**2019 EUREKA! Faculty Research Proposals**

**Mentor:** Dr. Jeremy Tzeng  
**Department:** Biological Sciences  
**Mentor Email Address:** tzuenrt@clemson.edu  
**Project/Faculty URL:** https://www.clemson.edu/science/departments/biosci/  
**Project Title:** Development of Therapeutic Approaches for Replacing and/or Augmenting the Use of Antibiotics

**Project Description:**
Increasing incidences of multi-drug resistant bacteria is posing serious threats in current clinical and healthcare settings. Developing alternatives to antibiotics for effective treatment of infections caused by such pathogens is of significant importance. Attachment of bacterial pathogens onto the surface of mammalian cells is one of the foremost events in host-pathogen interactions. Several pathogenic bacteria are able to adhere onto specific host-cell receptors via carbohydrate (glycan) binding proteins. The carbohydrate binding specificity could be utilized to develop therapies for prevention and treatment of infections caused by specific bacteria.

My research team has demonstrated, in vitro, that iron-oxide nanoparticles when functionalized with specific glycans can bind specifically to their targets. In addition, when such nanoparticle-bacteria complexes are exposed to alternating magnetic fields (AMF), the target bacteria are selectively killed via magnetically mediated energy delivery (MagMED) while exerting minimal impact on non-target cells. To further evaluate the feasibility of utilizing this technology for treatment of infections caused by drug-resistant bacteria, in vivo trials are essential in order to demonstrate its efficacy as well as to examine the fate/biodistribution of such nanoparticles. In one of the proposed research projects, we plan to establish a mouse model suitable for studying the use of glycan-functionalized iron-oxide nanoparticles for treatment of infections caused by Neisseria gonorrhoeae.

Overexpression of multi-drug efflux transporters enables pathogens to be resistant to multiple structurally dissimilar antibiotics. Inhibition of such efflux systems will enable us to effectively treat infections caused by multiple-drug-resistant pathogens. In a second proposed project, the student will fractionate extracts of Goldenseal leaves for presence of efflux-pump inhibitors against the bacterial efflux transporter superfamilies.

In a 3rd project, we will explore the use of synthetic biology for construction of biosensors to study bacterial infections on medical implant surface.

**Student Involvement:**
The students will each team up with a graduate student and the mentor to conduct daily laboratory activities on his/her specific project and will have opportunities to interact with other members in the laboratory.

**Expected Outcome:**
Students with prior experience working with microorganisms, e.g., growth media preparation and cultivation of bacteria, are preferred but not essential. During the course of this project, the student will learn basic skills in microbiology and molecular biology including aseptic techniques, quantitative PCR, protein assays, biological assays, etc. Students are expected to give weekly oral reports to the mentor and if sufficient data are collected, the findings will be reported via manuscripts.
Opportunities:
The students would have the opportunity to continue to participate in the mentor's research project and join a Creative Inquiry undergraduate research team.

Required Skills:
Students with prior experience working with microorganisms, e.g., growth media preparation and cultivation of bacteria, are preferred but not essential.

Research Location: Life Sciences Facility - Clemson Campus  Off-Campus Research Location: N
**Mentor:** Dr. Yanzhang Wei  
**Department:** Biological Sciences

**Mentor Email Address:** ywei@clemson.edu  
**Project/Faculty URL:** https://www.clemson.edu/science/departments/biosci/directory/profiles/ywei

**Project Title:** Human cancer cell engineer

**Project Description:**
Cultured human cancer cells are important materials in biomedical research. In many situations, a marker for a particular cell line is critical. In this project, a fluorescent marker or biological marker gene will be introduced into human cervical cancer HeLa cells. Student(s) will not only have the opportunity learn important biomedical research techniques, such as cell culture, DNA cloning, cell transfection, fluorescent microscopy, PCR, ELISA, etc., but also learn how to design and conduct experiments as well as collect and analyze scientific data.

**Student Involvement:**
Under a graduate student's supervision, the students will be able to independently perform the project.

**Expected Outcome:**
Student(s) will have the opportunity learn important biomedical research techniques, such as cell culture, DNA cloning, cell transfection, fluorescent microscopy, PCR, ELISA, etc. Student(s) will learn how to design and conduct experiments as well as collect and analyze scientific data.

**Opportunities:**
Student will be given higher priority to get in the CI project.

**Required Skills:**
Student(s) will have the opportunity learn important biomedical research techniques, such as cell culture, DNA cloning, cell transfection, fluorescent microscopy, PCR, ELISA, etc.

**Research Location:** Life Sciences Facility - Clemson Campus  
**Off-Campus Research Location:** N
Mentor: Dr. Sharon Bewick    Department: Biology
Mentor Email Address: sbewick@clemson.edu  Project/Faculty URL: https://www.clemson.edu/science/departments/biosci/directory/profiles/sbewick
Project Title: Drug Resistance in Space and Time

Project Description:
What do tuberculosis, MRSA and malaria all have in common? They're all microbes that have recently evolved resistance to the medicines we use to treat them. For tuberculosis and MRSA, those medicines are antibiotics. For malaria, it's anti-parasitic drugs like chloroquine. But whether you're looking at the effectiveness of antivirals on viruses, antibiotics on bacteria or antiparasitic drugs on parasites, it's always the same story - we start using a drug... the drug works really well... the microbes 'get smart' and evolve ways to avoid or degrade the drug...and then the drug stops working. One way to circumvent, or at least slow the evolution of pathogen resistance is to alternate the drugs that are used. This way, just as the microbe starts to adapt to a particular drug, it gets hit by another drug, and that new drug works in a different manner that the microbe has no defense against. Unfortunately, to implement such a strategy requires that everyone in a population use the same schedule for switching from one drug to another. But what if we didn't need to coordinate drug use in time? What if, instead of varying the type of drug being used through time, we varied the type of drug used through space. Pickens County could use Drug A and Anderson County could use Drug B. That way, the microbes that evolved resistance in Pickens County would get killed if they hopped over to Anderson County and vice versa. The question, then, is whether spatial variation in drug use can be as effective as temporal variation in preventing or slowing the emergence of pathogen resistance? And how does this depend on the amount of movement of people between spatial regions? And how does it depend on how easily the pathogen spreads, and how easily the pathogen evolves drug resistance? To answer these questions, we'll build agent based models of pathogen spread and evolution and determine how fast resistance emerges depending on how different drugs are prescribed across spatial regions and across time.

Student Involvement:
The research intern will build models of pathogen spread and the evolution of drug resistance using a computer programming language. Depending on the student's previous experience and their future goals, they may use Netlogo, which is a lot like coding up a video game (also like Logo, if they used that to learn to code in public school), or they may use Matlab or C++, which are a bit more mathematical. The student will then use their program(s) to explore the emergence of drug resistance, and how this depends on spatial and temporal variation in the type of drug prescribed. The goal will be to determine whether or not spatial variation in drug use is effective in preventing the emergence and spread of resistant pathogens.

Expected Outcome:
It would be good if the student had some experience in computer programming, although this is not necessary. It is necessary that the student be interested in learning to code, and that the student be comfortable with quantitative concepts, including the ability to read and understand graphs. An interest in the combination of medical biology, mathematics and computer programming would be ideal! I am open to biologists, physicists, mathematicians, engineers and chemists! Because I may not be present on campus, and may interact remotely, the ability to work independently, and to interact via Skype/FaceTime is a must. By the end of the project, students will be able to code in at least one computer language (NetLogo, Matlab, C++, etc.). Students will also have gained an appreciation for the biological mechanisms that lead to drug resistance and the ways in which drug resistant microbes spread through the human population. Likewise, students will have created code to simulate the evolution and spread of drug resistance across a landscape. Ideally, this will lead to a publication in a scientific journal presenting our findings on the effectiveness of spatial versus temporal variation in drug use as a means for preventing or, at the very least, slowing drug resistance. Finally, depending on progress, students may be able to present their findings at a scientific conference, for example the NIMBioS undergraduate conference in October (http://www.nimbios.org/education/undergradconf).

Opportunities:
Students who learn to develop and use computer code as a means for answering biological questions open the door to explore a wide range of other biological systems, both in the medical field and in other areas of biology, for example conservation biology or ecology. Additional projects in theoretical biology will be available in my group, and likely in other groups on campus as well. In addition, because of the medical nature of the project, this is an
ideal research topic for a student interested in ultimately pursuing an MD-PhD, particularly in a field where quantitative skills are required. Not only will the student learn about a highly relevant medical topic, but also, they will develop coding skills and an ability to think about biology quantitatively that will serve them well in the future. A published paper on a medically relevant topic also won't hurt their resumes when they are applying to medical school.

**Required Skills:**

It would be good if the student had some experience in computer programming, although this is not necessary. It is necessary that the student be interested in learning to code, and that the student be comfortable with quantitative concepts, including the ability to read and understand graphs. An interest in the combination of medical biology, mathematics and computer programming would be ideal! I am open to biologists, physicists, mathematicians, engineers and chemists! Because I may not be present on campus, and may interact remotely, the ability to work independently, and to interact via Skype/FaceTime is a must.

**Research Location:** Online via Skype or FaceTime  
**Off-Campus Research Location:** N
Mentor: Dr. Mark Blenner       Department: Chemical & Biomolecular Engineering
Mentor Email Address: blenner@clemson.edu      Project/Faculty URL: https://proteinengineering.sites.clemson.edu
Project Title: Efficient Production of Therapeutics By Control of Cellular Stress Response

Project Description:
The majority of biopharmaceuticals are produced in Chinese Hamster Ovary (CHO) cells. Industrially relevant production lines make huge amounts of protein that can induce a stress response. We have developed tools for identifying key stress responses in the endoplasmic reticulum, but stress responses resulting from overloading the rest of the protein secretory pathway has not been explored. This project aims to find additional stress targets that can improve the production of a monoclonal antibody.

Student Involvement:
Research interns will be actively involved in measuring mRNA and protein levels using quantitative PCR and western blot. This involves growing mammalian cell cultures, harvesting cells, purifying RNA, performing quantitative PCR, running SDS-PAGE, performing western blots, and analyzing data.

Expected Outcome:
Interns do not need any specific skills or experiences, but the intern should be highly motivated and interested in biomolecular engineering, genetic engineering, chemical engineering and/or biochemistry. Intern's research will be directly incorporated into peer-reviewed publications. Our lab views the inclusion of undergraduates in the creation of new knowledge as fundamentally important. It is expected that this research will be included in a peer-reviewed publication, on which the interns could be granted co-authorship. All of my students are encouraged to present their work at local meetings (SC Academy of Science, Regional American Institute of Chemical Engineers Meeting, SC Chapter of the American Microbiology Society) and, when appropriate, at national meetings.

Opportunities:
The research projects in my lab will generally have a long life span; therefore, long term research opportunities are plentiful. My hope is that interns enjoy their research experience and continue working with me and with my group for their years at Clemson. All work in the lab is likely to contribute to a peer-reviewed publication, and authorship potential exists for motivated researchers. Several prior EUREKA! students continued their research during the academic year.

Required Skills:
Interns do not need any specific skills or experiences, but the intern should be highly motivated and interested in biomolecular engineering, genetic engineering, chemical engineering and/or biochemistry.

Research Location: Earle Hall - Clemson Campus       Off-Campus Research Location: N
Mentor: Dr. Mark Blenner  
Department: Chemical & Biomolecular Engineering  
Mentor Email Address: blenner@clemson.edu  
Project/Faculty URL: http://proteinengineering.sites.clemson.edu  
Project Title: Engineering Therapeutics and Enzyme Production Using Nonconventional Yeast  

Project Description:
Our society uses proteins and enzymes in a variety of applications from laundry detergent to therapies for debilitating disease. Producing these molecules in a more efficient manner will be important driving down the price of enzymes and therapeutics. Our lab is pioneering the effort to establish a new yeast platform for production of industrially relevant enzymes. We are developing novel tools that allow us to manipulate its genetics and metabolism and enable high levels of protein secretion. This project uses a CRISPR-Cas9 library to identify genetic modifications leading to increased protein secretion from nonconventional yeast.

Student Involvement:
Research interns will be actively involved in developing a high-throughput method to screen for highly protein secreting strains. Interns will work directly with graduate students and postdoctoral scientists to accomplish our short-term goals. Interns will screen a CRISPR-Cas9 library in a strain that is producing an industrially important enzyme. The intern will measure enzyme production using activity assays and gel electrophoresis. Strains will be sequenced to identify the cause of increased secretion.

Expected Outcome:
Interns do not need any specific skills or experiences, but the intern should be highly motivated and interested in biomolecular engineering, genetic engineering, chemical engineering and/or biochemistry. Intern's research will be directly incorporated into peer-reviewed publications. Our lab views the inclusion of undergraduates in the creation of new knowledge as fundamentally important. It is expected that this research will be included in a peer-reviewed publication, on which the interns could be granted co-authorship. All of my students are encouraged to present their work at local meetings (SC Academy of Science, Regional American Institute of Chemical Engineers Meeting, SC Chapter of the American Microbiology Society) and, when appropriate, at national meetings.

Opportunities:
The research projects in my lab will generally have a long life span; therefore, long term research opportunities are plentiful. My hope is that interns enjoy their research experience and continue working with me, and with my group for their years at Clemson. All work in the lab is likely to contribute to a peer-reviewed publication, and authorship potential exists for motivated researchers. Several prior EUREKA! students continued their research during the academic year.

Required Skills:
Interns do not need any specific skills or experiences, but the intern should be highly motivated and interested in biomolecular engineering, genetic engineering, chemical engineering and/or biochemistry.

Research Location: Earle Hall - Clemson Campus  
Off-Campus Research Location: N
**Mentor:** Dr. Chris Kitchens  
**Department:** Chemical and Biomolecular Engineering  
**Mentor Email Address:** ckitche@clemson.edu  
**Project/Faculty URL:** https://www.clemson.edu/cecas/departments/chbe/people/kitchens_c.html  
**Project Title:** Sustainable Building Materials for Energy Efficient Housing  

**Project Description:**

This project is focused on the development of greener alternatives to current residential housing building materials. Structural Insulated Panel Systems (SIPS) are emerging as an alternative form of residential construction that can significantly increase energy efficiency and decrease build time. Currently the SIPS materials consist of oriented strand board (OSB) as the structural component. OSB is composed of wood chips and often a phenyl formaldehyde resin which have health concerns and are very flammable. We are working with a company, Jet Products, to develop new magnesium oxide based cement wallboards for structural applications. The focus of this research will be to make these cement boards and test their properties for building applications, including strength, chemical composition, and fire retardant properties.

**Student Involement:**

EUREKA! students will work with Dr. Kitchens and other members of his research group which consists of graduate research assistants and undergraduate research students. The graduate and undergraduate students will provide day to day assistance in the lab and train the EUREKA! students on laboratory practices and synthesis techniques used in the lab. After the first week in the lab, the students should be able to synthesize materials on their own. The students will then characterize these materials and analyze the results.

**Expected Outcome:**

Qualified students should be interested in science and comfortable working in a chemistry laboratory. Students should be comfortable working with other students as well as independently. Enthusiasm, scientific creativity, and a love of science are a must. The outcome of the project will include new synthesis protocols for the described material, a presentation describing the synthesis and characterization of the materials, and an opportunity to continue this research throughout the students undergraduate career which will hopefully lead to a scientific publication.

**Opportunities:**

Following the EUREKA! Program, students will have the opportunity to continue this research or related research in Dr. Kitchens' research group as an undergraduate researcher during the semesters and following summers. Opportunities exist through the Creative Inquiry program, Honors Research, or as an hourly paid researcher. Continuation of the research is strongly encouraged and students are not required to major in Chemical Engineering for these research opportunities. The EUREKA! students will be able to learn about these research opportunities from other undergraduate researchers in the lab over the summer.

**Required Skills:**

Qualified students should be interested in science and comfortable working in a chemistry laboratory. Students should be comfortable working with other students as well as independently. Enthusiasm, scientific creativity, and a love of science are a must.

**Research Location:** Earle Hall - Clemson Campus  
**Off-Campus Research Location:** N
Mentor: Dr. Chris Kitchens  
Department: Chemical and Biomolecular Engineering  
Mentor Email Address: ckitche@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/cecas/departments/chbe/people/kitchens_c.html  
Project Title: Gold Nanoparticles for Catalysis Applications  

Project Description:  
More than 60% of all chemical products (including fuels, commodity and fine chemicals) and 90% of chemical processes rely on catalysis. It is also estimated that more than 35% of the global GDP is tied to catalysis. The field of nanoscience is defined by the fact that when materials are reduced to the nanoscale, the nanomaterials possess properties that are different than their bulk material. Case in point, metals like gold that are thought of as inert become catalytically active in the nano-regime. The past 30+ years have seen an explosion in the number of nanomaterials that have been synthesized with different sizes, shapes, crystallinity, and atomic composition; all with unique properties. A majority of these methods rely on solution based methods and colloidal chemistry to obtain the desired materials, and thus, surface bound ligands are required. Herein is the dilemma: surface bound ligands are required to synthesize and preserve unique nanomaterials that are potential catalytic materials but the binding of these ligands to the surface can block the reactive surface sites and eliminate catalytic activity. To circumvent this dilemma, the nanomaterials can be deposited onto a support and treated to remove the bound ligand, but this results in potential changes in the surface properties, significant decrease in the available surface area, and influence of the support material on the activity, which can be advantageous or detrimental. The focus of this research is to compare the catalytic activity of gold nanoparticles in solution and deposited on a support for relevant chemical reactions.

Student Involvement:  
EUREKA! students will work with Dr. Kitchens and other members of his research group which consists of graduate research assistants and undergraduate research students. The graduate and undergraduate students will provide day to day assistance in the lab and train the EUREKA! students on laboratory practices and synthesis techniques used in the lab. After the first week in the lab, the students should be able to synthesize nanoparticles on their own and will work to develop new synthesis methods. The students will then characterize the catalytic activity of these nanomaterials and analyze the results.

Expected Outcome:  
Qualified students should be interested in science and comfortable working in a chemistry laboratory. Students should be comfortable working with other students as well as independently. Enthusiasm, scientific creativity, and a love of science are a must. The outcome should include new synthesis protocols for the described material, a presentation describing the synthesis and characterization of the materials, and an opportunity to continue this research throughout the students undergraduate career which will hopefully lead to a scientific publication.

Opportunities:  
Following the EUREKA! Program, students will have the opportunity to continue this research or related research in Dr. Kitchens' research group as an undergraduate researcher during the semesters and following summers. Opportunities exist through the Creative Inquiry program, Honors Research, or as an hourly paid researcher. Continuation of the research is strongly encouraged and students are not required to major in Chemical Engineering for these research opportunities. The Eureka students will be able to learn about these research opportunities from other undergraduate researchers in the lab over the summer.

Required Skills:  
Qualified students should be interested in science and comfortable working in a chemistry laboratory. Students should be comfortable working with other students as well as independently. Enthusiasm, scientific creativity, and a love of science are a must.

Research Location: Earle Hall - Clemson Campus  
Off-Campus Research Location: N
The determination of alcohol is one of the most important parameters in the fermentation industry, influencing not only the production yield and the quality of the product, but also its commercial value. In addition to the traditional approach based on distillation/density procedure that is considered laborious and time-consuming, methods based on chromatography are widely used. Alternatives using electrochemical, spectroscopic and colorimetric techniques have been also proposed for alcohol analysis. In general, these methods not only offer limited throughput, but also require harsh reaction conditions and/or complex instrumentation. Aiming to address these shortcomings, this project aims to develop a fast, simple and clean analytical approach for the determination of primary alcohols based on the photochemical oxidation under UV-LED irradiation in the presence of H2O2.

Students will be paired with a senior member of the team and trained in the operations of the lab. The goal is to progressively allow the student to take over the project and eventually perform his/her own experiments independently.

Students are expected to produce enough results for a presentation and (depending on the results) be co-authors of a paper.

They will be able to join the lab and continue doing research throughout their time at Clemson.

The student must possess basic notions of chemistry concentrations and a drive to learn.

The student must possess basic notions of chemistry concentrations and a drive to learn.
Mentor: Dr. Shiou-Jyh Hwu
Department: Chemistry
Mentor Email Address: shwu@clemson.edu
Project/Faculty URL: http://www.clemson.edu/science/departments/chemistry/people/faculty/hwu.html
Project Title: Electrochemical Crystal Growth of Inorganic/Organic Hybrid Solids

Project Description:
The proposed research employs an electrochemical method as a driving force to grow single crystals of new solids for structure and property characterization. A new series of hybrid solids made of inorganic building blocks and organic linker molecules have been explored recently in our laboratory as capacitors for battery applications. The former is made of transition metal oxide clusters, offering rich redox chemistry necessary for charging/discharging of secondary rechargeable batteries. These new compounds were synthesized in aqueous solution at room temperatures. We plan to investigate optimum reaction conditions for high-yield synthesis. These new phases will be subject to structure characterization by single-crystal X-ray diffraction (SXRD) methods, phase identification by powder X-ray diffraction (PXRD) methods, thermal behavior study by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC), electronic structure investigation by ultraviolet-visible (UV-vis) spectroscopy, and capacitance measurement via electrical conductivity. Ultimately, new compounds with superior capacitance property for battery applications will be identified.

Student Involvement:
The intern(s) will work under the supervision of a senior graduate student in my research group. The intern will learn fundamental skills in electrochemistry for the synthesis and crystal growth of solid state materials for device applications. When it is appropriate, the intern will be given guided opportunities to design new experiments for the study of optimum reaction conditions for high-yield synthesis. The resulting products will be subject to SXRD, PXRD, TGA, DSC, and UV-vis studies.

Expected Outcome:
To participate in this project, the intern should have some understanding and appreciation of fundamental chemistry. Skills to operate the advanced instruments will be learned. The intern will be trained to operate the state-of-the-art instruments in the lab. New studies will result in new results and scientific publications. The intern will be encouraged to present the research results at the local (on-campus) research symposium, as well as regional American Chemical Society meeting.

Opportunities:
This research is on-going. A well-trained intern will be invited back to the lab to do independent studies potentially for his/her Honors thesis.

Required Skills:
To participate in this project, the intern should have some understanding and appreciation of fundamental chemistry. Skills to operate the advanced instruments will be learned.

Research Location: Hunter Chemistry Laboratory - Clemson Campus
Off-Campus Research Location: N
Mentor: Dr. Sourav Saha       Department: Chemistry
Mentor Email Address: souravs@clemson.edu   Project/Faculty URL: https://souravs.people.clemson.edu/Home.html
Project Title: Stimuli-Responsive Functional Materials

Project Description:
We will design, synthesis, characterization, and performance evaluation of new fictional materials in prototype devices that can convert light to electricity, transport charges, and detect toxic chemicals.

Student Involvement:
The intern will work in a team with a postdoc and/or senior graduate student to learn the design principles of various functional materials, synthesize and characterize them, and test their optical and electronic properties in solutions as well as in device settings.

Expected Outcome:
Students should be proficient in Microsoft Word, PowerPoint, Excel, etc. The outcome of this project is to be able to synthesize and characterize new fictional materials that can convert light to electricity, transport charges, and detect toxic chemicals.

Opportunities:
After the project, the student could potentially continue the research project in the lab.

Required Skills:
Students should be proficient in Microsoft Word, PowerPoint, Excel, etc.

Research Location: Hunter Chemistry Laboratory - Clemson Campus       Off-Campus Research Location: N
Mentor: Dr. Prasad Rangaraju  Department: Civil Engineering  
Mentor Email Address: prangar@clemson.edu  Project/Faculty URL: https://www.clemson.edu/cecas/departments/ce/people/faculty/rangaraju.html  
Project Title: 3D Printing of Concrete Structures

Project Description:
The objective of this research is to develop a fundamental understanding of various factors that influence rheological properties of Portland cement concrete and use this information to develop a rational approach to proportion concrete that can be used in 3D printing of various concrete elements. The findings from this research will pave the way for writing a comprehensive research proposal to agencies such as NSF and FHWA for ramping up the work from a bench scale to a field pilot scale 3D printing of concrete elements.

Student Involement:
The EUREKA! student will have the first-hand experience of conducting physical testing of concrete mixtures and correlating the material characteristics with the design requirements for a 3D printer. The EUREKA! student will collaborate with a Graduate Student on this project and will be expected to share the findings from this research at professional meeting, such as at American Concrete Institute, SCDOT Spring Conference, SC Academy of Science.

Expected Outcome:
The EUREKA! student is expected to have passion and adequate mechanical skills to be able to work in the lab, have basic computer programming skills in LabVIEW or MATLAB (if not, should show aptitude to learn quickly), be aware and follow safety protocols in the lab. The effort of the EUREKA! student will contribute towards developing a rational methodology to select appropriate materials, evaluate necessary material characteristics, and develop the desired knowledge for a rational approach to proportioning 3D printable concrete mixtures.

Opportunities:
The students can continue to pursue UG research with the advisor and become part of a Creative Enquiry Team to dig deeper into this subject. This can eventually lead a student to pursue graduate education.

Required Skills:
The EUREKA! student is expected to have passion and adequate mechanical skills to be able to work in the lab, have basic computer programming skills in LabVIEW or MATLAB (if not, should show aptitude to learn quickly), be aware and follow safety protocols in the lab.

Research Location: Lowry Hall - Clemson Campus  Off-Campus Research Location: N
Mentor: Dr. Andrew Pyle  
Department: Communication  
Mentor Email Address: apyle@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/cbshs/departments/communication/  
Project Title: Managing Social Media Engagement in an Age of Disinformation  

Project Description:  
For this year's EUREKA! project we will be leveraging social media analytics resources in the Communication Department's Social Media Listening Center to study how organizations, communities, states, and nations are affected by information and disinformation campaigns on social media platforms, particularly Twitter. EUREKA! research intern(s) will work with a faculty team to examine how efforts such as Russian trolls on Twitter have been the tool through which disinformation campaigns have been managed on a global scale.

Student Involement:  
Research interns on our team are full partners. This means that interns will learn the entire research process, from conducting a thorough review of literature, to gaining knowledge about and skills in social media analytics. The student intern will have the opportunity to earn a role as co-author on the publication(s) and conference presentation(s) that result from this work.

Expected Outcome:  
Interns do not need any specific skills to join this team, other than focus and the motivation to learn and be an engaged member of the team. At least one conference presentation and one journal article are expected outcomes from this program, and the intern will have gained social science research experience and knowledge of social media analytics.

Opportunities:  
Students in past years (EUREKA! 2017 & 2018) have continued to work with our research team in various capacities and are still active participants in ongoing research.

Required Skills:  
Interns do not need any specific skills to join this team, other than focus and the motivation to learn and be an engaged member of the team.

Research Location: Daniel Hall - Clemson Campus  
Off-Campus Research Location: N
Mentor: Dr. Weitian Wang  
Department: Department of Automotive Engineering  
Mentor Email Address: wtwang@clemson.edu  
Project/Faculty URL: https://www.youtube.com/watch?time_continue=98&v=mdxlv5ENK44  
Project Title: Teaching Robots to Assist Humans in Human-robot Co-assembly Tasks using Multi-Modal Demonstrations  
Project Description:
Collaborative robotics have been applied more and more in industrial assembly tasks. Notably, with regard to the increasing needs for flexibility and complexity of assembly tasks, a robot-assisted system together with a human has many superiorities compared to conventional automatic machines. Therefore, the human-robot cooperation in manufacturing, especially for dexterous and complicated hybrid assembly tasks, are attracting increasing attention. In the hybrid assembly tasks, the robots must be able to interact with the human workers in a user-friendly and safe manner. Generally, when robots work with human partners in the shared workspace for assembly tasks, they have to interact physically in order to successfully collaborate. However, such traditional physical interaction approach may cause potential human safety concerns. In addition, when the collaborative task is updated, the human partner has to program the robot again by the conventional off-line approach, which cost lots of time and human efforts. Therefore, developing a time-saving, human-friendly, and natural-to-collaborate approach for human-robot collaborative tasks is a necessary issue to solve.

Research Objective: We propose to develop a teaching-learning-prediction (TLP) framework to investigate the collaborative robotic systems to work and communicate with human partners using natural language in human-robot co-assembly tasks to enhance the manufacturing efficiency and quality. In human-robot collaboration, we will employ the TLP approach to have the human utilize natural language to teach the robot to assemble the shared products. After that, the robot can construct its action planning policy independently by taking advantage of its learned knowledge to assist the human in the co-assembly tasks. As a consequence, in the proposed project, not only can the robot understand the human's assembly actions, but also the human will save lots of efforts to program the robot using natural language for the update robot-unknown collaborative tasks.

Technical Approach: The overarching vision of this work is to have the robot online learn from partial human demonstrations to predict human assembly intentions and assist the human in collaborative tasks flexibly. This model is composed of three main processes: human teaching using natural language based demonstration, robot learning from human demonstrations, and human-robot collaboration in shared tasks.
(1) Before starting the human-robot collaboration in a robot-unknown task, the human presents partial demonstrations of each assembly intention to the robot online by natural language instructions according to his/her personalized working preferences. The human's assembly actions are recorded by a vision system. Likewise, the robot also responds to the human through speech once it gets the intention information. During the teaching process, the quantitative elements of human intentions are extracted from natural language information and vision information. This multi-modal information will be employed in the robot learning algorithm to update the robot's assembly cognition.
(2) In the robot learning process, the extracted human assembly intention information is further parameterized online by different sets of features correspondingly. The processed natural language instructions work as learning objectives, and the vision information works as knowledge sets for the robot. After that, these features are utilized by the robot as inputs to the TLP model based on the ELM algorithm to construct its cognitive capacity of understanding different human assembly intentions.
(3) Based on the learned strategy, the robot is able to employ the human intention prediction algorithm in the TLP model online to make assembly decisions. In the prediction process, the optimal assembly policy is generated for the robot according to the online dynamic input information from the vision system. Then, the robot utilizes the prediction outputs to collaborate with its human partner to accomplish the co-assembly tasks by planning corresponding assembly actions.

Student Involvement:
(1) The research intern will be involved in developing the robot learning algorithms based on the Extreme learning machines. Extreme learning machines are feedforward neural networks for classification, regression, clustering, sparse approximation, compression and feature learning with a single layer or
multiple layers of hidden nodes. These hidden nodes can be randomly assigned and never updated, or can be inherited from their ancestors without being changed. In most cases, the output weights of hidden nodes are usually learned in a single step, which essentially amounts to learning a linear model. The research intern will be involved in conducting the human-robot collaboration experiment in our Lab. The proposed project will be implemented on the Multi-modal based Collaborative Robotics Research Platform 1 (MCRRP-1), which is designed and constructed by our lab for human-robot collaboration research. The platform is composed of a 6 DOF Staubli robot with a field controller, an engineer station and operator station, and a set of multi-modal based human-robot interactive interfaces, including the 3D vision system, the natural language processing system, and the high-precision sensing system. The operator station is deployed with open interfaces supporting multiple programming languages for different experimental requirements. We employ the 3D vision system and the natural language processing system, including speech-to-text (StT) and text-to-speech (TtS), as the interactive interface for the human and robot. The operator station is utilized to fuse the human-robot interaction information and run the TLP framework.

**Expected Outcome:**
Basic computer programming knowledge (Matlab, Python) or basic electronic knowledge (no need to be too skilled) is preferred for our human-robot collaboration experiments.  
(1) Collaborate on one research paper of the project;  
(2) One 10 minute research presentation of the project;  
(3) One research poster of the project (including poster printing);  
(4) One experiment demo video of the project for future potential academic activities.

**Opportunities:**
(1) Gain hands-on experience in the robot operation;  
(2) Collaborate on at least one published academic paper.

**Required Skills:**
Basic computer programming knowledge (Matlab, Python) or basic electronic knowledge (no need to be too skilled) is preferred for our human-robot collaboration experiments.

**Research Location:** CU-ICAR - Greenville Campus  
**Off-Campus Research Location:** Y
The Alper Lab has a number of projects that a EUREKA! participant could work on. These include:

1. The unique biophysical mechanisms of pathogenic parasites: Nearly all therapeutic strategies in the treatment of parasitic infections involve targeting the replication or metabolism pathways. However, pathogenic parasites also have multiple unique biophysical mechanisms that remain unexplored as therapeutic targets. We are trying to characterize the biophysical mechanisms including motility, immune system avoidance, and mechanisms of cell division, to name a few.

2. Engineering neuronal circuits: Neurons in the brain act in vast networks. We have built a tool to specifically build and electrically test simple circuits inspired by electrical circuits and basic logic gates. This project is to work with our system and build and test some simple circuits to develop the basic rules necessary to engineer neuronal circuits in vitro.

3. Biophysical and biochemical measurements of motor proteins: We have purified some motor proteins that drive the beat of flagella from a single-celled alga. The project is to make biochemical (characterize size, charge and enzymatic activity of these motors) and biophysical (measure their velocity and force production) measurements of these motors. This will help us build models that connect the molecular properties of these motors to the cell-level effects they drive.

Student Involvement:
Participants will have some flexibility in the way that they participate, and they may end up working more individually or as part of a team depending on what project within the lab they choose. Independent of project, any research intern in the Alper Lab will learn biophysical and biochemical techniques and apply them to molecular or cellular systems of interest.

Expected Outcome:
Basic wet lab skills (pipetting, using a balance, using a pH meter, etc.) are helpful. Basic knowledge of physics, chemistry and biology would also be helpful, as the work is inherently interdisciplinary. The intern is expected to materially contribute to the research. Perhaps collecting and analyzing the data for a figure in a peer-reviewed scientific paper.

Opportunities:
Students will have the opportunity to expand their knowledge in the area of molecular and cellular biophysics.

Required Skills:
Basic wet lab skills (pipetting, using a balance, using a pH meter, etc.) are helpful. Basic knowledge of physics, chemistry and biology would also be helpful, as the work is inherently interdisciplinary.

Research Location: Jordan Hall - Clemson Campus  Off-Campus Research Location: N
**Mentor:** Dr. Yongqiang Wang  
**Department:** Electrical and Computer Engineering  
**Mentor Email Address:** yongqw@clemson.edu  
**Project/Faculty URL:** https://cecas.clemson.edu/ndcl/

**Project Title:** Swarm Robotics  
**Project Description:**

We are researching a biologically-inspired swarm robotics communication/control strategy. Neurons can achieve synchronized firing with amazing robustness and scalability via exchanging simple identical pulses. Using a similar mechanism, fireflies can achieve synchronized flashing. Our group has systematically studied the cooperation mechanism of interacting neurons and designed a bio-inspired cooperation mechanism for swarm robotics. Based on the developed mechanism, students will use six ground robots in the lab to achieve various cooperative tasks. Such multi-robot based cooperative tasks have broad applications in flight formation, industrial automation, surveillance, and intelligent transportation, to name only a few.

**Student Involvement:**

There will be graduate students guiding the student hand-in-hand. Students will use six ground robots in the lab to achieve various cooperative tasks like pushing a coffee can to a designated position together. Students can work individually or as a team.

**Expected Outcome:**

There are no required skills. We expect students to know how robotics cooperate with each other to fulfill complicated tasks.

**Opportunities:**

After EUREKA!, students can still work in the lab to do research and publish papers on their findings.

**Required Skills:**

There are no required skills.

**Research Location:** Fluor Daniel - Clemson Campus  
**Off-Campus Research Location:** N
Mentor: Dr. Pingshan Wang   Department: Electrical and Computer Engineering
Mentor Email Address: pwang@clemson.edu   Project/Faculty URL: https://www.clemson.edu/cecas/departments/ece/faculty_staff/faculty/pwang.html
Project Title: Radio-frequency (RF) field effects on biological cells

Project Description:
Electrical stimulation (ES), such as electrical muscle stimulation and electrical neuromodulation, is widely used for pain management, rehabilitation intervention, wound healing, strength training and disease treatment. On the other hand, widely used wireless communication gadgets, such as mobile phones, raise the concern of RF heath hazards (e.g. cancer risks). Nevertheless, the fundamental ES mechanism and RF-cell interaction process are still subjects of debates and investigations, mainly due to the extreme complexity of biochemical systems and the lack of techniques for controllable, reliable, and systematic studies. For instance, current electrical systems often produce nonuniform ES and RF fields which make it difficult for reliable studies of ES and RF biological effects. Monitoring temperature changes at high resolutions, e.g. at 0.01 degree C, is problematic. Furthermore, there is no established method to screen RF frequencies for effective ES effect examination. In this project, the intern student(s) will work with senior PhD graduate students to use or modify our existing RF devices and technologies to study the effects of uniform RF fields on cell growth or investigate single cell responses to uniform RF fields. Different RF characteristics, such as frequencies, frequency modulations (or frequency combinations) and field polarizations, will be exploited. With the obtained RF devices and measurement systems, cell migration, proliferation, and differentiation will also be examined. The obtained results are expected to help (i) understand cell-RF interactions and RF effects on cell growth, (ii) determine suitable RF parameters for lab-on-chip development, and (iii) guide ES developments.

Student Involement:
The research intern(s) are expected to work closely with senior PhD students. After familiarizing themselves with the basic research procedures and activities, they are expected to identify their own research tasks and topics therein (in consultation with the PhD graduate students and the faculty mentor) and carry out the studies. In general, they are expected to use microscopes to observe cell behaviors, operate various electronic analytical instruments (e.g. vector network analyzers, RF sources, pulse generators and oscilloscopes), write (simple) Matlab codes for instrument control, data acquisition and analysis, and communicate with others about their efforts and results.

Expected Outcome:
Students are required to have the knowledge and skills equivalent more advanced than AP chemistry, biology, physics, and/or computer science. The interns are expected to establish reliable and operational modules of the experiment setup or improve current module performance. The interns are also encouraged to identify specific ES stimulation or RF-cell interaction topics to investigate in depth. Publications are the ultimate outcomes of the projects.

Opportunities:
Students will have the opportunity to expand their knowledge in the area of electrical and computer engineering.

Required Skills:
Students are required to have the knowledge and skills equivalent more advanced than AP chemistry, biology, physics, and/or computer science.

Research Location: Biosystems Research Complex & Jordan Hall - Clemson Campus   Off-Campus Research Location: N
Mentor: Dr. Patrick Hiesl  
Department: Forestry and Environmental Conservation  
Mentor Email Address: phiesl@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/cafls/faculty_staff/profiles/phiesl  
Project Title: Evaluating Cost Differences for Two Different Wood Chipping Methods  

Project Description:

The goal of this project is to evaluate and compare the utilization and cost of processing forest products in two different ways. One process commonly used is to cut trees and transport them without branches to a processing facility where they will then get chipped. A second process is to chip the trees in the forest and only bring the chips to a processing facility. Each of these methods varies in the price that is paid to the landowner, and possibly in the total volume being harvested. Using time study procedures student researchers will collect time consumption data for each of the two methods. A participating wood processing facility will also provide additional information as needed to answer the questions of productivity, cost, and volume differences between the two methods. One or two harvest sites in the Clemson Experimental Forest will be utilized for this project, with occasional travel to the processing facility in Greenwood. A vehicle will be provided.

Student Involvement:

Research interns will learn about time studies and be a crucial part of collecting time consumption data for different harvesting operations. Students will be spending several days observing harvesting equipment. After the time studies, the students will analyze data they have collected and combine it with data provided by processing facility. Results from the data analysis will have to be summarized in a report and presented to the processing facility.

Expected Outcome:

The student should possess good knowledge of Microsoft Excel and be proficient with computers and tablets. They should also have a willingness and ability to work in rough terrain outdoors and less than ideal weather conditions (rain). They should also have respect for safety procedures. Interns will learn new techniques and software to collect time study data. They will also learn ways to estimate cost based on multiple input factors. Results will be published, so interns will receive credit as authors on a publication.

Opportunities:

The field of forest operations research offers many avenues to continue research in graduate school or in smaller projects as an undergraduate student. Additional research experiences can be provided for the right student.

Required Skills:

The student should possess good knowledge of Microsoft Excel and be proficient with computers and tablets. They should also have a willingness and ability to work in rough terrain outdoors and less than ideal weather conditions (rain). They should also have respect for safety procedures.

Research Location: Lehotsky Hall - Clemson Campus  
Off-Campus Research Location: N
Mentor: Dr. Amy Lawton-Rauh  Department: Genetics and Biochemistry
Mentor Email Address: amylr@clemson.edu
Project/Faculty URL: https://www.clemson.edu/science/departments/genetics-biochemistry/people/profiles/amylr

Project Title: Evolutionary genomics of rices and amaranths

Project Description:
There are two active research programs in the Lawton-Rauh laboratory that have projects appropriate for EUREKA! students for summer 2019: 1) Comparative evolutionary genomics of 3 species of cultivated rice including African rice (Oryza sativa), Asian rice (Oryza glaberrima) and an Oryza species cultivated exclusively on the island nation Trinidad and 2) Evolutionary population genetics of resistance in invasive Amaranthus (pigweeds) in agroecosystems.

Project 1: Evolutionary genomics relationships among 3 cultivated rices
This project focuses on understanding the genetic relationship and origin of Trinidad rices compared with the two most prevalent cultivated rices in the world- Oryza sativa (Asian) and Oryza glaberrima (African). To accomplish this, the genomic DNA sequence data of the 3 rices will be aligned to look for differences and similarities within the DNA structure. We will also focus analysis on the coding regions of the DNA, specifically the genes that confer traits that support and enhance cultivation (domestication) and genes that that confer local adaptations (typically associated with weediness). Comparisons are conducted using DNA sequence analysis software. The results of this study will help further elucidate the genetic relationship and origins of Trinidad rices compared with Asian and African domesticated rices and may reveal genome regions involved in heritable traits unique to Trinidad rices which presently is not cultivated outside of the island.

Project 2: Population genetics of resistance in invasive Amaranthus in agroecosystems
Another research project focuses on the population dynamics of invasive populations of Amaranthus palmeri (pigweed) that differ among populations for resistance to the herbicide glyphosate (aka 'Roundup') in agroecosystems that include plants transgenic for herbicide resistance. DNA sequences of the genome region containing the gene involved in resistance comprise a 400 KB region will be analyzed among populations and possibly species. This genome region occurs in multiple copy numbers from the original single copy to dozens and hundreds of gene copies and this number expands rapidly in populations. In this project, levels and patterns of genetic relatedness and variation within and among resistant and susceptible populations from the Southern U.S. and among species will be calculated from DNA sequences. This information will help to determine the population history and patterns linking genetic diversity, divergence and resistance levels. This project also involves contribution to response assays and altogether the DNA sequence data and bioassay data provide important insight into the mechanisms responsible for the spread of resistance across space and time.

Student Involvement:
Our lab consists of a full time research associate with nearly 15 years of research and teaching experience (Mary Beth Johnstone, PhD) who is involved in both projects and the PI (Amy Lawton-Rauh) whom will be in the lab for lab meetings, outings, and biweekly one:one meetings with students. Currently, the lab has two undergraduate research interns graduating May 2019 and anticipates a visiting researcher during the summer. The student(s) will work independently and collaboratively with Mary Beth directly daily and with colleagues in gene sequence analysis and other tasks and procedures related to the projects which may include DNA extraction and purification and processing for NextGen sequencing at the Center for Human Genetics, and plant bioassays and plant care in the greenhouse. If the field conditions are right and timely, the lab will conduct a field collection experiment. Each student will have a research question that they will complete and present independently.

Expected Outcome:
The student should have a very basic understanding of genetics (Punnett squares, nucleotides A-T-C-G, and the relationships among DNA, RNA, amino acids, and proteins). The student should also have experience with the Microsoft operating system as well as the Microsoft office suite for collection/presentation of data. The student should have interest in learning lab techniques, reading primary literature, and analysis of DNA data. Most of all, the student should be enthusiastic about research, well-organized, be curious, and communicate well with others. The students will become familiar with DNA sequence analysis and be able to utilize a variety of analysis tools (including visualizations of genomes and DNA sequences of genes).
They will also learn how to test hypotheses that use genetic patterns within and among rices or amaranth populations and between amaranth species. This research will form the basis of written and oral reports in publications, presented at regional and national meetings (including if desired the 2019 Southeastern Population, Ecological and Evolutionary Genomics meeting being hosted by Clemson University), and contribute to larger projects and programs providing insight into domestication, breeding and resistance evolution.

Opportunities:
The student(s) will be well prepared to either continue research in the Lawton-Rauh lab, take part in research projects in other labs during their undergraduate careers on campus and/or be competitive for off-campus internships. This hands on training will broaden the students understanding of research methods, and reporting and provide skill sets desired by graduate or professional schools.

Required Skills:
The student should have a very basic understanding of genetics (Punnett squares, nucleotides A-T-C-G, and the relationships among DNA, RNA, amino acids, and proteins). The student should also have experience with the Microsoft operating system as well as the Microsoft office suite for collection/presentation of data. The student should have interest in learning lab techniques, reading primary literature, and analysis of DNA data. Most of all, the student should be enthusiastic about research, well-organized, be curious, and communicate well with others.

Research Location:  Biosystems Research Complex - Clemson Campus  Off-Campus Research Location:  N
Mentor: Dr. Hong Luo  Department: Genetics and Biochemistry
Mentor Email Address: hluo@clemson.edu  Project/Faculty URL: http://www.clemson.edu/cafsls/faculty_staff/profiles/hluo
Project Title: Functional characterization of three novel genes involved in plant stress response

Project Description:
Environmental stress is one of the most important factors impacting agriculture production. Understanding molecular underpinnings for plant response to environmental stress will provide information for development of novel strategies for crop improvement using biotechnology approaches. This project focuses on functional characterization of three novel genes from a highly salt tolerant grass species, seashore paspalum that are potentially involved in plant response to abiotic stress, particular salt and drought stress. These genes have been cloned from our previous research identifying new candidate genes determining plant abiotic stress responses. In this proposed project, we plan to functionally characterize three genes and investigate their roles in determining plant stress response and manipulate their expression in transgenic plants to develop novel molecular strategies to improve food and economically important crop species, rice and turfgrass using biotechnology approaches.

Student Involvement:
The research intern will work with graduate students and post-doc researcher to actively participate in all aspects of the research project, including chimeric gene construction, plant transformation and gene functional characterization. The interns will be expected to become independent in conducting the assigned research after initial training by working together with other senior lab members.

Expected Outcome:
No specific skills are required for the intern to start the project. The interns will be trained in the lab and learn basic molecular and cell biology techniques including DNA RNA extraction, DNA cloning, plasmid construction, PCR, plant tissue culture and plant genetic transformation. The research would lead to a poster presentation in related professional meeting and publications in peer-reviewed professional journals.

Opportunities:
The students could continue their research in the lab, gain more research experience, and have opportunities to present research data in professional meetings and publish their discoveries.

Required Skills:
No specific skills are required for the intern to start the project. The interns will be trained in the lab and learn basic molecular and cell biology techniques including DNA RNA extraction, DNA cloning, plasmid construction, PCR, plant tissue culture and plant genetic transformation.

Research Location: Biosystems Research Complex - Clemson Campus  Off-Campus Research Location: N
Mentor: Dr. Michael Sehorn  
Department: Genetics and Biochemistry  
Mentor Email Address: msehorn@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/science/departments/genetics-biochemistry/people/profiles/msehorn  
Project Title: Investigating the impact of cancer mutations in DNA repair genes  

Project Description:
We are investigating a number of human DNA repair genes that are integral to the error free repair of damaged DNA. In many cancers, these DNA repair genes are often mutated. The effect of many of these mutations have on the normal functions of these DNA repair genes is not known. We will determine whether the mutations in these DNA repair genes have a detrimental effect on the activity of the DNA repair genes.

Student Involvement:
We start our students with a PCR project to introduce the cancer mutation into the normal gene to create a 'cancer mutant' version of the DNA repair gene. Once this is complete, the student will produce and purify the protein encoded by the 'cancer mutant' gene. After, the 'cancer mutant' protein has been purified, the student will determine whether the mutation has an effect by comparing the activity of the 'cancer mutant' to the activity of the normal version of the DNA repair protein. The lab is team oriented where people help each other out but each person has their own projects on which to work.

Expected Outcome:
We do not expect the student to have any lab skills. We will teach the student how to conduct the research experiments. The goal of our research program is to publish the results from our experiments in a peer-reviewed scientific journal. We have had several past EUREKA! participants earn authorship on published research articles.

Opportunities:
If the students enjoy the work that they performed during the EUREKA! program, then they would be invited and encouraged to continue to conduct research in the lab until they graduate from Clemson. This would give the student more than 4 years of research experience which is invaluable, especially if the student intends on applying to medical or graduate school.

Required Skills:
We do not expect the student to have any lab skills. We will teach the student how to conduct the research experiments.

Research Location: Life Sciences Facility - Clemson Campus  
Off-Campus Research Location: N
**Mentor:** Dr. Liangjiang (LJ) Wang  
**Department:** Genetics and Biochemistry  
**Mentor Email Address:** liangjw@clemson.edu  
**Project/Faculty URL:** http://www.clemson.edu/cafls/faculty_staff/profiles/liangjw  
**Project Title:** Prediction of Novel Autism Risk Genes from Genomic Data  

**Project Description:**
Autism spectrum disorders (ASD) are clinically and genetically heterogeneous, probably with 1,000 or more genes contributed to the susceptibility of ASD. Although many ASD risk genes have been identified, the molecular etiology of ASD is still poorly understood. Growing evidence suggests that transcriptional regulation of many genes during early cortical development is critical for ASD manifestation. This project investigates the potential involvement of two new classes of non-coding RNAs (ncRNAs) in ASD. First, long non-coding RNAs (lncRNAs) constitute a large portion of the human brain transcriptome. Recent studies indicate that lncRNAs play key roles in gene regulation, development and disease. Although multiple lines of evidence suggest that lncRNAs are involved in neurodevelopmental disorders, their role in ASD is still unclear. Second, circular RNAs (circRNAs), formed by head-to-tail splicing of exons, are a large new class of ncRNAs expressed by the human genome. Recent studies suggest that circRNAs can regulate gene expression, and appear to be enriched in the brain. However, it is still unknown whether circRNAs are involved in ASD.

We have developed a machine learning model for ASD risk gene prediction based on developmental brain gene expression profiles (Cogill and Wang, 2016. Bioinformatics, 32:3611-3618). We have also generated a large RNA-seq dataset to investigate the expression changes of lncRNAs and circRNAs in ASD patients. Lymphoblastoid cell lines from representative ASD patients and normal subjects were used to prepare the RNA samples. In this project, both the machine learning model and RNA-seq dataset will be used to predict and prioritize novel candidate lncRNAs and circRNAs associated with ASD.

We will also utilize the publicly available genetic and genomic data to further evaluate the candidates. The high-priority candidates identified in this work can not only provide new insight into the role of ncRNAs in ASD pathogenesis, but may also be further developed as ASD biomarkers.

**Student Involvement:**
Research interns will be directly involved in the project. Each intern student, under the supervision of a graduate student, will conduct RNA-seq data analysis to identify differentially expressed genes in ASD patient samples, and to apply a machine learning model for ASD risk gene prediction and prioritization. They will also contribute to the further evaluation and curation of novel candidate lncRNAs and circRNAs associated with ASD.

**Expected Outcome:**
Research interns are expected to have good computer skills and understand the basic concepts of genetics. Experience with computer programming and basic understanding of machine learning are preferred, but not required. The project will generate a prioritized list of candidate non-coding RNAs associated with autism. The findings can be used for presentations and journal publications. The intern students will also learn large-scale genomic data analysis and use of machine learning models in biomedical research.

**Opportunities:**
The data analysis skills learned through this project can be useful for future careers in bioinformatics, genomics, human genetics, and precision medicine.

**Required Skills:**
Research interns are expected to have good computer skills and understand the basic concepts of genetics. Experience with computer programming and basic understanding of machine learning are preferred, but not required.

**Research Location:** Life Sciences Facility - Clemson Campus  
**Off-Campus Research Location:** N
Mentor: Dr. Eric Touya  Department: Languages
Mentor Email Address: etouya@clemson.edu
Project/Faculty URL: https://www.clemson.edu/caah/departments/languages/about-contact/faculty-and-staff/facultyBio.html?id=589
Project Title: Macron's Presidency and France's contradictions

Project Description:
I explore Macron's presidency in light of the recent protests taking place in France. Beyond the traditional oppositions (left/right) that have occurred in the French political discourse, at least since WWII, I examine how the recent social movements can no longer be solely explained through the traditional/historical left/right discourse. The aim of my current research is to explain the causes of this significant transformation. Beyond this, are the protests only a French story or do they also reveal something about the current state of the European Union and globalization?

Student Involvement:
The student will be involved in retrieving and reading through material on the subject. S/he will also partake in exploring and discussing with me the themes and critical questions that emerge from the research and writing of the project.

Expected Outcome:
The student should have a strong interest in French or European politics and its relation to the world beyond. The expected outcome of the program is the publication of a book on Macron's presidency, its challenges, and possible ramifications for France, Europe, and internationally. The intern will be informed of the objectives of the research and participate in the elaboration of the project.

Opportunities:
Following her/his projects, the intern will be able to present her/his work at a conference, or possibly publish a book chapter on the subject.

Required Skills:
The student should have a strong interest in French or European politics and its relation to the world beyond.

Research Location: Strode Tower - Clemson Campus  Off-Campus Research Location: N
Mentor: Dr. Kai He  Department: Materials Science and Engineering
Mentor Email Address: kaihe@clemson.edu  Project/Faculty URL: https://cecas.clemson.edu/helab/
Project Title: Nanomaterials for Sustainable Energy Technologies

Project Description:
Sustainable energy is being significantly promoted to meet today's society and technology demand without causing harm to the environment. As such, renewable and clean energy sources have attracted great attention in scientific research. To realize the efficient use of sustainable energy, we need to convert energy from renewable sources into electricity and put it in storage for delivery to end users when and where needed, which requires high-performance catalysts and batteries. Our research aims to develop advanced nanomaterials with improved properties for applications in catalyst and rechargeable batteries. We will synthesize the relevant materials via chemical reactions, examine their structures by electron microscopy, then test and optimize the properties. The results obtained from these experiments will provide valuable information for fundamental understanding and also show applications to real-world engineering.

Student Involvement:
The research interns will work in a team in the PI's lab. The graduate students and post-doc researcher will be the mentors to advise the interns on the daily basis. The PI expects to meet the interns on a regular basis as needed. The research will be mostly performed at Advanced Materials Research Lab (AMRL) campus.

Expected Outcome:
The research interns are expected to understand fundamental physics and chemistry. Knowledge and experience on nanomaterials and electrochemistry is desirable. Computation skills are a plus. The expected outcomes include presentations on the research topics after the internship; and publication in scientific journals is also possible, depending on the quality of the data collected from the internship.

Opportunities:
The students may have continuing opportunities to conduct research projects in the PI's lab in future, based on mutual interest.

Required Skills:
The research interns are expected to understand fundamental physics and chemistry. Knowledge and experience on nanomaterials and electrochemistry is desirable. Computation skills are a plus.

Research Location: Advanced Materials Research Lab - Anderson Campus  Off-Campus Research Location: Y
**Mentor:** Dr. Olin Mefford  
**Department:** Materials Science and Engineering  
**Mentor Email Address:** mefford@clemson.edu  
**Project/Faculty URL:** https://www.meffordresearch.com/  
**Project Title:** Polymers and Particles for Magnetic Hyperthermia  

**Project Description:**
We are currently developing a therapeutic technique for the treatment of bacterial infections and cancer. This technique is based upon the introduction of magnetic nanoparticles to diseased tissue. These particles are then irradiated with an alternating magnetic field causing the particles to heat. This applied heat will damage the surrounding tissue and promote cell death. The student involved in this project will be synthesizing magnetic nanoparticles and polymers for use in this application.

**Student Involvement:**
Our laboratory works on a team effort approach. The students involved in this project will be integrated into existing work. For example, the student will be trained on the proper synthesis and characterization of nanoparticles, and the measurement of their heating efficiency. Following training the participants will be given a unique challenge within the project for them to solve. In the past this has been developing new techniques for non-destructive characterization of materials, testing frequency response to temperature, and measuring the effects of viscosity.

**Expected Outcome:**
A successful student will have a strong background in chemistry (such as AP or IB chemistry) and an eagerness to learn. In addition, the student must be willing to work individually as well as in a team. Good communication skills (both speaking and writing) are also important. The results of this summer will be included in several developing publications focused on the dimensionality of materials and their respective heating rates. This new information will also be presented at several national and international meetings.

**Opportunities:**
Based on performance, students will be given the opportunity to continue on their projects during the school year for either credit or salary. Previous participants have used their EUREKA! experience in our labs as a springboard toward other REU programs.

**Required Skills:**
A successful student will have a strong background in chemistry (such as AP or IB chemistry) and an eagerness to learn. In addition, the student must be willing to work individually as well as in a team. Good communication skills (both speaking and writing) are also important.

**Research Location:** Advanced Materials Research Lab - Anderson Campus  
**Off-Campus Research Location:** Y
**Mentor:** Dr. Konstantin Kornev  
**Department:** Materials Science & Engineering  
**Mentor Email Address:** KKORNEV@clemson.edu  
**Project/Faculty URL:** https://www.clemson.edu/cecas/departments/mse/people/faculty/kornev.html

**Project Title:** Butterfly proboscis as a superior microfluidic device

**Project Description:**

The success of fluid-feeding insects on our "buggy planet" is unprecedented; more than half of all known insects on Earth - more than 500,000 species - are fluid feeders. Over a span of about 300 million years, insects that feed on fluids have developed a unique feeding device called a "proboscis." Fluid-feeding insects, such as flies, moths, butterflies, and mosquitoes, have proboscises for reaching into flowers and piercing plant or animal tissue. Amazingly, the proboscis length might be 10 times longer than the size of the body for some insects. Thus, understanding of mechanisms of fluid uptake and its transportation through the proboscis is a great challenge for evolutionary biologists. In the current project, we question the classical oversimplified model of the proboscis as a drinking straw, which is shown to overestimate sucking pressure developed by the insect. We use the biomechanics approach to attack this problem and propose a self-consistent explanation of this phenomenon.

https://www.youtube.com/watch?v=QHDbdKj8NuM  
https://infinitespider.com/butterfly-proboscis-straw-sponge/

**Student Involvement:**

This project aims to use a MatLab computational model that has been developed in the lab to analyze the existing experimental data. The model validation is a crucial step in the research. The student will be trained in the image analysis of real proboscises and use these data to feed the model and collect the results. The student will be involved in microfluidic experiments supervised by the professor and graduate and postdoctoral research fellows.

**Expected Outcome:**

The project does not require any specialized techniques. The student would have an opportunity to learn everything in the lab. Some familiarity with computers would benefit the project. The student will learn MatLab and will be introduced to the image analysis and microscopy. If time allows the project assumes conduction of microfluidic experiments on live butterflies to populate the available data for the model.

**Opportunities:**

There is a great possibility to co-author a paper. Introduction to microscopy and image analysis open great opportunities for further research on campus and STEM education.

**Required Skills:**

The project does not require any specialized techniques. The student would have an opportunity to learn everything in the lab. Some familiarity with computers would benefit the project.

**Research Location:** Sirrine Hall - Clemson Campus  
**Off-Campus Research Location:** N
Mentor: Dr. Kelly Smith
Department: Philosophy & Religion
Mentor Email Address: kcs@clemson.edu
Project/Faculty URL: https://www.clemson.edu/caah/departments/philosophy-religion/people/facultyBio.html?id=542
Project Title: What is Life?
Project Description:
Since biology is defined as the study of life, you would think that the nature of life is long-settled, but you would be wrong. Since Aristotle, we've just made lists of characteristics shared by life on Earth, but it's an open question whether this has anything to do life in general. This is a problem that combines science and philosophy, since it's both a highly theoretical question about concepts and an extremely pragmatic question of major concern to practicing scientists. How can we look for life on other worlds or declare we have created it in the lab - both ongoing projects on the cutting edge of science - if we literally don't know what we are talking about?
Dr. Smith is an internationally recognized expert in astrobiology (the search for life on other planets). Trained both in biology and philosophy, he has consulted with NASA, the European Space Agency, the American Association for the Advancement of Science, and the National Academies of Science and Medicine on this and related issues.

Student Involvement:
This is not a traditional "laboratory project," which has distinct advantages and disadvantages. On the one hand, students will be much freer in how they use their time during the week, since they are not required to report to a lab 8 hours each day. On the other hand, this means they must be sufficiently organized and self-motivated to carry out research on their own, without constant supervision. Despite this, students in this project will actually spend more 1:1 time with their research supervisor than in many laboratory projects, where the majority of interaction is with graduate students. The research in question is highly interdisciplinary and will first involve mastering complex concepts from biochemistry, evolutionary biology, physics, complexity theory, and philosophy of science, among others. At least once a week, and typically twice, students will be given specific tasks (e.g., literature surveys, reading and writing tasks) to complete on their own, interspersed with regular meetings where Dr. Smith will assess their progress and make new assignments. Once this is complete, students will switch over to thinking about how they would approach the problem - given the options on the table, which notion of life should be adopted in what situations and why? The ultimate work product will be a paper surveying the current state of research and arguing for a specific position in the ongoing debate. In the past, students with high quality work have gone on to present and even publish their ideas.

Expected Outcome:
The ideal student is someone who is:
1) Interested in "big questions" that draw on empirical research but also go beyond it in important ways.
2) Organized and self-motivated - someone who can be relied upon to do assignments in a timely and careful manner rather than procrastinating.

Students will learn:
1) The latest research in a number of fields that bear on this problem, including synthetic biology, origins of life research, and NASA's search for life on other planets.
2) How to think through a complex scientific debate where empirical data is relevant but not yet sufficient to decide matters.
3) How to write a tightly argued paper articulating and defending their position.

Opportunities:
If a student does an excellent job and is interested in pursuing the work beyond EUREKA!, Dr. Smith will work with them to see that they have an opportunity to present their work at an academic conference and perhaps even publish it.

Required Skills:
The ideal student is someone who is:
1) Interested in "big questions" that draw on empirical research but also go beyond it in important ways.
2) Organized and self-motivated - someone who can be relied upon to do assignments in a timely and careful manner rather than procrastinating.

Research Location: Hardin Hall - Clemson Campus or Downtown Clemson
Off-Campus Research Location: N
Mentor: Dr. Ziliang Zhang
Department: Plant & Environmental Sciences
Mentor Email Address: zilianz@clemson.edu
Project/Faculty URL: https://www.clemson.edu/cafls/mual/index.html
Project Title: Dissolved organic matter characteristics of condensed tannin decomposition under priming effects
Project Description:
The program is about the dissolved organic matter characteristics of condensed tannin decomposition under priming effects. As we know, SOM is chemically diversified, including both labile and recalcitrant fractions. Previous studies mainly focused on the priming of the entire SOM, but the priming and turnover of specific SOM components remains unknown, which could be helpful in better understanding the SOM turnover and stabilization. Tannins are estimated to be the fourth most abundant substance produced by vascular plants. Tannin inputs from litter into soils are significant and may substantially influence interactions between plants, microbes and microbial processes. They are resistant to being decomposed by most microbes, especially the condensed tannins. They could also easily precipitate proteins to form another recalcitrant compounds----tannin-protein complex.

So, I have three questions for this project. First, how do priming effects induced by labile C inputs influence the decomposition rates of condensed tannin when combined into complexes or not? Second, how is the magnitude and direction of priming effects on condensed tannin decomposition influenced by different soil community composition? Third, do priming effects impact the trajectory of decomposition of condensed tannin and CT-protein complexes?

Student Involvement:
In this project, the students will work as a group, supervised by me. I will introduce them what priming effect is, how to determine priming effect and other related background information. Then, they will be involved in the real experiment including how to determine condensed tannin content by using acid butanol assay, how to detect soil respiration, how to detect enzyme activities and microbial community composition, and how to analyze chemistry of dissolved organic matters. After the experiment, they will also learn how to analyze the data and present the results.

Expected Outcome:
The students should know basic chemical techniques, such as weighing and preparing chemical solutions. Of course, laboratory safety training is prerequisite. One publication will be produced in this program. The students will know how to perform related experiments, how to analyze data using SPSS or R, and how to correctly present the results.

Opportunities:
Students will have the opportunity to expand their knowledge in the area of plant and environmental sciences.

Required Skills:
The students should know basic chemical techniques, such as weighing and preparing chemical solutions. Of course, laboratory safety training is prerequisite.

Research Location: Bisosytems Research Complex - Clemson Campus
Off-Campus Research Location: N
Mentor: Dr. Juan Carlos Melgar  
Department: Plant and Environmental Sciences  
Mentor Email Address: jmelgar@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/cafls/faculty_staff/profiles/jmelgar

Project Title: Optimizing irrigation practices for maximizing fruit size and improving water, soil and nutrient conservation in peach orchards in South Carolina

Project Description:
Irrigation is essential in fruit production, especially during the last three weeks before fruit harvest. Current tools for scheduling irrigation include soil-based and tree-based sensors that monitor and provide data on soil water availability and tree water use. With these tools, our goal is to improve irrigation practices for increasing high-quality fruit production while conserving our natural resources (soil, water). This project proposes 1) to quantify tree water needs and water use during the fruit growing season to optimize irrigation practices for maximizing fruit size; 2) to determine soil structural changes caused by different irrigation systems; and 3) to measure nutrient leaching (specifically nitrates and potassium) below the root zone. The intern will learn concepts that are at the intersection of plant physiology, soil sciences and crop management.

Student Involvement:
The research intern will work with the faculty mentor and with other faculty and graduate students, in monitoring soil and tree water status. Some examples of measurements to be taken include soil matric potential, leaf/stem water potential, leaf transpiration and leaf water use efficiency. We will also characterize daily and hourly water needs and fruit water usage during all fruit growth stages, study the effect of irrigation time on cell turgidity and fruit growth, and collect soil samples for soil fertility and physicochemical characteristics so that we can understand the impact of two irrigation systems on soil nutrient leaching.

Expected Outcome:
Basic plant biology understanding and some experience with Excel for data management would be desirable. During the EUREKA! program, the student will learn how to use the equipment that we will use in this project or download data from data loggers. The most important skill will actually be to enjoy working outdoors: I estimate the student will spend at least half of the mornings in the field (our routine is normally to do the field work in the morning to avoid the heat during the central hours of the day, and then lab work or result/data management in the afternoons). Even though there won't be heavy physical labor (no lifting, bending, etc.), we're in SC and it gets warm in the field even in the morning. Field experiments will be located in off-campus sites (a university farm and a commercial orchard). Nevertheless, the intern doesn't need to drive; we will travel to these locations in a state vehicle and the faculty mentor or one of his graduate students with permission to drive the state vehicle will always drive. These data are very important for growers, extension agents, and other researchers in the region and in the nation. Thus, results are expected to be presented at a conference. Also, upon collection of at least one more year, data are expected to be published in a scientific journal (probably two articles). The student will be invited to participate in these dissemination efforts, as described below.

Opportunities:
The student will be given the opportunity of presenting at a regional conference in Fall 2019 (either the SC Water Resources Conference or the Southeastern Professional Fruit Workers Conference, based on student availability). Furthermore, if the intern contributes in a meaningful and substantive way to the intellectual content of the article (e.g. data acquisition and analysis, participation in writing of the manuscript, etc.), the intern will be given the opportunity of being one of the authors of the publication(s).

Required Skills:
Basic plant biology understanding and some experience with Excel for data management would be desirable. During the EUREKA! program, the student will learn how to use the equipment that we will use in this project or download data from data loggers. The most important skill will actually be to enjoy working outdoors: I estimate the student will spend at least half of the mornings in the field (our routine is normally to do the field work in the morning to avoid the heat during the central hours of the day, and then lab work or result/data management in the afternoons). Even though there won't be heavy physical labor (no lifting, bending, etc.), we're in SC and it gets warm in the field even in the morning. Field experiments will be located in off-campus sites (a university farm and a commercial orchard). Nevertheless, the intern doesn't need to drive; we will travel to these locations in a state vehicle and the faculty mentor or one of his graduate students with permission to drive the state vehicle will always drive.

Research Location: Biosystems Research Complex - Clemson Campus  
Off-Campus Research Location: N
Mentor: Dr. Sruthi Narayanan  
Department: Plant and Environmental Sciences  
Mentor Email Address: skutty@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/cafls/departments/plant-environmental-sciences/index.html  
Project Title: Climate resilient crops for food security  
Project Description:  
Climate models predict continued warming and increased frequency, duration, and intensity of droughts across the southeast U.S. In South Carolina, 35 counties were declared as primary disaster areas due to drought by the U.S. Department of Agriculture in 2015. Our research focuses on understanding crop response and adaptation to changing environmental conditions (water and temperature) in order to develop climate resilient crop varieties. In this summer, we will be evaluating soybean, peanut, and cotton varieties for their performance under drought and heat stress conditions. We will also evaluate the effect of cover crops (crops that provide a ground cover and improve soil organic matter content) on conserving soil water and improving soil health.

Student Involvement:  
The research interns will work with the graduate students and take part in the on-going research projects. The interns will work with the graduate students in designing the field lay out for a peanut and soybean trials, planting, maintaining the field studies by various operations including irrigation and pest control and conducting a controlled environmental experiment on cotton root architecture and water use efficiency. The interns will assist in collecting data on important plant physiological traits including photosynthesis using sophisticated equipment and latest technology, monitoring in-situ root growth and development using cameras installed in the field, and measuring soil water content using neutron probes. Since the peanut plants will be grown under large structures called ‘heat tents’ (imposes heat stress to the peanut plants), the interns will get a unique opportunity to experience growing crops under controlled environmental conditions. The interns will also work with the graduate students to maintain a cover crop field research, collect data on soil water content and soil health, harvest cover crop biomass, and process them in the laboratory. The intern will get an opportunity to work as part of a team, experience how actual crop science research projects are designed and maintained, and how research data are collected. The projects will continue even after the summer; there is a possibility for the interns to continue working on the same projects in the Fall semester as well.

The interns will have fun going out to the field (Pendleton, SC; 15 minute drive from campus) and work on a plant project out in the field in nice summer weather with other students.

Expected Outcome:  
Students should have a passion for plant science, ability to work as a team, and interest to work in the field and grow crops. The student will learn research methods common to any crop science research program. This will prepare them for future undergraduate research and graduate school. If the student continues to work on the research project in the Fall, he/she might get an opportunity to present their research in the Crop Science Society of America annual meeting. Depending upon the contributions, the student will get a co-authorship in the publication.

Opportunities:  
They will get an opportunity to continue research in our lab (depending upon their performance in the summer). In the long run, there is a potential opportunity for a graduate research assistantship, if the student demonstrates potential for a researcher.

Required Skills:  
Students should have a passion for plant science, ability to work as a team, and interest to work in the field and grow crops.

Research Location: Biosystems Research Complex - Clemson Campus  
Off-Campus Research Location: N
Mentor: Dr. Irene Pericot-Valverde  
Department: School of Health Research  
Mentor Email Address: iperico@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/health-research/  
Project Title: Addition Research Training  

Project Description:
Students will be able to get involved in three different research projects.

Project 1
Title: The PREVAIL Study: Intensive Models of HCV Care for Injection Drug Users.
Description: This study is a randomized controlled trial aimed at determining the effectiveness of three models of care for HCV treatment in individuals who inject drugs.

Project 2
Title: Characteristics and correlates of cancer among the US population
Description: This is an epidemiological study aimed at exploring the American public’s knowledge of, attitudes toward, and use of cancer- and health-related information.

Project 3:
Title: Feasibility, acceptability, and preliminary efficacy of a cognitive behavioral therapy for opioid use disorder.
Description: This is a pilot clinical trial aimed at exploring the efficacy of a cognitive behavioral intervention for opioid use disorder.

Student Involvement:
Activities during the internship will focus on providing enough research training to prepare students for careers in addiction research. Learning materials will be provided prior to the internship participation to introduce students to the activities and topics addressed, maximize their learning experience, and facilitate an active participation. Follow-up materials will also be provided to the students at the end of the internship. Students will also be asked to complete a brief survey rating the quality of the training. Interns will be involved in a wide variety of tasks in each of the three projects. In projects 1 and 2, interns will learn to conduct secondary data analyses using SPSS. Each interns’ experience will be individualized to his/her interests and experience.

In project 2, interns will realize various recruiting tasks, conduct screenings of potential participants, shadow intake sessions, and data entry. Based on prior experience in clinical psychology, interns may also shadow clinical sessions. Each student will be assigned to specific tasks. These assignments will be carefully considered based on the student's interest and prior experience. In addition to daily research activities, students also participate in:- Regular meetings with their mentor (weekly)- Seminars on scientific and professional development (every other week)- Journal club sessions (weekly)- Oral and poster presentations - Small research group meetings/activities (weekly)- Research training events  

At the end of the program, interns will be requested to complete: 1) An IRB submission 2) A poster 3) A paper

Expected Outcome:
Students are required to possess knowledge of basic statistics, be an incoming freshman or currently enrolled undergraduate, and be able to participate for the entire EUREKA! program. The overall goal of our application is to help undergraduate students to develop the knowledge, attitudes, and skills to become life-long, self-directed clinical researchers.

After finishing the program, interns will have experience on:
- Conducting literature searches
- Submitting an IRB protocol
- Analyzing data using statistical packages
- Writing an abstract and a poster
- Writing a scientific paper
Opportunities:
Interns would participate in a unique, intensive, and highly interactive summer research internship in a multidisciplinary team with extensive clinical and research experience. This internship will provide the opportunity to gain direct research experience under the mentorship of faculty who are actively involved in addiction research. Secondly, interns will have exposure to a wide range of translational and clinical research activities. Finally, interns will be offered to continue collaborating with the research group if it fits in their interests.

Required Skills:
Students are required to possess knowledge of basic statistics, be an incoming freshman or currently enrolled undergraduate, and be able to participate for the entire EUREKA! program.

Research Location: Clemson Nursing Building & Greenville Memorial Hospital (both in Greenville)  Off-Campus Research Location: Y
Mentor: Dr. Daphne Wiles  
Department: Teaching and Learning  
Mentor Email Address: daphnew@clemson.edu  
Project/Faculty URL: https://www.clemson.edu/graduate/academics/program-details.html?m_id=Teaching-Learning  
Project Title: The Incidence of Perfectionism in Clemson Honors College Students  
Project Description:

The purpose of this study is to gain a deeper understanding of the levels of perfectionism in Clemson Honors College students. We would gain this understanding by administering a perfectionism scale to Clemson Honors College students. The Hewitt-Flett Multidimensional Perfectionism Scale will be administered in the spring of 2019 via Qualtrics. The survey has 45 items and each item is measured on a seven-point scale that ranges from Disagree to Agree. It measures Self Oriented Perfectionism, Other Oriented Perfectionism, and Socially Prescribed Perfectionism. High Self Oriented Perfectionism scores are generally associated with high productivity, motivation, and success in career. High Other Oriented Perfectionism scores are generally associated with having unrealistically high expectations of others. Socially Prescribed Perfectionism scores are generally associated with external pressure to be perfect and have been associated with anxiety and depression. The survey will be emailed to current Honors College students and their participation is voluntary. The research questions are:

1. Are there differences in levels of perfectionism (i.e., Self Oriented, Other Oriented, Socially Prescribed) between upper and lower classmen in the Honors College at Clemson?
2. Are there differences in levels of perfectionism between male and female Honors College students at Clemson?
3. Are there differences in levels of perfectionism between Honors College students who have been identified as gifted/talented (during their K-12 education) and those who were not identified?

Research indicates that gifted and high-achieving students often have perfectionistic traits, so it seems responsible to investigate the prevalence in our own Honors College population, since these are high-achieving students. If results indicate that there is a high incidence of perfectionism in our Honors College students, future research could include ways to provide appropriate support and resources for the Clemson Honors College students.

Student Involvement:

We will analyze the survey responses together. We will examine the data to see if there are differences between male and female students, if there are differences between upper and lower classmen, and if there are differences between students who were identified as gifted during their K-12 education and those who were not identified. Together, we will write about our results, compare our results to other similar studies that are in the literature, and prepare a research poster for presentation. If appropriate, we will prepare a proposal for a conference or possibly a journal article.

Expected Outcome:

Basic research skills (e.g., how to locate scholarly resources, how to determine if a source is credible, how to paraphrase and synthesize information in a source), basic writing skills, and basic word processing skills are required. We will work together to help the intern(s) prepare their research. If appropriate, we can also submit a conference proposal and/or a journal article. All work and authorship will be shared.

Opportunities:

If the results of the initial study are interesting and lead to further research questions, I am open to continuing work with the intern(s) in a larger research capacity.

Required Skills:

Basic research skills (e.g., how to locate scholarly resources, how to determine if a source is credible, how to paraphrase and synthesize information in a source), basic writing skills, and basic word processing skills are required.

Research Location: Tillman Hall - Clemson Campus  
Off-Campus Research Location: N
Mentor: Ms. Brenda Burk  
Department: University Libraries
Mentor Email Address: bburk@clemson.edu  
Project/Faculty URL: http://library.clemson.edu/depts/specialcollections/
Project Title: Understanding Archives and Archival Research Project

Project Description:
The successful intern will work with the Clemson University Libraries' Special Collections and Archives on gaining an understanding about research methods in the humanities and understanding archival processes. The intern will learn about the archival basics of appraising, organizing, and creating access to materials in the Archives. The archival collection chosen for the intern will be based on their research interest ranging from architecture, agriculture, military and politics to name just a few research areas.

Student Involvement:
The intern(s) will learn the basic skills of an archivist by working with a collection in the Archives. It will involve researching the individual or organization to gain an understanding about their importance. For creating access to the collection, the intern will learn appraisal skills based on some established criteria, preservation methods, including digitization, utilized on items in danger of deterioration and loss of information, writing skills in the creation of a guide describing the contents of the collection to enable access and discovery. Besides the guide, the intern will create an online exhibit about the collection to help researchers understand the collection and the importance of the individual or organization.

Expected Outcome:
The student should have an understanding of basic research methodology, interest in history particularly of South Carolina and/or the United States, attention to detail, strong writing skills, knowledge of Microsoft Office Suite or comparable tools. The expected outcomes will be a completely organized collection that results in a written guide to the collection available on the Archives' website and an online exhibit. The intern will also be invited to present on their learning experience during an Archives event open to the campus and local communities.

Opportunities:
The intern will gain a proficiency in researching with primary and secondary resources that can carry over into any aspect of their education and career. They will enhance their skills of describing their thought process, opinions, and interpretation of sources. While the successful intern will be able to continue their archival work in any archives, library, or museum, it is not limited to those institutions. The analytical skills developed during the internship can be applied in any field of study they pursue.

Required Skills:
The student should have an understanding of basic research methodology, interest in history particularly of South Carolina and/or the United States, attention to detail, strong writing skills, knowledge of Microsoft Office Suite or comparable tools.

Research Location: Strom Thurmond Institute Building - Clemson Campus  
Off-Campus Research Location: N