience-inspired dynamic architectures (NIDA), graphs constructed in a network to achieve the brain emulation. A hardware implementation of the NIDA structure is the dynamic-adaptive neural network array (DANNA). Additionally, NIDA networks have been previously shown to properly classify handwritten digits. Research into this application has been conducted by Dr. Catherine Schuman, who produced NIDA networks using 28x28 pixel images from the MNIST database of handwritten digits using evolutionary optimization (EO). Based on her work, we sought to do is produce a network small and accurate enough that we may eventually map it to a memristor-based DANNA (MrDANNA), but rather than using handwritten digits, we trained our networks on 8x8 pixel images of Cherokee characters. In order to reduce the size of the networks, I inserted conditions that would encourage deletion of neurons during mutation in the EO. As a result, we produced a network of 37 neurons with an accuracy floating around 90%. Since acquiring these results, research to simulate and implement a MrDANNA has been conducted through undergraduate and graduate students currently working in the team.

The Growth of Bacteria in Various Conditions

There are various types of bacteria composed of different strains. These strains are made out of a combination of different components that can affect a cells growth. Cells growth rate are affected by their physical attributes and environment. In order to learn a cells doubling time, the time required for a cell to double, certain factors are controlled while measuring the cells growth. These factors include the temperature, media, and environment in which a colony of cells is exposed. Cells can be grown inside a tube with a predetermined amount of media that supplies a colony of cells with the nutrients needed for the cells to grow. The tube is placed in an incubator and its optical density is taken periodically throughout the day. The natural log of each measurement is later taken and graphed. Then the proper calculations are taken in order to find the doubling time of the cells. Multiple strains of bacteria can be tested and compared. Through comparison, it is determined which strain provides the most effective cells for experiments.
Developing a Methodology to Quantify the Geometry of Ant Nest Casts

My research study was under the Center for Bio-mediated and Bio-Inspired Geotechnics (CBBG) program. Studies are being conducted on how root architecture and ant tunnels can be used as inspiration for civil engineering structures like tunnels or foundation applications. I used a combination of one-dimensional and three-dimensional measurements to quantitate the structures. I measured the depth of systems, horizontal spread, and maximum width, graduated maximum widths, graduated perimeters, total, cumulative and graduated volume distributions, and used these measurements to calculate efficiency. Combined with a thorough study of ant excavation techniques, we will be able to apply this knowledge to man-made tunneling efforts to increase stability and efficiency.

Carbon-Nanostructure Enhanced Electrodes for Vanadium Redox Flow Batteries

Vanadium redox flow batteries (VRBs) offer an easily scalable, long lasting, and highly efficient means of energy storage. VRBs convert energy from chemical reactions into electrical energy, while offering the possibility to either use the power immediately or store it. Depending on the electrolyte volume, 500 kW-h to 100 MW-h can be readily stored with power capability determined by the cell size. VRBs can contribute a stable and significant amount of energy when combined with other alternative energy sources; such as, wind, solar, and geothermal energy. Current large-scale energy storage is relatively expensive, but can be optimized by the use of advanced membranes and electrodes. High surface area electrodes are known to result in increased current densities, in this study, we will investigate the effects of growing carbon-nanostructures on conventional carbon felt electrodes via chemical vapor deposition (CVD) on battery performance.

Meteorite or Meterowrong

There was a piece of metal found on school grounds that was assumed to be a meteorite. I took the chance to study it to find out if it is. Meteorites are a piece of iron or rock from outer space. A meteorwrong, however, is a rock from this earth that is assumed to be a meteorite. The knowledge of differentiating meteorites from meteorwrongs help me to understand the rocks on earth better. This study uses several testing techniques that prove the meteorite or meteorwrong. They are the magnetic test, the streak test, the density test, the window test, and the nickel composition test. We analyzed several meteorites in comparison to the sample found and accurately predicted the status of the piece of metal.
A software pipeline for the rational design of soft materials

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 dynamic 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 implicitly 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.
An Exploration of Tropical Agriculture and Evaluation of the Viability of a Native American Grape Variety in Honduras

Students visited and worked with the faculty and staff of the Instituto Nacional de Formación Profesional (INFOP), a residential school and research center located in La Paz, Honduras over the month of July, 2016 as part of their Study Abroad TLSAMP experience. INFOP is a research partner with this year’s TLSAMP Study Abroad leader on a project to evaluate the viability of growing a native American grape variety known to be highly resistant to most molds and mildews (Vitis aestivalis) and conducts teaching and research on the production of both temperate and tropical fruit and vegetable crops. Students were introduced to Honduran agriculture through visits to coffee production and processing facilities, agricultural research being conducted at INFOP and at Zamarano University (Zamarano, Honduras), and organic and biodynamic farms in Honduras. Students also encountered Honduran culture by living with a Honduran citizen and through visits to the UNESCO World Heritage Site at Copán, numerous towns and cities across the country, and contact with numerous Hondurans. Each student also worked with a different researcher on projects under way at INFOP to further comprehend the unique requirements associated with agricultural production in Honduras.

Li-ion batteries are found in almost every modern portable electronic device. As the market for these devices expands, new Li-ion battery electrodes with high energy and power densities must be developed to satisfy consumer demands. Within the Pintauro Lab, I am researching electrospun electrodes and the effects of morphology changes on electrode energy and power densities. Li-ion battery electrodes were prepared using a rotating drum electrospinning apparatus. Electrospun nanofiber mats containing carbon nanoparticles in a poly(vinylidene fluoride) binder (PVDF) were prepared and characterized as Li-ion battery anodes; electrospun nanofiber mats containing LiCoO2 and carbon nanoparticles in PVDF were prepared and characterized as Li-ion battery cathodes. Compared to traditional slurry cast electrodes of the same composition, the nanofiber mats exhibited higher capacities at fast charge/discharge rates. The excellent performance of the electrospun electrodes was attributed to electrolyte intrusion throughout the interfiber void space and efficient Li-ion transport between the electrolyte and active material nanoparticles in the radial fiber direction.
Angeline Eugene  
Senior  
Biology  
Fisk University, Dr. Phyllis Freeman

**Characterization of Glial Proteins during Prefrontal Cortical Development Suggests Lack of Astrocytic Involvement in Dendritic Spine Pruning**

Schizophrenia is a neurodevelopmental disorder suggested to be associated with excessive developmental pruning of dendritic spines, the primary site of excitatory input to the neuron, in the prefrontal cortex (PFC). Microglia and astrocytes have recently been shown to be involved in the pruning of spines during early postnatal development. However, the PFC has a delayed structural maturation compared to other cortices and this pruning is more evident during the periadolescent stage. The purpose of this study is to determine microglial and astrocytic involvement in the developmental pruning of dendritic spines in the PFC. We previously examined microglial engulfment of spines on pyramidal cells (PCs) in the PFC at postnatal days 24 (increasing PFC PC spine density), 30 (peak PFC spine density), and 39 (decreasing PFC spine density) via immunohistochemistry. We found increased co-localization of protein markers of microglia (Iba1) and dendritic spines (PSD-95) at P39 relative to the earlier time points which indicate active developmental microglial engulfment of spines. For this experiment, the PFC was dissected from eight male and female rats each at postnatal days (P) 30, 39, and 50. Immunoblotting techniques were then utilized to quantify levels of both microglial (Iba1) and astrocytic (GFAP) proteins. The optical densities of the bands were determined and referenced to total protein on Ponceau-stained gels. Data were analyzed by one-way ANOVA with Bonferonni t-tests. We anticipated that levels of microglial proteins will increase at P39, corresponding to the time at which there is active glial engulfment of dendritic spines. Results indicated that there is not a change in Iba1 protein levels during these time points which suggests that the number of microglia is constant across this period. Iba1 may not be a good marker for the engulfment process; another protein such as CD68, which is found in activated microglia, may correlate better with engulfment and will be examined in future experiments. GFAP levels significantly decreased between P30 and P39 which suggests that number of astrocytes is decreasing during adolescence. This observation also suggests that astrocytes are probably not involved in dendritic spine pruning directly nor indirectly.

Stephanie Morris  
Senior  
Physics  
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**The Effects of Doping to Create PN and PIN CdZnTe Diodes for CdZnTe Gamma Detectors**

Bulk leakage and surface leakage current remain as 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 of ion implantation at elevated temperatures. For this project, in particular, other elements were used as dopants for CdZnTe gamma detectors to observe whether such elements serve as better bulk and surface leakage reduction agents. As a result, initial current voltage measurements of dopant implanted CdZnTe gamma detectors indicated that boron and aluminum are highly effective dopants. Thus, for future testing plans, a boron implanted CdZnTe gamma detector performance measurement is of priority.
Berberine Inhibits M2 Polarization in Colitis-Associated Cancer

Inflammatory bowel disease (IBD) is a result of inappropriate chronic activation of the mucosal immune system, leading to inflammation of the digestive tract. The risk of development of colorectal cancer, so called colitis- associated cancer (CAC) significantly increases in patients with IBD. These observations underscore the importance of development of IBD therapies targeting both disease remission and prevention of CAC. Berberine, an isoquinoline alkaloid isolated from many kinds of plants such as *Berberis aristata* and *Coptis chinensis*, has been used as a traditional medicine for several diseases, including bacterial diarrhea. Recently, berberine has been shown to suppress tumor growth. However, information is limited regarding mechanisms of berberine’s action in diseases. Our lab has shown that berberine prevented development of CAC in mice. Since M2 polarization in macrophages (alternatively activated macrophages) function to induce tumor growth, the aim of this study is to determine the effects of berberine on M2 polarization in macrophages. IL-4 stimulates activation of STAT-6 to promote M2 polarization. M2 polarization results in increased expression of genes, including Arg1 and YM1. Raw 264.7 mouse macrophages were treated with IL-4 with and without berberine. STAT6 activation was detected by Western blot analysis using antibody against phosphor-STAT6. The effects of berberine on expression of M2 marker Arg1 in Raw 264.7 cells was assessed using Real-time PCR analysis, and its effects on M2 polarization in AOM-DSS-induced CAC in mice was investigated by detecting the number and the activation level of M2 polarized macrophages in tumor tissues by immunohistochemistry and flow cytometry. We found that berberine inhibits IL-4 stimulated STAT-6 activation in Raw 264.7 cells, in a concentration-dependent manner. Furthermore, SOCS1 serves as a negative regulator for STAT-6 activation and that berberine up-regulates SOCS1 in Raw 264.7 cells treated with IL-4. Results from our studies support the role of berberine in inhibition of M2 polarization in macrophages, thereby, contributing to prevention of cancer development.
Optimizing Schwann Cell Viability after AC Stimulation for Future Use in Spinal Neuron Injury Repair: Adaption of LabVIEW to Capture 0.1 Msec Pulse Data for Multi-assay Assessment

Peripheral Nerve Injury refers to the damaging of the axonal component of a neuron in the peripheral nervous system (PNS); this damage underlies numerous diseases and disorders. Following peripheral nerve injury, the distal portion of the injured axon dies and restoration of function requires injured neurons to extend axons through the injury site to reconnect with the proper targets. Axonal extension involves support cells, such as Schwann cells, to span the injury site, eventually re-myelinating the axons. Schwann cell participation and presence at the nerve injury site is a rate-limiting factor in large-gap PNS repair. Schwann cells support regrown axons through the release of soluble neurotrophic factors, removal of inhibitory myelin debris, expression of neuro-supportive surface ligands, and re-myelination of the regrown axons. It is postulated, increases in neuro-supportive factors secreted by the Schwann cells may serve to enhance axonal growth through a large-gap injury. The rationale behind these studies was to optimize Schwann cell treatments that would foster nerve repair to support future applications as patient autographs, rather than relying on current allograph strategies.

Previous work in this laboratory has shown that exposure of Schwann cells to direct current (DC) electrical stimulation at 50 mV/mm (1 mA, 8 h duration) promotes neurite outgrowth, with a more pronounced effect occurring when Schwann Cells and neurons were co-stimulated.

However, DC stimulation on its own can be harmful to cells, suggesting that AC stimulation, known to have a less harmful impact on cellular viability, should be investigated as a less harmful stimulus for effecting neurite outgrowth. In addition, it is observed that post 24-hour DC stimulation yielded significantly low cell viability. However, when AC stimulation is applied to the cells an increase in cell viability is observed. After data analysis the following observations were recorded; the control yielded a cell viability percentage of 96%, the samples exposed to 20 Hz frequency yielded a cell viability percentage of 99% and the samples exposed to 100 Hz yielded a cell viability percentage of 96%. The results collected from the cell viability test show that for AC stimulation does not significantly harm the cells unlike DC stimulation. The present studies tested two frequencies (20Hz, 100Hz) of Alternating Current (AC) with 0.1ms pulses for 24 hours on Schwann cells and their impact on nerve growth factor release, the presumptive agent effecting neurite outgrowth. In addition, the refinement of the LabVIEW’s parameters and data collection allows multiple cultures to be assessed simultaneously which accelerates the identification of optimal conditions for Schwann cell stimulation to support neuronal injury repair.