



University of South Alabama

**Journal of Undergraduate
Research and Creative
Activities**

JOURACA, Volume 1, Issue 1, 2017

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Welcome,

Research is the cornerstone of academic discovery. JOURACA is intended to provide a starting point for undergraduate publication. We will provide peer review to all submissions and give valuable feedback for beginning researchers. The journal will accept submissions from all types of creative endeavors, to include all students of the University community. By publishing online twice a year, JOURACA will allow students to publish in a timely manner, allowing students to get their research out quickly, while maintaining copyright for future publication in discipline specific journals.



I have mentored student research for many years, taking students to regional conferences to present their works. I have had many conversations related to publishing an online journal for student research for the better part of a decade. When Dr. Shelley-Tremblay brought up the concept last summer I jumped at the chance to participate, because I strongly feel that this is one of those things we are supposed to do at the University. I look forward to assisting this editorial staff in creating a quality publication, so that USA students will have a platform to show their work to the community and the world. We plan to develop and grow JOURACA to meet the needs of the undergraduate research students.

Alan F. Chow, Ph.D.

Advisor to the Student Organization of Academic Research &
Associate Professor of Quantitative Methods
Department of Marketing and Quantitative Methods
Mitchell College of Business

A Message from the Editors



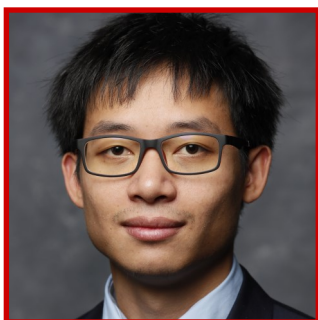
To have not only the opportunity to be funded as an undergraduate researcher, but to have an undergraduate journal is a notable triumph of the University of South Alabama. JOURACA will give less represented students an opportunity to showcase their research in a peer-reviewed, non-copyrighted journal. This journal will expand not only the opportunities of undergraduates to publish their original research, but also allow other students to view and draw inspiration from other students' work.

- Elizabeth Bemis
SOAR President



As Managing Editor for the Journal of Undergraduate Research and Creative Activities (JOURACA) and as Vice President for the Student Organization of Academic Research (SOAR), I see that JOURACA and SOAR are organizations founded by students for students. Our biggest goal is to provide students with more opportunities to publish their work and develop themselves professionally to promote their future careers and enable opportunities. We hope that our readers will take advantage of this opportunities and gives us editors plenty of late nights working getting the next edition out.

- Kevin Ingles
SOAR Vice President



As the SOAR secretary, I have been helping out with the other officers to plan out different SOAR events and put together this journal. Thank you for reading the first issue of JOURACA. Our goal is to showcase the variety of research and other creative activities in which undergraduate students from various academic disciplines at the University of South Alabama have been involved. We are excited to jumpstart this preliminary edition containing the abstracts from students who participated in SURF and VIP programs in summer 2016. After going through this first issue, please let us know if you have any comments, suggestions, or questions.

- Phiwat Klomkaew
SOAR Secretary



As a senior at USA, I have seen the Office of Undergraduate Research grow so much just in my short time at the university. We are excited to finally unveil the first edition of JOURACA, the Journal of Undergraduate Research and Creative Activities. This semester, the journal consists of abstracts by the students who participated in the Summer Undergraduate Research Fellowship. However, the journal will grow into a biannual publication that will showcase undergraduate research at USA. Also, we would like to include full length papers in future editions. Thank you for your appreciation of undergraduate research, and I can't wait to see how this journal evolves.

-Ayla Oden
SOAR Treasurer

Aims and Scope

The Journal of Undergraduate Research and Creative Activities is a platform of undergraduate researchers to present their works in all fields of study. The goal of this journal is to provide students of South Alabama with an opportunity to promote their work and receive real feedback from professionals in their respective fields of study, as well as, promote professional development. We aim to publish original and high quality work from all fields of study.

All submission should be in English and can be formatted in the convention typical for your discipline. All submission are subject to a peer-review process. Preference is given to novel work the contributes to the knowledge of the respective field.

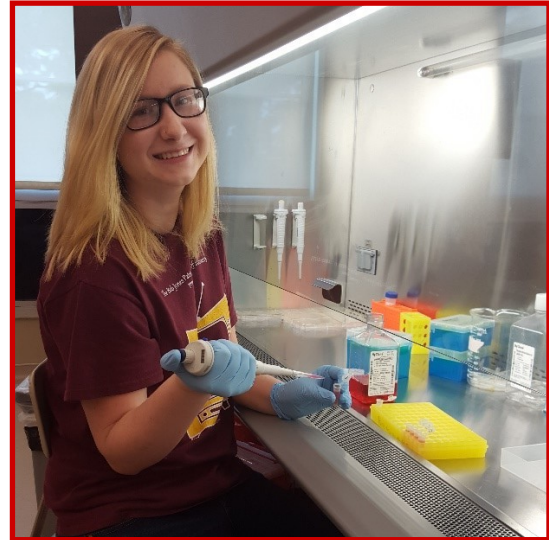
Submission deadlines for the spring issue in March 1st and October 1st in the fall. Publication can be expected to be completed by the following month and will be made available online.

Abstracts

A Bench-Top Atherosclerotic Vascular Model

Kellie Agasloff

Peripheral arterial disease (PAD), a circulatory problem in which narrowed arteries reduce blood flow to the limbs, affects approximately 8 million people in the United States alone. This is a chronic disease that is negatively impacted by damage due to unavoidable treatment, such as balloon angioplasty and atherectomy. The use of drugs combined with these treatments is becoming the gold standard of clinical treatment as they lengthen time between restenosis, or the accumulation of buildup. To date, no studies have been performed to create an in vitro model that can be used to assess the effects of damaging treatments on drug delivery and retention following clinical standard of care. Therefore, we propose to take the first steps in developing a benchtop 3-D structure in which cells can be grown to mimic an occlusion within an artery. This model can then be used to allow for the visualization and quantification of drug adhesion and transport and provide a platform to quantify biological changes. This will allow for the best conditions for optimizing drug delivery to be determined. The goal of this



Department of Biomedical Sciences

Mechanical Engineering

Mentor: Dr. Saami K. Yazdani

Conformal Printed Array Antenna Design and Modeling at mm Wave Frequencies

Chad Austin

The primary aim of this project is the development of a biomedical device that can detect vascular pathologies via analysis of microvascular blood flow. Specifically, this project is designed to determine whether the rate of thermal dissipation of heat applied to the skin serves as a useful measure of the state and quality of blood flow. It is thought that blood flow measurements based on thermal diffusivity can provide information about the state of vascular health. Such a device must include two core components: an antenna to heat a region of the epidermis and a thermopile for detecting the change in temperature. The antenna will serve as a mechanism to apply an adequate amount of heat to a small region quickly and effectively. Our specific focus concerns the electrical engineering portion of this project. A small area of skin must be heated sufficiently and quickly enough to avoid vasodilation. Previous simulations demonstrated that a single mm-wave patch antenna provided a moderate temperature rise in a humanoid phantom material. However, testing on the fabricated mm-wave patch antenna must be conducted to evaluate the performance of the design. Information about the antenna's response is acquired from the vector network analyzer, and thermal performance data is obtained from phantom heating tests in the sensor lab. As this project evolves, a static 2 x 2 patch antenna array may be designed if the



Department of Electrical/
Computer Engineering

Electrical and Computer
Engineering

Mentor: Dr. Saeed Latif

placement of the antenna is 30 mm or greater from the object surface in the final device. To obtain the desired performance features from an array, it must operate from the far-field which is defined as being 30 mm or greater from the target. An array has the benefit of focusing the beam and thereby increasing the power density.

Chlorination of Natural Organic Matter Components and Preparation of Samples for High Resolution Mass Spectral Analysis at the National Laboratory in Tallahassee, Florida

Shahrzad Badri

Chlorination of Natural Organic Matter Components and Preparation of Samples for High Resolution Mass Spectral Analysis at the National Laboratory in Tallahassee, Florida

Natural organic matter (NOM), a product of decomposing biological matter, consists of numerous compounds which contribute to its complex chemical makeup. To reduce this complexity, NOM is frequently broken into fractions before analysis. Fulvic acid (FA), a component of NOM which dissolves in acidic water, has been successfully fractionated using high performance liquid chromatography (HPLC). Characterization of fractions can be achieved by UV-vis, mass spectrometry (MS), and total organic carbon (TOC) analysis. Mass spectrometry is advantageous as it can accurately quantify the masses of compounds in a sample. Samples in the gas phase are ionized and separated according to their mass-to-charge ratio which is plotted as a spectrum. The mass spectrum of a humic substance may contain thousands of peaks, each peak with its own unique mass, and the use of software can substantially simplify the process of assigning formulas to peaks. The composi-



Department of Chemistry

Chemistry

observed. Once peak assignments were made, van Krevelen plots and Kendrick plots were used to graphically represent the data. The van Krevelen plots indicated that unchlorinated samples prepared by a ZipTip had peaks with high H/C ratios and low O/C ratios but unchlorinated unzipped samples exhibited peaks with both high H/C ratios and high O/C ratios. The results are likely due to the non-polar stationary phase in the C18 ZipTip attracting non-polar compounds that tend to naturally have a lower abundance of electronegative oxygen. Furthermore, ziptipped and chlorinated samples exhibited some similarities in their plots in terms of their peak distribution. However, the chlorinated samples also displayed considerably less peaks in the region around 5 O/C and 2 H/C suggesting that chlorination may have possible altering effects on SRFA. Kendrick plots also displayed a similar distribution across all SRFA samples.

Practice Methods of Atonal Song and Extended Vocal Techniques

Elizabeth Bemis

This paper addresses the most daunting challenge an undergraduate singer faces when learning atonal vocal music - voice leading. Because atonal vocal music lacks the harmonic clues of functional tonality, many younger singers are often deterred by atonal repertoire. Inspired by Joseph Straus' theory of "fuzzy transformations" and the properties of uniformity and balance, I have developed a pedagogical technique I have termed Common Knowledge Interval Relativity (CKIR) to aid singers systematically learning atonal vocal lines. I have used Anton Webern's *Wie Bin Ich Froh* as an example of the process of CKIR and of excerpting for the sake of creating effective intervallic exercises. In creating this technique, I have embraced standard undergraduate sight-singing curriculum, which places significant emphasis on subconscious and conscious use of functional tonality in determining accurate voice-leading, and created a method of understanding and executing voice-leading in terms of standard intervals. This theory, though a stand-alone technique, will also serve as the preparational materials in my future study of the effectiveness of CKIR versus rote repetition in accurately learning atonal vocal music.



Department of Music, Theater, and Dance

Music

Mentor: Dr. Rebecca Mindock

Effect of Sialylation of MUC1 by Honokiol in Mammary Carcinoma Cells

Hannah Brooks

While genetics play an important role in the development of carcinoma tissues, environmental factors have also been shown to affect the development and growth of carcinoma tissues. Humic acids occur naturally in the decomposition of natural organic matter and have various pharmacological properties which suggest that humic acid could affect cancer cell growth. The purpose of this study was to examine the effects of humic acid on the growth of RT-4 bladder cancer cells and to identify by what mechanism, if any, humic acid impacted cellular growth. Results from this study show that RT-4 cells treated with 25 $\mu\text{g/L}$ and 50 $\mu\text{g/L}$ humic acid decreased cellular growth. Preliminary data shows that treatment of RT-4 cells with 50 $\mu\text{g/L}$ humic acid decreased the expression of vascular endothelial growth factor A (VEGFA). These findings provide mechanistic insight on how humic acid may regulate angiogenesis, invasion, and metastasis of RT-4 cells. Further studies will be conducted to determine whether humic acid plays a role



Department of Biomedical Sciences
Biomedical Sciences
Mentor: Dr. Padma Thulaasiraman

Agricultural Responses and Sensitivities to Microclimates

Steven Schultze

Precision agriculture is a topic of research primarily in the fields of climatology and agronomy. Precision agriculture is concerned with soil data on a sub-field level, which allows a grower to see a crop that varies in yield and quality over space. It is considered to be at the cutting edge of agronomy by utilizing "Big Data" and modern technologies to make better growing decisions. However, precision agriculture has not yet considered weather and climate data. We measured microclimates on a sub-field level throughout a satsuma crop in southwestern Mobile County, Alabama in order to determine how growth is affected on a micro scale. The satsuma trees are planted among rows of pecan trees that provide some shade for optimal growth. However, not all the trees receive the same amount of sunlight and shade, causing the trees to grow at different rates and produce varying amounts of fruit. Using microloggers to collect temperature and humidity data at each tree throughout the crop, we are able to observe the microclimatic conditions that effect each their growth. Twelve microloggers were housed in PVC pipe stations at the base of each tree six inches above the ground. Data from the microloggers were collected on a weekly basis. Differences in temperature across the study area were striking: there were times when the temperature was as much as 10°C despite the fact that the study area was only 50 x 25 meters in size. We conclude that such temperature



Department of Earth Sciences

Earth Sciences

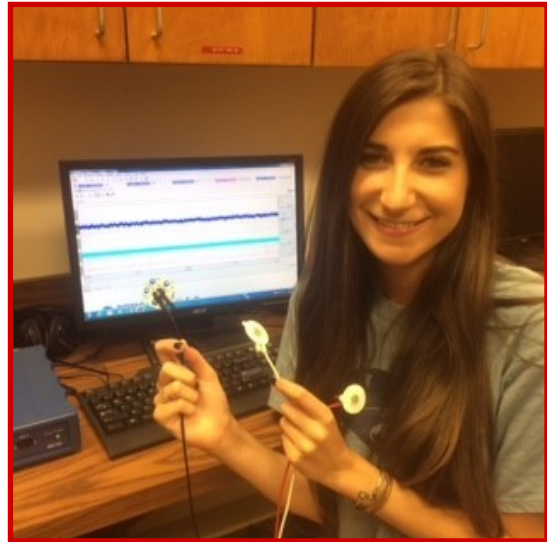
Mentor: Earth Sciences

differences exposes each individual tree to a different climate in any given minute of any given day, which then affects each tree differently in terms of growth, disease pressure, or fruit quality. Additionally, the number of fruit on each tree was counted at the beginning and end. After two months of data collection, it was found that the satsuma trees that received the most shade from the pecan trees had the most growth and fruit production. The data collected could benefit a wide variety of clients in the agricultural community, as well as climatologists and meteorologists. Information on microclimates, when combined with soil data, could allow growers to pinpoint areas within the crop site where growth will be maximized.

Meditation Versus Relaxation: Comparing the Psychological and Physiological Effects

Jessica Campbell

Mindfulness meditation and progressive muscle relaxation (PMR) are two empirically supported techniques that have been found to produce sensations of relaxation, decreased autonomic arousal, and a reduction in symptoms of anxiety (Baer, 2006; Rausch, Gramling, & Auerbach, 2006). Mindfulness meditation functions to reduce anxiety by promoting the nonjudgmental, objective observation of anxiety provoking thoughts and experiences, observing these thoughts and experiences with curiosity, and allowing them to come and go without the intention to respond to them. Progressive muscle relaxation is an exercise founded on the proposition that anxious thoughts and experiences can result in muscle tension, which consequently leads to subjective feelings of anxiety. Physiological tension, and the subjective experience of anxiety is reduced through tensing and releasing different muscles of the body in a systematic fashion. The existing research comparing the mechanisms by which each intervention functions to reduce symptoms is sparse. The present study aims to investigate the differing psychological and physiological responses to mindfulness meditation and progressive muscle relaxation. The overall effectiveness of mindfulness meditation and progressive muscle relaxation will be compared on levels of state mindfulness, as well as physiological response (heart rate and respiration), and a reduction of symptoms of stress and anxiety.



Department of Psychology

Psychology

Mentor: Dr. Elise Labbe– Coldsmith

Assessing Firing Characteristics of Locally Sourced Clays and Their Potential for Use in Pottery and Ceramics

Mary Cave

Clay has been used to manufacture pottery for approximately 20,000 years. Over that time, all major cultures learned which clays and other ingredients were best for producing vessels and other ceramic products. Because these basic ingredients were locally sourced, there was significant variation in the nature of the clay bodies as far as plasticity, refractory firing temperatures, shrinkage, texture and color were concerned. Modern clay bodies that are available commercially are manufactured to meet industrial standards with respect to these properties and for the most part, this is welcomed by ceramists that desire consistency with respect to working and firing. However, for many artists, especially those that specialize in atmospheric firings, the character of the clay body is as important as the consistency. A locally sourced clay used in a wood-fired kiln using locally sourced wood adds "local flavor" to their pieces. The Gulf Coast is enriched with modern clay-dominated depositional environments and clay-bearing Cenozoic geological units. This study seeks to assess the ceramic potential of some of these materials. We have sampled a variety of modern clay materials from Weeks Bay and the Mobile River Delta, as well as clay-rich intervals of the Citronelle Formation (Pliocene), the Bucatunna Clay Member of the Byram Formation (Oligocene) and other undifferentiated Miocene units, all within 160 km of Mobile, Alabama. Each sample



Department of Earth Sciences

Earth Sciences

Mentor: Dr. Douglas W. Haywick

will be geologically assessed (clay mineral composition, carbon and carbonate content, grain size etc.) before being worked into clay bodies for test firing. Firing will be done under controlled conditions in a kiln at low fire (c. 1000°C), medium fire (c. 1200°C) and high fire (c 1300°C) settings as well as in a wood fired kiln. The quality of the fired ceramics will then be evaluated by ceramic artists. It is rare to find a naturally occurring clay body that can suit all requirements of all ceramists (especially for high temperature firings), but studies such as ours will provide important information about the quality of the materials that are locally available to artists.

Human Resource Activities in Franchise and Family Business

Emma Fairbanks

Organizational structure and its relationship to strategy and performance is a well-studied topic in management. However, most research has considered large, multi-divisional organizations or complex organizational forms such as a matrix organization. The purpose of this research is to gain an understanding of how different business structures in one industry, restaurants, use their organizational form, their human resource policies, and the effectiveness of these policies when compared to those of other business structures. We study three ideal types of restaurant ownership structure: corporate, franchise, and family. A corporate owner is usually passively involved and hires professional managers to run all aspects of the business. A franchise owner may be either passive or actively involved and follows an operating system to help standardize the customer experience and brand name. A family owner is actively involved in all aspects of the business and usually encourages other family members to be involved. In addition, each ideal type may be combined with another ideal type to illustrate a hybrid ownership structure. For instance, a family may own and run a franchise operation which would operate differently from a true franchise or true family business. I intend to use a qualitative, multiple case study research method by interviewing owners and managers of all six



Department of Management

Management

Mentor: Dr. William Gillis

restaurant ownership structures, along with a sampling of employees from each to determine the influence of ownership structure, size, and the effect of human resource policies. It is hypothesized that smaller businesses (based upon number of employees and units) will have better performance when they follow an ideal business form. Also, it is hypothesized that larger businesses will more likely become hybrid organizations as well as more formal in their human resource practices. Performance will be self-evaluated based on a subjective rating of managers/owners as well as employee performance, and employee satisfaction.

Weaponization of Electronics— Capable 3D Printer

Jacob Gatlin

The recent development of electronics-capable 3D printers allows for a variety of novel attacks on printed circuits. The design techniques used for Hardware Trojans can be used here to target higher level components such as buses. We describe an antenna-based eavesdropping attack, implement this attack against an I2C bus, then evaluate the attack's performance. We consider the criteria for target buses based on our observations.



Department of Electrical and
Computer Engineering

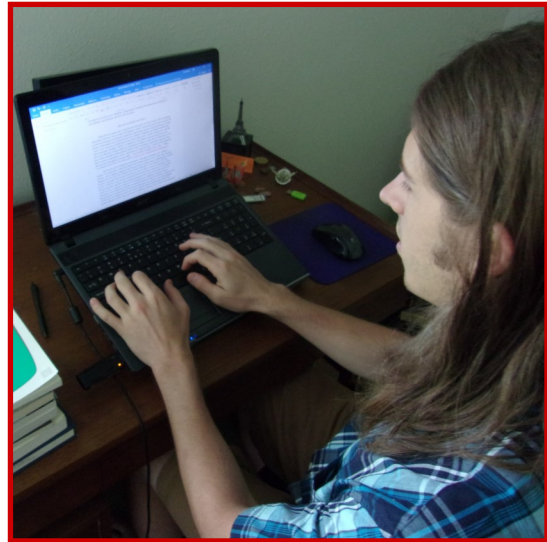
Computer Science

Mentor: Dr. Mark Yampolskiy

Parallel Societies Post-Colonial France

Cameron Graham

Since the creation of the First Republic, France has promoted universalist ideas of liberty, equality, and fraternity. In practice, however, French society continues to struggle with integration and the realization of the multicultural ideal. The popularity of far-right movements and recent terrorist attacks perpetrated by radicalized native-born French citizens clearly show that insufficient progress has been made to achieve France's ideals of equality and fraternity. As the history of colonial France, racist speech by former political leaders, and the Paris Massacre of 1961 demonstrate, this failure of integration is not strictly a recent occurrence. Whether it be the Islamist extremist imams or the far-right French political party the Front National, political forces manipulate societal divisions in such a way as to politically weaponize identity. Through literary analysis, this project seeks to understand the nature of the various cultural identities that are present in the French social and political landscape. The primary works studied, Dalila Kerchouche's journalistic investigation *Mon père, ce harki* (2003) and Zahia Rahmani's autobiographical fictions *France, récit d'une enfance* and "Musulman" roman demonstrate that European French baselessly rejected the Arabs and Berbers patriated into France following the decolonization of Algeria. Furthermore, the accounts of these writers demonstrate how youth treat the heritage that their parents strive to pass down to them. In fiction, the Algerian author Boualem Sansal in his work



Department of Foreign Languages and
Literature

French

Mentor: Dr. Susan McCready

Le Village de l'Allemand (2008) and the European writer Michel Houellebecq in *Soumission* (2015) explain and critique both the ways in which individuals associate themselves with groups and the potentially destructive ramifications of these associations. Drawing on Sartre's description of how group identities bind themselves together so as to revolt against oppression, along with the research of Dayna Oschewitz, Janice Gross, and Amy Hubbell this paper further explores how the passage of time degenerates cultural memory in addition to the means by which artists and political parties contrive inauthentic replacements for that memory.

Software Infrastructure for Cubesat

Brent Greenwald

This paper describes the development of the Command & Data Handling System (C&DH) for the "JAGSAT-1", a CubeSat created by the CubeSat Team at the University of South Alabama. The C&DH is designed to receive status messages from other components of the CubeSat, receive commands and code updates from ground control, and issue commands to components of the CubeSat in order to carry out the scientific mission and perform important house-keeping functions. Using a "software ecosystem," which is being developed to enable multiple microprocessors to connect and communicate with each other each other, the C&DH will receive events, interpret them, then generate commands to issue back with the use of real-time queuing. Our team is creating a probe for measuring the frequency-dependent behavior of ionic plasma in the magnetosphere. The team successfully launched its first prototype in a suborbital mission in March 2016, and is still analyzing the data from the launch. Now moving on to stage two, we plan to create a complete satellite (called a "Cubesat") that will orbit the planet collecting measurements that we will receive throughout the mission's life span. The first step was to purchase two "Tower" development systems for the microprocessor that has been selected for most of the CubeSat boards. The processor is an NXP Kinetis processor,



Department of Electrical and
Computer Engineering

Electrical and
Computer Engineering

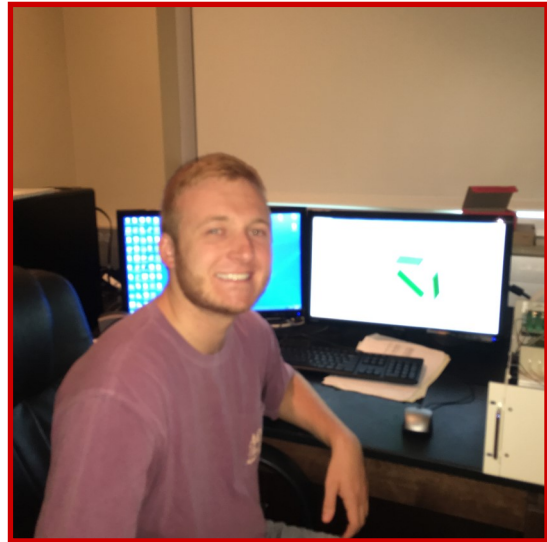
Mentor: Dr. Samuel Russ

which features low power consumption and a usable software development environment. After learning to use the environment, a simple "hello world" program was developed and tested using PuTTY (a serial-port debugger). The next step was to get two development systems to communicate over a CAN interface. This was accomplished by, first, configuring the Kinetis processors to enable CAN pins for transmitting and receiving and, second, sending and receiving messages over CAN. In conclusion, we have developed a software environment for

Microprism Array Based Spectral Prism Technique

Dallas Guffey

This study involves the study of feasibility of using a microprism lens array (MLA) as the spectral separator for usage in multi-/hyper-spectral imaging systems. MLA usage makes the system more compact and less power hungry compared to the current methods. For a white light ray hitting a triangle prism, the average difference between exiting rays of the main colors in the visible wavelength spectrum was calculated to be 0.00179 degrees. Using the exit angle, photodetector dimension (5.5 x 5.5 microns), and trigonometric equations it was calculated that a distance of 17.92 cm is needed to accurately read the different wavelengths. Original plan to use MLA from commercial vendors was not achieved due to their unavailability, and so we focused on designing the MLA in the software and light propagation inside it. Trace Pro and Autodesk software were used to design the MLA and LightTools software for simulation of the images to study the light propagation inside the MLA. Due to the delay in obtaining the student licenses for the LightTools software, the research took longer than expected and the research did not go as far as the initial plan proposed. This research project gave a jump start towards attacking the problem of using a MLA for spectral separation, and over the course of this research project many obstacles were overcome, all the while making tremendous progress. I learned a great amount of things in the electromagnetic and optics field of study, and how research in graduate school is done.



Department of Electrical and
Computer Engineering

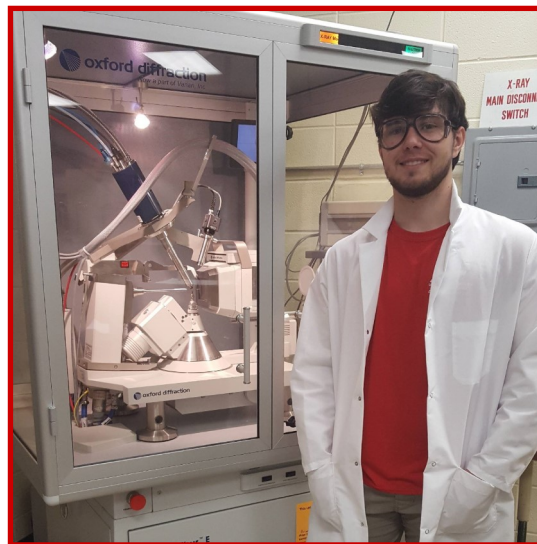
Electrical and Computer
Engineering

Mentor: Dr. Ravi Gollapalli

Aurophilic Interactions and their Effect on Intermolecular Energy Transfer

Name of SURF Member

The importance of transition metal containing lanthanide polymers is quite extensive; Au(I) based polymers are of particular importance because of their interesting physical properties. In this regard, determining the efficiency with which energy transfers along these polymers is essential to creating more efficient forms of solar energy collection as well as traceable drug-delivering biomolecules. The critical problem of these heterometallic systems is the inefficient direct absorption of the f-f excited state in the lanthanide ion. To compensate for this flaw, conjugated organic ligands have been coordinated onto the lanthanide of interest to increase the light-energy harvesting capabilities of the lanthanide ion. Understanding how these various organic ligands affect energy transfer in heterometallic compounds requires the synthesis and characterization of novel classes of lanthanide and transition metal coordination compounds incorporating gold-gold (aurophilic) interactions as well as organic ligands (specifically, 2,2'-bipyridine and 2,2'-bipyrimidine). This work details the synthesis of two series of isostructural lanthanide dicyanoaurates containing the ancillary ligand 2,2'-bipyridine. Reactions were carried out by reaction of Ln³⁺ triflate salts and potassium dicyanoaurate which resulted in the compounds of [Ln(C₁₀H₈N₂)(H₂O)₄(Au(CN)₂)₂] and [Ln(Au(CN)₂)₄] (Ln=Tb, Eu, and Gd). X-ray diffraction studies reveal the existence of dimeric aurophilic



Department of Chemistry

Chemistry

Mentor: Dr. Richard Sykora

interactions as well as π -stacking. Luminescence studies reveal enhanced Ln-based emission due to energy transfer from the dicyanoaurate and 2,2'-bipyridine ligands.

Expectations and Experiences of Childbirth: Perspectives from Twenty-First Century Mothers in the United States

Lauren Hand

What do twenty-first century women in the United States actually expect out of childbirth and how is this affecting their first-time experiences? Women today have expectations of their ideal childbirth. However, unfulfilled expectations can have a huge impact on a woman's perception of her birth experience. Research Question: This IRB-approved study sought to describe perceptions of birth through birth stories. Methods: Nine women ranging from ages 18-30 years old were interviewed 1-2 days postpartum about what they expected their childbirth to be like, how they prepared for the event, and finally the reality of what they experienced. All women were screened to fit specific criteria as healthy mothers with healthy babies. Questions were student-developed and reviewed for content validity. Through qualitative and quantitative questions, women were asked to describe the relationship with their medical support, rate their childbirth experience, and state any comments or suggestions on what they would improve, change, or prepare for differently when it comes to their next birthing experience. Results: In the 9 interviews, recurring themes included maternal-child bonding, praised nursing care, lack of preparation, excitement, and relationship with doctor. There was no observed relationship between level or type of preparation and satisfaction.



Department of Nursing

Nursing

Mentor: Dr. Ellen Buckner

Further exploration is needed on the bonding between nurses and laboring mothers while in hospital, in-hospital labor experiences compared and contrasted with out-of-hospital birthing center delivery experiences, improving education and preparation for childbirth, and gaining an increased awareness of the laboring mother's perspective during her first childbirth experience.

The Color Diversity in Academia: A Look at Race and Hiring in Higher Education

Harold Hedgepeth

In Alabama, public, predominantly white institutions of higher education have, for decades, been legally required to publish records indicating the number and race/ethnicity of top-level (EEO-1) applicants, interviewees, and hires. These statistics provide a unique, exclusive insight into hiring and firing in American institutions of higher learning that has not been fully addressed in the literature. This project analyzes this data - particularly that of the University of South Alabama - by vetting it using federal statistical tests for non-discrimination outlined by the Equal Employment Opportunity Commission, including tests of adverse impact and of statistical significance. The project concludes that with the exception of the University of West Alabama, every Alabama university tested fails these federal measures of non-discrimination in hiring, including the University of South Alabama.



Department of Political Science

Political Science

Mentor: Dr. Scott Liebertz

Optimizing System Design Using SystemC and VHDL

Tristen Higginbotham

SystemC is a system design and implementation language that is modeled after C++. This language builds on the user's familiarity of C++, allowing digital design to take place at a relatively higher level with hardware functionality being expressed by behavioral constructs. JHDL, based on Java, is another hardware description language which allows for the utilization of object-oriented style programming in circuit design. Alternatively, VHDL is a commonly used hardware description language which allows the user to design circuitry more explicitly. While these languages can be utilized to produce similar systems, the complexity of the resulting logic determines the optimal design. The purpose of this research project is to identify and analyze differences between SystemC, JHDL, and VHDL implementations through execution timing, complexity comparisons, and analysis of resulting chip space. Through this research, we will be able to determine in what capacity each language is most optimal, be it speed, size, or simplicity of their respective products.



Department of Electrical Engineering
and Computer Engineering

Computer Science

Mentor: Dr. Todd Anzel

Training the Next Generation: An Analysis and Comparison of Educational Techniques in Instrumental Music Education

Destin Hinkle

Music education curricula usually have a common division of ensemble types in the fall and spring of the academic year. In instrumental music, this division occurs with primarily marching band in the fall and indoor ensembles in the spring. Unfortunately, marching band puts more of an emphasis on repetition and automatization than genuine musical development, and music students are generally not introduced to a comprehensive music education until midway through the year. This study sought to identify exactly the strengths and weaknesses of a curriculum that is structured in this manner.



Department of Music, Theater, and Dance

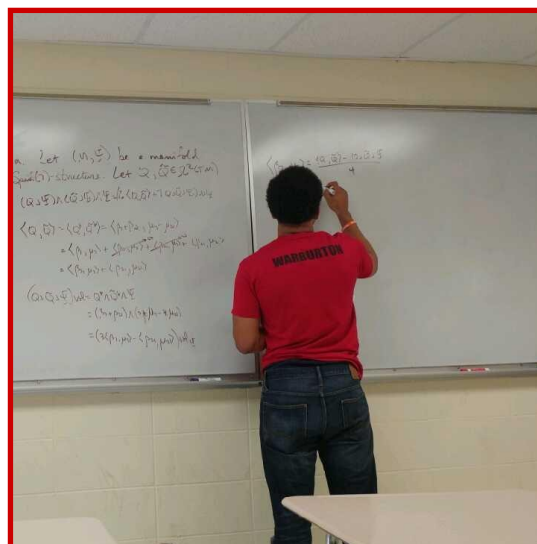
Music

Mentor: Dr. William Petersen

Hamiltonian Structures of Spin(7)-Geometry

Kevin Ingles

Many discover the concept of dimension when first exposed to geometry in high school. In college students are then exposed to various concepts in calculus involving three dimensions. Thus an idea of calculus in higher dimensions was established. Of particular interest to me are the dimensions 7 and 8 as they have found applications in physics. These dimensions include geometries defined by the G_2 and $\text{Spin}(7)$ exceptional holonomy groups, respectively. For the physicists, there is particular interest in studying the dynamics of higher dimensional systems, and a convenient tool of exploration is the Hamiltonian. In this paper we defined various Hamiltonian structures on $\text{Spin}(7)$ manifolds and use properties of $\text{Spin}(7)$ -structures to investigate them. We give some nonexistence results on closed $\text{Spin}(7)$ manifolds that allow for more precise identifications.



Department of Physics/
Mathematics & Statistics

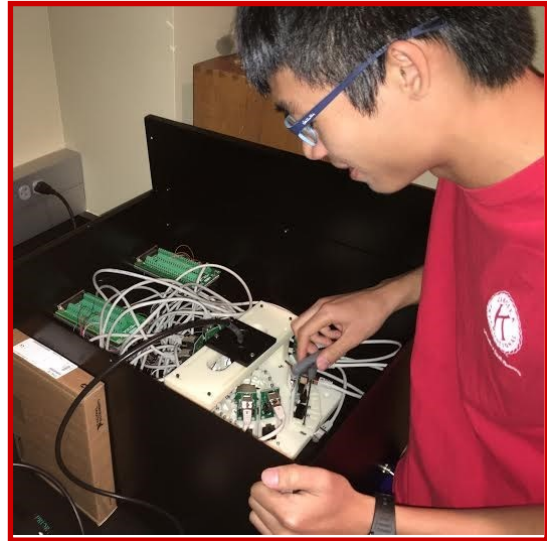
Physics

Mentor: Dr. Albert Todd

Optimizing Speed and Sensitivity of Hyperspectral Imaging System (OSSHIS)

Phiwat Klomkaew

Hyperspectral imaging (HSI) is a powerful tool that uses images at multiple wavelengths to provide spectral information that allows one to uniquely characterize any two unique materials or substances. The applications of HSI are numerous, from medicine to remote sensing. For microscopy and cancer detection applications, our team has previously designed an HSI system coupled with an inverted fluorescence microscope using an LED-based light source. This current research sought to optimize the previous HSI system, particularly focusing on replacing 16 regular LEDs with higher-power LED chips and adjusting the setup of the light source to minimize light losses. From the spectroradiometric output measurements, we found that the new HSI system showed the increased power output of the new LED chips and the optimized optical geometry due to 100 times more power than the previous design.



Department of Chemical Engineering
Chemical Engineering
Mentor: Dr. Leavesley

The Analysis of Instrumental Conducting Techniques and their Effectiveness: Does it Make a Difference?

Peter Kohrman

This research project is an in depth analysis of various instrumental conducting techniques and their effectiveness at conveying musical expression to an ensemble. This project will review both primary and secondary sources to determine different conducting styles. Specifically, this project will analyze the effectiveness of said techniques in the three stages of the conducting process: score analysis, rehearsal, and performance. In addition, this project will review the concepts and recordings of prolific conductors such as: Leonard Bernstein, Riccardo Muti, Herbert von Karajan, Michael Tilson Thomas, and Pierre Boulez. In the end, the purpose of this project is to determine and establish a series of the most effective conducting techniques for the intent of creating transcendental musical experiences.



Department of Music, Theater, and Dance

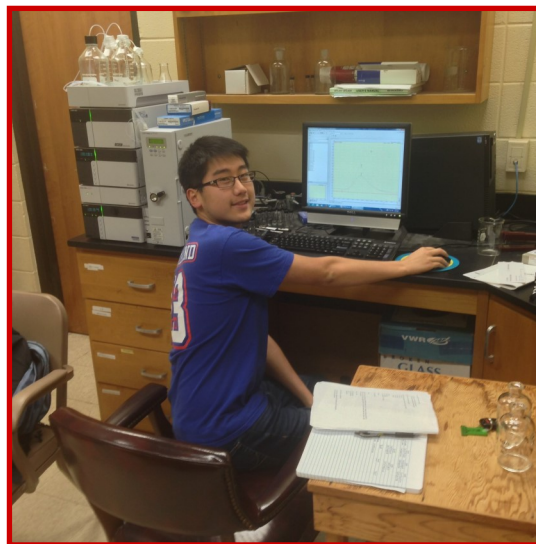
Music

Mentor: Dr. Greg Gruner

Effect of Mobile Phase Composition on Steroid Retention in Reverse-Phase Liquid Chromatography

Evan Li

Reversed-phase liquid chromatography is a common technique used in analytical chemistry for separating compounds in a solution. In the chromatography experiment, a mixture containing solutes to be separated is dissolved in a liquid called the mobile phase. The mobile phase is pumped through a column containing a packed bed of material, called the stationary phase. Differences in interactions between solute, stationary phase, and mobile phase cause different solutes to exit the column at different times. In particular, steroids such as cortisone, hydrocortisone, prednisolone, and betamethasone, whose structures are similar, can be separated by liquid chromatography, if separation conditions are optimized. Understanding the influence of various chromatographic variables on separation is key to designing a successful chromatographic method. In this experiment, we examined the effect of three chromatographic variables on the retention of the four previously mentioned structurally-similar steroids: mobile phase composition of a ternary solvent system (water/methanol/acetonitrile), temperature, and addition of a sugar molecule called methyl-beta-cyclodextrin (MBCD). We wish to observe how the steroid-cyclodextrin complex is formed upon addition of it to the mobile phase, and how it affects retention of the steroids. Our hypothesis is that through the addition of cyclodextrin, these steroids will form a complex that will lower its retention in the chromatographic system. A change in the



Department

SURF Member Major

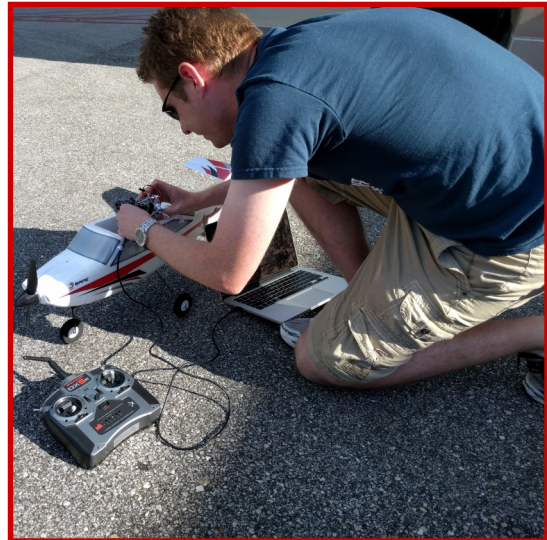
Mentor: Name of Mentor

mobile phase composition and temperature will also alter interactions between the steroids and cyclodextrin, and consequently will alter their retention rates. Cortisone typically had the smallest retention factor (abbreviated k') while betamethasone had the largest. The general trend for all four steroids was a decrease in k' by increasing MBCD concentration and temperature. A higher acetonitrile concentration significantly lowered the k' among the steroids but addition of MBCD and higher temperatures did not seem to have a significant role as compared to the solvent system with greater methanol concentrations. Betamethasone had the largest change in k' factor by altering the MP.

Arduino Autopilot Design of a Fixed Wing Aircraft

Jacob Magnin

This project demonstrated the viability of using off-the-shelf microcontroller and sensor equipment to create a customizable autopilot system capable of controlling a fixed-wing, remote controlled aircraft. By designing an in house autopilot from mass produced, readily available components, researchers can have access to a highly customizable system that could be modified to meet the specific demands of individual research projects more easily and cost effectively than purchasing mass market autopilot systems such as the 3DRobotics Pix-Hawk autopilot. Results from this project indicated that a system could be designed that contained the capability of bringing an aircraft to a desired pitch and bank angle, regardless of the attitude of the aircraft prior to the autopilot initiation. Additionally, the data showed that the system could hold the aircraft in this position, within a few degrees, for as long as the autopilot was engaged. Finally, the test flights proved a switching circuit could be made that would allow a pilot from the ground to select between autopilot and manual modes. Overall, this project forms the foundational structure that a final, fully customizable, experimental autopilot system can be built upon and demonstrates the feasibility of creating such a system using readily available and affordable components.

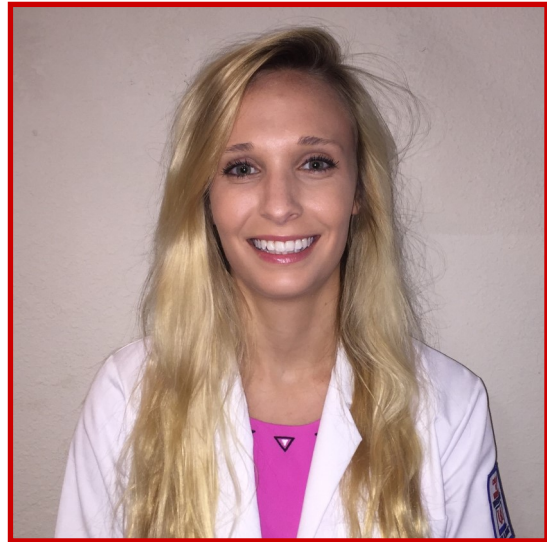


Department I of Electrical and
Computer Engineering
Electrical Engineering
Mentor: Dr. Carlos Montalvo

Anxiety and Uncertainty During Breastfeeding for Pre-Term Mothers

Brandy Mann

In the Neonatal Intensive Care Unit, pain scales are used to measure the pain a neonate experiences and indicate the need for reassessment to determine if pain is lessened with intervention. The purpose of this IRB-approved study was to compare two scales for effectiveness and ease of use by Neonatal ICU nurses. Scales were a modified CRIES Scale—Crying, Requires O₂, Increased Vital Signs, Expression, and Sleeplessness—and the NPASS—Neonatal Pain Agitation and Sedation Scale. During the pilot, nurses were given a bedside form to assess the pain level using both scales in the neonates at 4 hour increments. One cohort measured pain in stable neonates, a second cohort measured pain in higher acuity neonates. The nurses were then given a questionnaire to determine their perspectives and opinions of the scales. All of the nurses stated that they viewed the scales as important and necessary. When asked which scale they preferred, majority of nurses chose the NPASS. However, every neonate that was assessed scored a 0 on all measures of the scales, leading the researchers to question whether they were sensitive enough to detect subtle changes or whether the nurses were using them correctly. Currently, a survey is being developed for all of the nurses to determine their understanding and use of the scales correctly. Implications are for more specific education for NICU staff prior to implementing a new scale.



Department of Nursing

Nursing

Mentor: Dr. Ellen Buckner

Automatic Difference Detection between Similar Scenes Captured in Non-Identical Images

Jacob Maynard

Abstract

Spot the Difference type puzzles are problems where two similar images are to be compared, and the object of the puzzle is to locate all of the differences between the two photos. Trivial versions of these problems can be solved automatically with little effort. However, a nontrivial puzzle has too much noise to solve in such a simple manner. In this paper, a method for automatically solving nontrivial versions of these puzzles will be presented. The strategy proposed involves using color grouping and edge detection algorithms to break both images into component pieces, and creating a list describing the objects and their locations on each image. These lists can then be compared, thus identifying the differences.



Department of Computer
Science

Computer Science

Mentor: Michael Doran

Effects of Fractionated Humic Substances on Cancer Cells in Vitro

Jimmie McGehee

Abstract

Natural organic matter (NOM) is the material formed by the degradation of organic material in soil; it is present in all drinking water. Chlorinating agents added to drinking water react with NOM to form disinfection byproducts (DBPs) linked to increased cancer risk. Although interest in DBPs has increased in recent years, the effects of unaltered NOM are still relatively unexplored. Recent studies have reached contradictory conclusions of NOM being either mutagenic or anti-mutagenic under different circumstances. Because NOM is a highly complex and variable mixture, it is possible that different compounds are responsible for these competing effects. Previous experiments have had success characterizing the acid soluble portion of NOM, fulvic acid (FA), by fractionating the mixture using high performance liquid chromatography (HPLC) before analysis. The portion of NOM that is acid insoluble, humic acid (HA), is more bioactive than FA. This makes HA a likely source of NOMs health effects; however, fractionating HA is more difficult than fractionating FA. Standard HPLC methodology of separating acidic material with acidic mobile phase is confounded by HAs insolubility at low pH. The goal of this paper is to fractionate HA to determine and characterize the compounds most responsible for NOMs mutagenic/anti-mutagenic effects.



Department of Chemical Engineering

Chemistry

Mentor: Alexandra Stenson

Utilizing a shallow gradient, HA was successfully fractionated with a replicable chromatographic distribution. To fully characterize the fractions, material must be gathered from several HPLC collection cycles. Development is in progress to modify the method for faster cycling and material collection

Kyphosis and Corresponding Effects on Levels of Self-Efficacy

Omar Mulla

Mild hyperkyphosis, an abnormal forward curvature in the thoracic spine, is a common progressive deformity of the spine that affects up to 50% of older adults. Hyperkyphosis can lead to significant deterioration in health status, physical mobility, and quality of life (Katzman et al., 2016). While this disorder has been shown to contribute significantly to poor psychosocial functioning in the older adults, only one study has previously examined the link between Hyperkyphosis and psychological well-being, particularly self-efficacy. The current study measured levels of self efficacy, self esteem, anhedonia, muscular fitness, and postural stability in six (6) college students. Four of the students exhibited mild hyperkyphosis at baseline, and two were included as age-matched controls. Students are currently enrolled in 10 weeks of physical training at the University of South Alabama Student Recreation Center. In young people, the Kyphosis is often referred to as “laptop neck,” and is becoming an increasing problem for American students. Results from the baseline examination reveal that individuals with Kyphosis do not vary on physical fitness or BMI, but do exhibit higher levels of psychological tension and anxiety, and lower levels of self-efficacy. These results indicate that mild Kyphosis may be a risk factor for psychological illness and interfere with development of positive coping strategies in college students.



Department of Exercise Science

Psychology

Mentor: Dr. John Shelley, Tremblay

The Organization of Early Archaic Technology in Southwest Alabama: A Lithic Analysis of 1WN106

James Norris

The Seed Tick Site (1WN106) was excavated in 1991 by the late Read Stowe, who prepared preliminary reports in addition to analyses by Becky Stowe. Located in the Tombigbee River Basin in southeastern Washington County, it is a multi-component site based on stone tool types; including Late Paleoindian, Archaic, and Woodland diagnostics with a range of 10,000 - 1,200 B.P. This study provides the first detailed analysis of the Early Archaic component, which appears to be the most extensive. In order to investigate Early Archaic lifeways, a poorly understood time period in the region, an organization of technology model is employed which examines how stone tools are responsive to economic, ideological, and social strategies. Before the analysis could begin, the entire collection had to be organized. This included re-sorting by raw materials and establishing proveniences. Once the reconstruction of the entire site was completed and a site map produced, the Early Archaic components were isolated, mapped and analyzed. This analysis included an examination of the stone tools from a cultural-historical and technological basis, as well as a detailed analysis of flake debris through aggregate and individual flake analysis. These analyses are ongoing, to date results indicate people occupying the site brought a stone toolkit with them to the site that included non-local Tallahatta Sandstone and chert. Based on the flake debris and tool analyses, these curated tools were used at the site, resharpened, and discarded there.



Department of Anthropology and
Geography
Anthropology
Mentor: Phil Carr

These tools were used in the day-to-day activities of acquiring food resources and making the site habitable for the time people occupied it. Those discarded tools were replaced by ones newly made using a local raw material: Ferruginous Sandstone. The heavily concentrated Ferruginous Sandstone debris, as well as quartz debris suggest the manufacture of expedient as well as curated tools by Early Archaic hunter-gatherers. Additional analyses will be aimed at testing hypotheses regarding the mobility strategy employed by the site's residents. Through the investigation of cultural lifeways in the past, archaeologists can examine long-term cultural changes to better understand how and why cul-

War and Memory in Mobile, Alabama

Ayla Oden

Abstract This project focuses on the Alabama War Dog Memorial as a case study in the complexity of commemoration. In 2006, the Alabama War Dog Memorial Foundation was created to build a memorial that would commemorate the sacrifices made by dogs and their handlers from the state of Alabama. To raise funds and inspire support, the foundation approached Vietnam veteran Charles Wade Franks, a handler who had lost his canine companion in combat. However, when the Memorial was revealed at its inauguration, Franks and his companion Little Joe were not mentioned anywhere on the memorial itself. Somehow the story of Little Joe, the inspiration behind the memorial's founding, was lost on the finished project. When a memorial is built, there is always more to the story than what meets the eye.

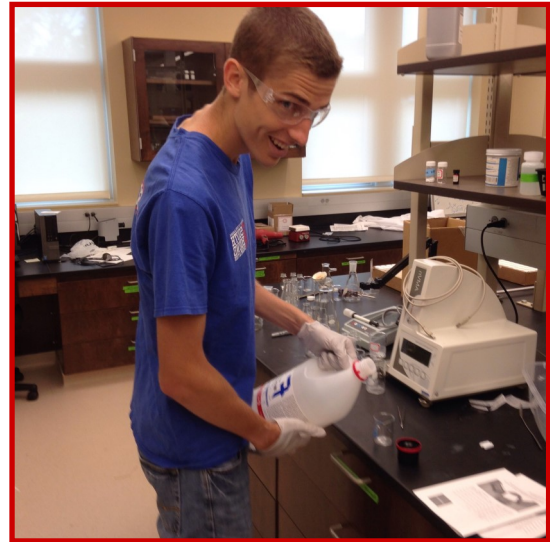


Department of English
Strategic Communication
Mentor: Dr. Steven Trout

Synthesis of Novel Adsorbent Materials Via Supercritical Fluid Deposition

Cody Parker

The separation of ethylene and ethane is an important process in chemical engineering as the ethylene that this process yields can be used to make fibers, plastics, and other chemicals. However, this process currently accounts for 1% of the total energy used in the chemical industry, making it very expensive. Recent work in our research lab has been done to make supports for metal ions, such as copper and silver, which have been shown to be able to separate ethylene and ethane. The process is much more cost-effective than current methods and environmentally friendly. Copper was deposited onto γ -alumina via two methods, incipient wetness depositions and supercritical fluid depositions. Incipient wetness depositions were carried out with copper acetate dissolved in methanol and supercritical fluid depositions were carried out using supercritical CO₂. Both methods deposited copper onto the surface of the pellets, seen in the light blue color that the pellets turned after the depositions. When the pellets were washed with methanol, the copper on the incipient wetness deposited pellets was removed while the copper on the supercritical fluid deposited pellets was not. This leads us to believe that the incipient wetness deposition leads to equilibrium bonding and the supercritical fluid deposition leads to reactive bonding, meaning that the copper is more stable when bound this



Department of Chemical Engineering

Chemical Engineering

Mentor: Kevin West

way. In the future, the previous methods will be done with silver and we will test how well that these supports remove ethane from ethylene.

Identification of Genetic Units for Conservation in Endangered Alabama Red-Bellied Turtle, *Pseudemys Alabamensis*

Asutin Ray

Abstract

The Alabama Red-Bellied Turtle, *Pseudemys alabamensis*, is an endangered species of turtle endemic to only Mississippi and Alabama in the lower parts of the Mobile Bay Drainage Basin, the Pascagoula River, and Back Bay of Biloxi watersheds. In this project, we compared the known species occurrence and distribution in Alabama to land cover type at these sites using ArcGIS to study how land disturbance (proximity to agricultural urban sites) affects distribution. This will provide important data on habitat suitability for the species and possible barriers to gene flow. This study will be significant for conservation efforts for the species by identifying environmental characteristics that may represent a threat to this species. Furthermore, these data will also constitute the necessary background to further study the relationship between environmental factors, such as urbanization, and genetic diversity in the studied species.



Department of Biology

Biology

Mentor: Ylenia Chiari

Age Specific Patterns in Window Mortality in Avian Populations

Emma Rhodes

Abstract

Building collisions, especially window collisions, pose a major anthropogenic threat to birds. Mortality caused by building collisions is estimated to be between 100 million and 1 billion annually, and it is the second largest source in the U.S. for direct human-caused bird mortality. Studies have been conducted focusing on the frequency of building/window collisions in avian populations, but so far no studies have looked at the relationship between age and mortality due to the collision. The primary goal of this study is to address this question by examining available data using bird collections. Data were collected from bird specimens persevered as study skins at Louisiana Southern University. Only specimens with cause of death as window strike were used. I collected data on a total of 183 birds belonging to three genera (*Cardinalis*, *Setophaga*, and *Seiurus*). In order to age the birds, external morphological data were attained from the specimens as well as data on death date, location, and sex from. Morphological data were attained primarily considering the morphology of the feathers following the criteria indicated Identification Guide to North American Birds: Part 1 and Part 2 by Peter Pyle. Our results indicate that most birds' death due to window collision occurred in adults. Further study needs to consider both external morphological features



Department of Biology

Biology

Mentor: Dr. Ylenia Chiari

for a better predictor of age. The results of this study provide significant implications on how window strike mortality effects avian populations for conservation purposes. The study observed how an age-specific correlation with window strike mortality may play a role in the turnover rate of avian populations as well as on estimating the effective population size and survival.

Creation of Imidazo[1,5-a]pyridine Ligands

Kaitlyn Roberts

In palladium-catalyzed cross-coupling reactions a carbon-carbon bond is created by the addition of two carbon fragments with a transition metal. The "ligand" plays an important role in the palladium-catalyzed cross-coupling reactions. Imidazo[1,5-a]pyridines and imidazo[1,2-a]pyridines are "privileged structures" in medicinal chemistry. We propose that these "privileged structures" will be useful as "ligands" in palladium-catalyzed cross-coupling reactions. Efforts have been directed toward the syntheses of the Imidazo[1,5-a]pyridine and imidazo[1,2-a]pyridine phosphorus "ligands" by various synthetic methods. In the future, we will employ the application of these ligands towards Suzuki-Miyaura cross-coupling reactions.



Department of Chemistry

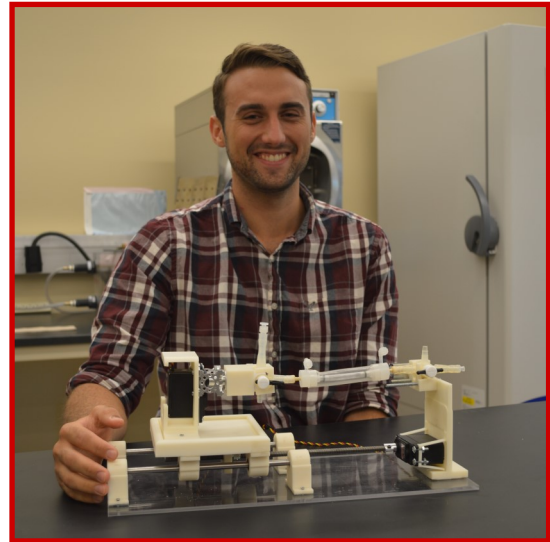
Chemistry

Mentor: Dr. Larry Yet

In-Vitro Model for Real-Life Movement in Arteries

Carson Schaff

Peripheral Arterial Disease is the narrowing and restriction of blood flow of the peripheral arteries, specifically in the legs. This is caused by the buildup of plaque in the arterial wall. If left untreated it can lead to the formation of a blood clot, gangrene, heart attack or stroke. The current surgical treatment is an angioplasty balloon that is inflated at the disease site. This compresses the plaque outwards and opens up the artery. A stent can then be placed there to hold the artery open. If the disease is below the knee, typically a stent is not used due to a high fracture rate from excessive movement caused by walking. In this case a balloon coated with paclitaxel is used. This drug stops the growth of cells and is done so that the smooth muscle cells do not proliferate and cause restenosis. There is evidence that drug-coated balloons are not as effective below the knee as above the knee. There are many factors as to why this might happen. In this study it is hypothesized that the twisting and shortening of the artery, below the knee, may affect the pharmacokinetics of the paclitaxel. However, this is yet to be determined. Our goal is to design and build a machine that will model the twisting and shortening movements to the artery while maintaining temperature and flow conditions as would be experienced in the body.



Department of Mechanical Engineering

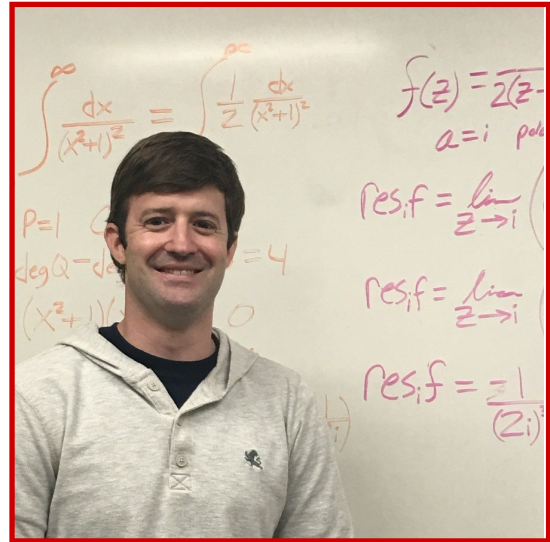
Mechanical Engineering

Mentor: Dr. Saami Yazdani

3D Model for cAMP Intra-cellular Signaling

Steven Shettlesworth

Second messengers, such as cyclic adenosine monophosphate (cAMP), are responsible for a plethora of cellular functions. The essential role cAMP signaling plays in living organisms is well understood, yet there is still much debate on the information stored within these signals. In the last decade, mathematical models have been developed for explaining concentration of cAMP gradients. In this report, we will work to expand a previously constructed 2D finite element analysis model into three spatial dimensions. The model is based upon a linearized partial differential equation developed around describing the synthesis, degradation, and spatial diffusion of cAMP. Initially, a simplified spherical geometry is used for testing the simulation. The validation of the results of this analysis will aid in the model's eventual adaptation into more realistic complex cellular geometries.



Department of Mechanical Engineering

Mechanical Engineering

Mentor: Dr. Anh-Vu Pahn

Speech Recognition Errors: Implications for Aging

Rachel Short

In natural environments, listeners are faced with having to understand speech in a variety of listening conditions. Listeners are often able to understand speech with accuracy in interrupted or steady-state background noise by exploiting useful glimpses of the auditory information, but still make recognition errors.¹ Previous findings suggest unimpaired younger listeners are more successful at speech recognition in interrupted conditions compared to steady-state noise.² Therefore, this study evaluated the extent to which degraded spoken information in sentences is recognized by age-normal hearing older listeners in interrupted and steady-state noise. Nine older listeners repeated sentences that were presented in interrupted noise at three proportions of preservation, 33%, 50%, 66%, and steady-state noise (SSN). Responses were transcribed, and the number and type of errors for key words in the sentences were scored for each condition. For total, whole and part word errors in the interrupted noise condition, proportion of signal preservation was critical. Fewer errors were made when the signal was more preserved (66%) compared to less preserved (33%). For whole word errors, in both noise conditions, listeners made significantly more omission errors than substitution errors, and significantly more substitution errors than addition errors. For part word errors, in both noise conditions, listeners made significantly more substitution errors



Department of Speech
Pathology & Audiology
Speech and Hearing Sciences
Mentor: Kimberly G. Smith

than either omission or addition errors. We also compared the interrupted 33% and SSN conditions directly, as performance on these two conditions was similar. No differences emerged between the two noise conditions for total, whole, or part word errors. These findings imply that older listeners resolve speech signals similarly across noise conditions. Differences in cognitive or perceptual processing in older listeners may explain these findings compared to younger listeners.

A Model of Lower Limb Cooling for Mitigating Ischemic Damage from Tourniquets

Luke Smith

In severe battlefield injury, tourniquets are commonly employed to restrict blood flow to limbs incurring severe bleeding. During prolonged application, ischemic and reperfusion tissue damage can occur as cells are starved of oxygen and then overwhelmed as blood flow is restored. An understanding of heat transfer may allow future tourniquet design to mitigate this damage. Tissue loss may be reduced by decreasing the temperature of the affected tissue, thereby extending the time available for tourniquet use. This allows for longer transportation of the wounded as well as a greater chance of tissue recovery. Models of heat transfer can be used to understand and design for the human thermoregulatory system. The Pennes bio-heat transfer equation uses a numerical analysis to understand thermoregulation between bone, muscle, fat, and skin within the human body, treating tissue as concentric geometric layers. Using TAItherm thermal software, we constructed a visual numerical model of these layers based on these equations and observed thermoregulatory change due to transient blood flows. A human thermal model was created as a 3-dimensional mesh consisting of 16 thermal layers with the potential for additional clothing layers, and varying body sizes, this difference in temperature may be further observed and controlled.

The model followed proportions of a 50th percentile male and blood flow was restricted to the left thigh to mimic the effects of tourniquet application.



Department of Mechanical Engineering

Mentor: David A. Nelson

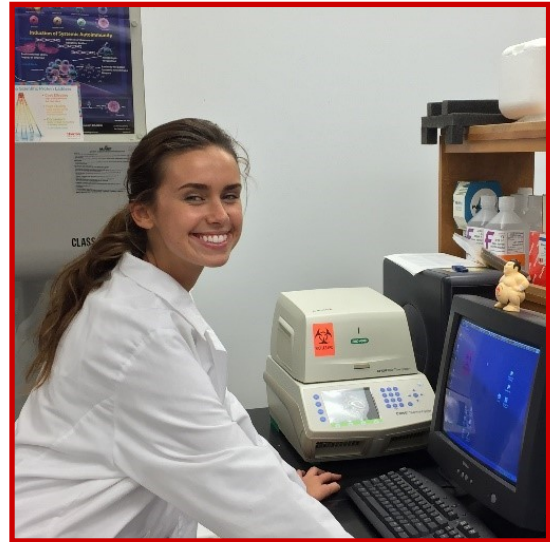
Mechanical Engineering

The Functions of Vg1 and Vg4 in Gamma Delta T Cells

Katelyn Speights

The Functions of Vg1 and Vg4 in Gamma Delta T Cells Corneal infections by herpes simplex virus type 1 (HSV-1) can cause herpes stromal keratitis (HSK), the leading cause of blindness in developing countries. Upon infection, HSV-1 triggers an immune response that can result in corneal opacity, scarring and eventually blindness. T cells are critical for the immune response to HSV-1 infection, with $\gamma\delta$ T cells involved early on and T helper cells later in the response. The early response has been found to not be harmful to the eye, while the later response involving T helper cells is damaging and enhances the progression of HSK. Because of their ability to protect mice from intracorneal infection with HSV-1, $\gamma\delta$ T cells have potential as a vaccine target. More specifically, $\gamma\delta$ T cells producing interleukin 17A (IL-17A) represent a subset that is particularly important for early protection from HSV-1 infection. My project focused on how these IL-17A-producing $\gamma\delta$ T cells are recruited to the cornea, and how they are instructed to make IL-17A. We hypothesized that corneal fibroblasts, upon infection with HSV-1, produce the chemokine CCL20 that serves to recruit $\gamma\delta$ T cells poised to make IL-17A.

Infected corneal fibroblasts also make IL-1 and IL-23, that we hypothesize provide the requisite signals to turn on IL-17A production in $\gamma\delta$ T cells. To begin testing these



Department of Biomedical Sciences

Mentor: Robert A. Barrington

hypothesis, I evaluated CCL20, IL-1 and IL-23 production in HSV-1 infected fibroblasts in vitro. I established cultures of murine kidney and corneal fibroblasts that could be maintained for up to 6 passages. At passage 4, the cells were seeded onto tissue culture plates and infected with HSV-1. Cell supernatants and lysates from these cultures were collected at 0, 6, 12, 18 and 24 hours following HSV-1 infection and examined for CCL20, IL-1 and IL-23 by enzyme-linked immunosorbent assay (ELISA).

Evaluating Expression of *N. tabacum* SP41a in *Arabidopsis*

Adam Stern

If a map was constructed of everything we know about cell-cell interactions in floral tissue some areas would include rich detail of specific molecules involved in signaling cascades (i.e. the SI system in *Brassica* that prevents self pollination). Whereas, other areas would simply read "here be dragons". Sadly, one of the blank areas of the map would be signaling pathways involved in pollen tube guidance through the transmitting tract during fertilization. This project is the first phase of a larger project to map cell-cell signaling between floral tissue and the pollen tube during fertilization. As the pollen tube travels through a number of different tissues on its way to the ovule, this system provides the opportunity to also study context specific cell-cell interactions. The specific goal of this phase of the project is to develop a molecular tool kit and associated protocols for the rapid evaluation of tissue- and species- specificity of gene promoter regions. To this end it is important to understand that a gene contains information related to more than just the gene product. A gene also has specific regions that provide information about when a product is made and where it is deployed. Three regions involved are the promoter, the product and the localization signal. The promoter is responsible for recruiting transcriptional machinery to read the gene and generate a corresponding mRNA. The protein product coded by the gene, is subsequently delivered to the locale of its function via a localization signal. This research project is focused only on the evaluation of promoter sequences that are responsible for gene expression in floral tissue. The center piece of the promoter evaluation tool kit generated here is a custom constructed plasmid that allows for integration of a promoter and a product, via Golden-Gate



Department of Biology

Mentor: Tim Sherman

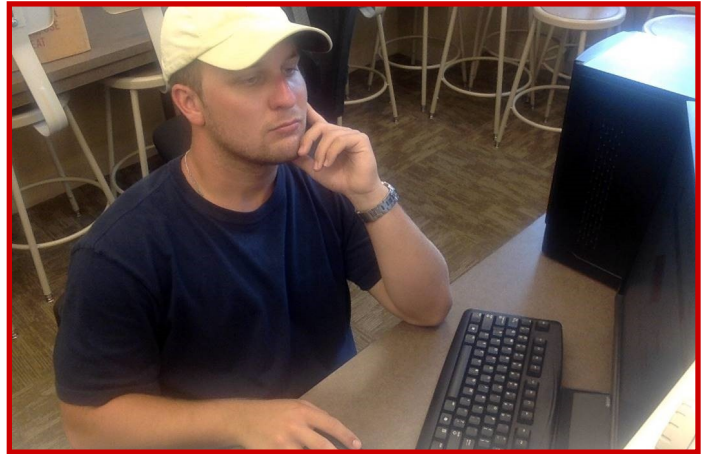
Gate digestion/ligation. Candidate promoters can be found in literature related to gene expression of specific tissues. As an example, SP41a is a transmitting tract specific mRNA found in *N. tabacum* and is a promoter under evaluation here. The method for inserting a promoter of interest into the test plasmid was to design a set of primers for the sequence that include a *I*Is endonuclease site coded to insert the digestion product into the plasmid in the proper configuration. The *I*Is endonuclease site is added to the sequence via overhang PCR allowing for integration from PCR product. For this project, SP41a and 35s promoter regions in tobacco and *Arabidopsis* plants were evaluated using the same procedure and enzymes to construct the plasmid changing only the promoter used. It is hoped that the system being developed here will allow for rapid evaluation of tissue specific promoters across a large number of plant species and will allow for the development of a standard library of promoters enabling the construction of tools that can facilitate the mapping of cell-cell communication pathways by targeting molecular probes to specific tissues and gene expression pathways.

Infrared Sensing of Normal and Malignant Tissues in Humanoid Phantoms

Thomas Stubblefield

My research project involves combining infrared sensors and antennas to detect tumors in human breast tissue. The idea is to try and create a prototype device that could potentially detect these tumors at an early stage. The device that is created will send microwaves through the breast tissue in order to excite the tissue. This will cause a temperature change in the corresponding tissue. Regular breast tissue will give different temperature readings compared to tumors. These temperatures will be captured by the infrared sensors and would then be used to create an image for the breast. The sensors have been procured and the microwave antenna is under fabrication. Ideally, the image created would be the temperature profile of the breast.

Due to the presence of cancerous tumor, temperature asymmetry is induced between two breasts. This asymmetry is captured by the infrared sensors to indicate abnormality. This concept is used in breast thermography (BT). However, The Food and Drug Administration clearly states that BT is not a valid replacement for mammography when trying to diagnose breast cancer. In the proposed method, the temperature asymmetry would be amplified by the microwave signal for better sensitivity.



Department of Electrical and Computer
Engineering

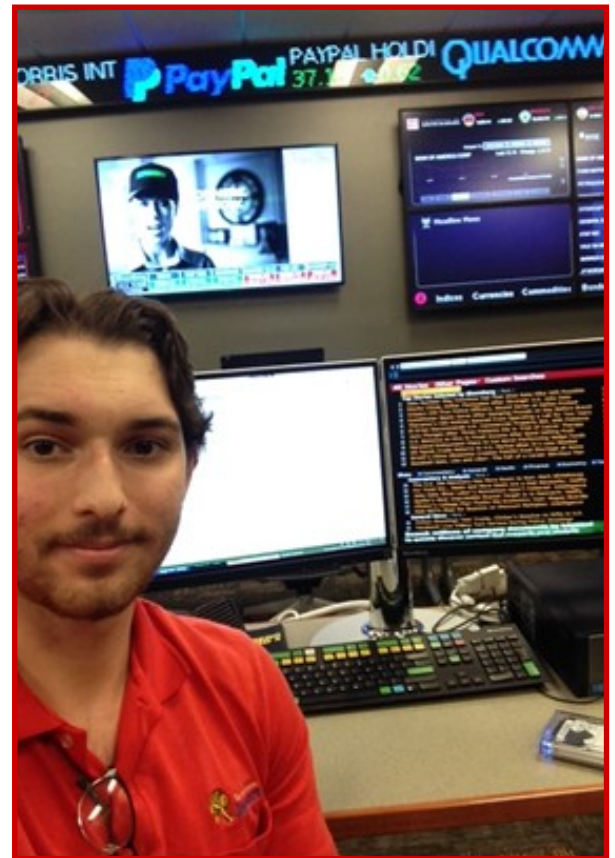
Mentor: Saeed Latif

Electrical and Computer Engineering

Analysis of High-Frequency Financial Market Data

Alexander Theodore

The research that we will be conducting seeks to improve upon previous studies of the role implied and realized volatility have as estimators of future volatility. Utilizing the Bloomberg Terminal System, transactional level data of the DOW Jones Industrial 30 will be extracted from the previous year (June 2015 through June 2016). Once the data has been compiled into a uniform format, realized variance estimators can be used to calculate the volatility at various time intervals, i.e. 1 minute, 5 minutes, 15 minutes, etc. Furthermore, range-based estimators can be used to analyze the realized variance for each interval size, with an "interval size" representing the amount of trades within a specified period. The focus of this research is the return volatility of the DOW Jones Industrial 30. However, if warranted, the research can be extended across other indexes, such as the S&P 100 index and the S&P 500.



Department of Finance

Mentor: Alan Chow

Management

Development of Small Molecule Chemical Probes for Serine/Threonine Protein Phosphatase 5

Madison Tuttle

Recent studies have shown that the over-expression of serine/threonine protein phosphatase 5C (PP5C) is associated with invasive ductal carcinoma of the breast, cancer cell proliferation, and resistance to apoptosis. However, scientists currently lack the molecular equipment with which to further characterize the biological and pathological roles of PP5C in the anti-tumor activity of breast cancer. Previous high-throughput screening (HTS) efforts revealed two potentially selective and potent small molecule chemical probes for PP5C, containing either a 6,7-dimethoxyisoquinoline core or a 1,4-naphthoquinone core. Several analogs were synthesized and evaluated by means of a homogenous fluorescence intensity-based (HFIB) assay in %inhibition at 50 μ M. It was determined that the 6,7-dimethoxyisoquinoline series was more potent relative to the 1,4-naphthoquinone series at 50 μ M concentrations. Based on a structure-activity relationship (SAR) analysis, future analogs are being developed containing the 6,7-dimethoxyisoquinoline core to increase %inhibition at lower concentrations.



Department of Chemistry

Mentor: Larry Yet

Chemistry

From Profane to Sacred: European Materials' Integration Into Native American Cosmology

Campbell Walker

The precarious sociopolitical setting of mid-to-late sixteenth-century Mississippian southeastern North America witnessed a transition in native worldview. This transition is reflected in the archaeological record of Pine Log Creek burial mound site in southwestern Alabama, where local Mississippian elites incorporated European materials into traditional cosmological artifact forms. Analysis of these artifacts' attributes (including material, color, form, and origin) reveal characteristics that indicate these items communicated symbolic meaning pertaining to the Mississippian cosmos. European materials were incorporated into cosmological media as a way to retain status, invoke the supernatural, and impose order during turbulent times.



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5 dimensional (5D) Hyperspectral Measurement of Fluorescence and FRET Signals in Living Cells

Mohammed El-Sharkh

Cyclic AMP (cAMP) is a ubiquitous second messenger that regulates diverse cellular functions. In the past, cAMP distribution has been thought to be non-uniform; however, cAMP gradients have not been measured in three spatial dimensions (x, y, and z). Because the spatio-temporal cAMP distribution has not been measured, it is difficult to understand how cAMP signals simultaneously regulate dozens of cellular functions. A standard imaging technique used to investigate cellular functions is Förster resonance energy transfer (FRET). FRET probes have been used to measure cAMP levels for more than a decade. One reason 3D cAMP distributions have not been measured is the low signal-to-noise ratio inherent to FRET measurements. We have previously reported that hyperspectral imaging improves the signal-to-noise ratio of FRET measurements. Here we present hyperspectral imaging-based measurements of intracellular cAMP in five dimensions (5D): three spatial dimensions (x, y, z), time (t), and wavelength of emitted light (?). 5D imaging was used to measure cAMP levels in pulmonary microvascular endothelial cells (PMVECs) transfected with the H188 FRET probe. The H188 probe contains a cAMP binding domain sandwiched between donor (Turquoise) and acceptor (Venus) fluorescent proteins. Hyperspectral images were taken with a Nikon A1R inverted confocal microscope and analyzed with the accompanying Elements software and custom MATLAB scripts. Results demonstrate real-time measurement of cAMP in 5D.



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They also illustrate related problems including photobleaching and interfering fluorescence signals, likely from non-uniform background fluorescence. Interfering fluorescence can be overcome by including background fluorescence spectra in the spectral library. Subsequent spectral unmixing of hyperspectral image stacks allows quantitative assessment of spatially varying FRET and background fluorescence signals. The approach was validated in single PMVECs. cAMP production was triggered with 100 nM PGE1, which resulted in an increase in cAMP. A subset of cells were pretreated with 100 nM thapsigargin, which inhibited PGE1-triggered cAMP accumulation, consistent with Ca²⁺-mediated inhibition of cAMP production. Treatment with thapsigargin alone did not alter cAMP levels. Overall, these data suggest that 5D hyperspectral imaging allows real-time measurement of intracellular cAMP signals in three spatial dimensions.

Design of an ADCS Board

Mohammed El-Sharkh

With the expansion and increase in space capability it has become more feasible to launch satellite into space for research purposes. An appealing approach that is available for universities is the construction of CubeSat satellites to launch into the orbit of earth. By placing a CubeSat into space institutions are able to obtain pertinent data for research and design. The satellites are allowed to take on several different sizes that have been standardized into various sets. The standard sized CubeSat, termed as a 1U CubeSat, comes in the standard size of the 10 x 10 x 10 cm. The CubeSat contains four main boards that will control its functionality and navigation in space. The four boards are the electrical power supply board (EPS), the communications and data handling board (C&DH), the communications board, and the attitude determination and control system board (ADCS). Each board provides an essential functionality that is necessary for the success of the satellite. The EPS board is responsible for storing, controlling, and distributing the power to all the other boards. The C&DH board is the brain of the satellite. It controls the flow of information between the various boards placed on the CubeSat. It also oversees the task of storage of information that is pertinent to the CubeSat as a whole. The communications board is the link between the satellite in space and the human operators. It provides a method of sending and receiving data. It also provides a method of initiating commands to the satellite. The ADCS board provides the navigation of the satellite

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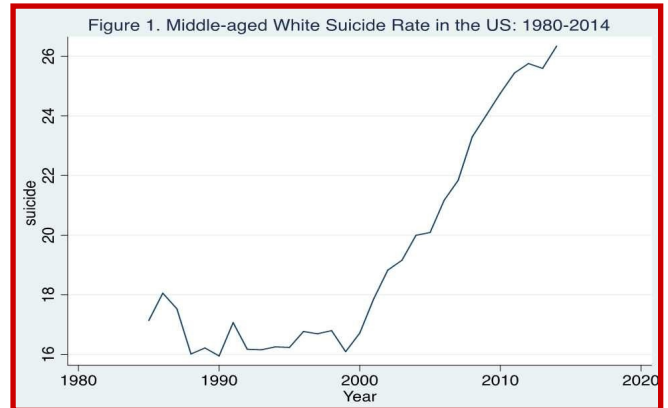
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through space. The CubeSat when initially launched will be tumbling freely in space, so one of the necessary responsibilities of the ADCS board will be stabilization of the satellite. After the stabilization of the satellite the ADCS board is responsible for navigation through space and maintaining the correct orbit. With these primary four boards placed on the CubeSat, institutions are able to add additional boards for the research purposes. The goal of this study is to measure changes in plasma applied at an altitude of 500-600 km in space. To ensure the proper success of the CubeSat each of the four boards have to be successfully designed in a cost effective manner. The goal of this project is to design and simulate an ADCS board that will successfully stabilize the satellite in space and provide accurate navigation and control.

Time Series Analysis of Non-Hispanic White Middle-Aged Mortality From 1980 to 2014

Braden Urban and Seth Lamb

This project, Time Series Analysis of White Middle-Aged Mortality from 1980-2014, is to examine the relationships between associated factors and the White Middle Aged mortality. The mortality rate has increased for the middle-aged whites, while at the same time decreasing in all other aggregate groups. Our main focus was on the socioeconomic effects on suicide rates as a main cause for this increase in mortality rates. In looking at socioeconomic status, unemployment, education, economic growth, Gini coefficient, and poverty rate were collected from the CDC, and analyzed the trends and patterns in each category that correspond with the suicide rate. This paper used linear regression analyses to estimate the effect of economic inequality on suicide. As this analysis is a time series one, the autocorrelation is the major concern that violates the assumptions of the general linear regression model. Thus, this study employed the Prais-Winsten method as statistical model to control the first order autocorrelation. In addition, the Prais-Winsten method has an advantage when the time period is short, because it includes the first year data in the analysis. As this study has only 30 observations, the Prais-Winsten methods is an appropriate choice. Stata 14.1 version is used as a statistical software. The results presented trends in each of the categories represented in the figures below. As seen in the tables and the figures, GINI coefficient and poverty rate have a significant relationship with white mortality. The economic growth rate has a significant inverse relationship with suicide rate, as expected. The interpretations as follows: The GINI coefficient is a scale from 0-1 that measures economic inequality, 0



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being completely equal and 1 being completely unequal. So, as economic inequality increases, suicide rate increases. This along with an increase in poverty rate has a correlation to more suicides in middle-aged white people. Also, as the economy grows and gets to a better place, the suicide rate decreased. The data collected for this experience and the correlations drawn between the factors and suicide rate all logically make sense. The fact that when economic inequality and poverty increase, suicide rate increases seems to go together. When someone is in a lower state of economic security and does not have as much as they used to, they may think that suicide is the only way out of a bad situation. On the converse, when the economy is on the rise, suicide rate decreases. When someone is making more money and their quality of life goes up, they would have a lesser desire to take their own life. To improve our current project, we could use a larger sample set from more than one source. Merging studies from more than just the CDC can do this.

C. elegans thick filaments assemble with a decapitated myosin A

Hallea Ward

Striated muscle makes up about 40-70% of animal muscle mass, and around 40% of that consists of contractile filaments. Actin (thin) and myosin (thick) filaments, in striated muscle, assemble together in such a way that they slide past one another to generate contractile force and shortening. Thick filaments in the body wall muscle of the nematode *Caenorhabditis elegans* have a unique bipolar structure that is composed of myosin A (myoA) and myosin B (myoB) isoforms. These two isoforms are located in distinct regions of the thick filament and are encoded by different genes, thus making it possible to investigate muscle assembly by genetically altering one isoform while still keeping the other isoform functioning appropriately. We used CRISPR-Cas9 homologous gene editing to make a transgenic strain that expresses the myoA head and tail domains as separate polypeptides to create a large bare zone in the center of the thick filament. By using fluorescence microscopy, we found that the myoA tail domain localizes to thick filaments in all expected muscle types including body wall muscle and that the sarcomere organization is normal. Surprisingly, viability, development, growth, and locomotion of the transgenic and wildtype worms are indistinguishable from each other under normal laboratory conditions. Our results show that the thick filament assembly can occur when the myoA head is separated from the myoA tail. We propose an assembly model where the myoA tail is capable of nucleating thick filaments independent of thin filament interactions.



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Mentor: Dr. Ryan Littlefield
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Undergraduate research (UR) is a high impact practice! What does that mean? It means that it positively effects GPA, retention, graduation rates, and acceptance into graduate programs. How does it do this? Is it magic?

Well yes, sort of, it is! UR requires students to learn new knowledge and techniques and to apply them rapidly while they are being acquired. This intense and goal-directed learning changes students perception of College, of their relationship with faculty, of their field of study, and of their place in the world. This magical type of learning is called transformational learning, and really changes students lives.

When I first started the Student Organization for Undergraduate Research, and hired the first Undergraduate Research Ambassadors, I had no idea how wonderful they would be. Now I can plainly see that being student leaders for the SOAR has also been transformative, and that the student leaders for this journal have pushed the boundaries of the journal in terms of scope and quality.

I want to give a special thank you to Dr. Al Chow, who has sought out and taken charge of the Journal. He has been a great sponsor, mentor, and friend to me and the students this year, and his leadership is greatly appreciated! I want to encourage all faculty and students to read and submit to JOURACA, South Alabama's first and only truly interdisciplinary, undergraduate journal.

Sincerely!



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