## 2021 EUREKA! Faculty Research Proposals

The following list details projects available for the 2021 EUREKA! Program. Project details are available in the pages following this list. All students participating in the program are required to have a computer with a camera and microphone as well as a strong internet connection, access to Zoom and Microsoft Teams, and the additional equipment listed for their project.

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**Project Title:** The Effects of Climate Change on Water Demand in South Carolina  
**Mentor:** Dr. Mani Rouhi Rad, Assistant Professor  
**Department:** Agricultural Sciences  
**Project/Faculty URL:** https://www.clemson.edu/cafls/faculty_staff/profiles/rrad

**Project Description:**
Water resources have not been historically scarce in South Carolina. However, going forward, increasing demand and a changing climate can shift this balance. Changes in climatic conditions can affect human well-being and economic activity. One way to adapt to these changes has been to increase water use. For example, agricultural irrigation can reduce the effect of drier conditions on crop yields. In order to understand the magnitude of the effect that climate change may have on water use in the future, we can study the historical effects of changes in temperature and precipitation on water demand. In this project, using the existing data, we study how year-to-year changes in temperature and precipitation have affected water use across South Carolina within different sectors.

**Student Involvement:**
The selected intern(s) will perform 1) data gathering including climate data from different online sources 2) data cleaning by merging the climate data with water use data using R and 3) running simple regressions to estimate the effects of temperature and precipitation on water demand.

**Opportunities:**
Students will have the opportunity to continue research within the group after the EUREKA! program.

**Required Skills:**
Some experience with R is required (could include data cleaning, running regressions), a basic understanding of statistics/econometrics including regressions as well as spatial analysis skills are required.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Creativity with Toys  
**Mentor:** Dr. Michael Kleiss, Associate Professor  
**Department:** Architecture  
**Project/Faculty URL:** [https://www.clemson.edu/caah/departments/pdbe/people/facultyBio.html?id=1793](https://www.clemson.edu/caah/departments/pdbe/people/facultyBio.html?id=1793)

**Project Description:**
This project aims to research the role of toys in the creative process, teamwork and collaborative efforts. Based on the faculty mentor's previous work, this project aims to explore specific aspects of the relation between types of toys and the creative process.

**Student Involvement:**
We will work in teams with individual tasks. During sessions each individual will report on their findings from specific tasks and share from own experiences.

**Opportunities:**
Students will have the opportunity to continue working with the faculty mentor or other faculty in the Honors College or continue work in a Creative Inquiry project.

**Required Skills:**
Students should have the ability to follow directions, complete tasks, act independently, and think outside the box as well as an ability to collect information and write summaries.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Mapping Visual Stimulus Complexity & Spatial Navigation: Factors that Change with Age  

**Mentor:** Dr. Winifred Newman, Mickel Professor  

**Department:** Architecture  

**Project/Faculty URL:** [https://www.clemson.edu/caah/departments/architecture/people/faculty-and-staff/facultyBio.html?id=2206](https://www.clemson.edu/caah/departments/architecture/people/faculty-and-staff/facultyBio.html?id=2206)

**Project Description:**  
Age-related changes to mobility are a significant factor in longevity and quality of life in older adults. Mobility is directly related to changes in spatial navigation impacted by stimulus complexity in the immediate environment. It is critical to identify changes in spatial navigation due to decline in sensory perception. This study proposes a novel way to assess changes in space navigation based on stimulus complexity and age. It is expected that modeling mobility behavior based on age and stimulus complexity will help us predict a "mobility" age and address potential fall hazards more effectively.

**Student Involvement:**  
Students will participate in organizing files and testing journals for an experiment. They will also be gathering relevant articles and background data for similar experiments.

**Opportunities:**  
This project will provide students with exposure to design of experiments and literature review.

**Required Skills:**  
Students should be familiar with Adobe Suite and have a willingness to learn new software.

**Additional Special Knowledge or Equipment Required:** N/A
Project Title: Assistive Technologies and Mobility Aids for At-Risk Populations
Mentor: Dr. Bing Li, Assistant Professor
Department: Automotive Engineering
Project/Faculty URL: http://cecas.clemson.edu/bingli

Project Description:
More and more new robotics and AI technologies have shown the potential of improving the life quality of at-risk populations. However, how to efficiently deploy affordable solutions to enable greater levels of independence for the users remain a challenge and gap. For example, advanced computer vision and AI technologies could significantly help the blind and visually impaired individuals to perceive the world; the robotics technologies could improve independent travel for individuals with mobility impairment. The goal of this research is to explore and deploy assistive technologies to augment the sensing, actuation, or mobility capabilities of at-risk populations. The involved technologies include sensing, robotics, computer vision, and artificial intelligence (AI).

Student Involvement:
The research interns will have weekly meetings with me through Zoom online to address concerns, questions, and progress in the research topic. Each research intern will be assigned a Ph.D. student as the mentor who will be available for extra meetings. A research and engineering goal will be identified for each of them. Hardware and software recourses will be purchased as supplies to support the research topics. They will deploy hardware and software technologies for the research goal, and present final achievement in the form of presentation or report. They will work individually for his/her own goal but as part of a team for the whole project.

Opportunities:
- The students can practice their presentation skills, and learn how a scientific research group works for research merit and broader impact;
- The students can learn new skills in sensing, robotics, computer vision, and AI. They can apply what they learned from this internship in any of their future projects and even for a great societal impact;
- The students can potentially publish their research progress and results. (A local high-school junior student, as a current intern in my group, has published a conference paper);
- Local students could get the opportunity to continue research in my group after the internship period.
Required Skills:
- Basic skills of programming experience (e.g. Python, Java, Matlab or equivalent) if the intern works on software aspect;
- Basic skills of mechatronics or electronics hands-on experience if the intern works on hardware aspect

Additional Special Knowledge or Equipment Required: N/A
**Project Title:** Mitochondrial Genomics  
**Mentor:** Dr. J. Antonio Baeza, Associate Professor  
**Department:** Biological Sciences  
**Project/Faculty URL:** [https://baezaantonio.wixsite.com/clemsonmitogenomics](https://baezaantonio.wixsite.com/clemsonmitogenomics)

**Project Description:**
In short, in this project, we will learn about mitochondrial genomes; assembly, annotation, detailed analyses of all its features (protein coding, ribosomal, transfer RNA genes, etc.). Mitochondria are organelles of utmost importance in 99.999% of unicellular and multi-cellular organisms. Perhaps more importantly, I will expose you to the scientific method and you will learn to think critically. We will be using various mitochondrial genomes as examples to improve your critical thinking skills. You will also improve your information literacy skills.

**Student Involvement:**
This project has three general topics: (1) structure. What is the length and main structural characteristics of animal mitochondria?, How many genes and other elements the mitochondrion genomes code for? What genes are there? (2) Function. What is the identity and function of all genes encoded by the mitogenome? (3) Evolution, including the exploration of selective pressures in protein coding genes present in animal mitochondrial genomes. In this project, we will explore the structure, function, and evolution of the mitochondrial genome using a set of ‘friendly’ bioinformatics tools. This project is part of the Clemson Thinks2 (CT2) critical thinking experiment, a program aimed at improving student critical thinking skills. Simple memorization of facts and repetition of definitions is not a sufficient skill set to address the complex problems our world faces today! As a Clemson undergraduate, we expect you to develop the ability to think critically and to evaluate how knowledge is constructed and the assumptions underlying such knowledge.

Student learning outcomes are listed below.
* Understand and analyze the structure of animal mitochondrial genomes.
* Understand structural and functional annotation of mitochondrial features.
* Visualization of protein coding genes, tRNAs, and rDNA.
* Explore and learn online genomic tools.
* Understand and estimate selective pressures in protein coding genes.
* Infer systematic relationships using protein coding genes present in mt genomes.
* Interpret quantitative relationships in manuscript graphs and tables.
* Explain the limitations of correlational data published in scientific papers.
* Analyze data to identify and summarize problems as part of the scientific method.
* Integrate information/data to solve a problem as part of the scientific method.
* Develop and justify one or more than one hypotheses.
* Identify the limitations of one or more than one hypotheses.
* Identify alternative interpretations of the data or observations.
* Evaluate competing interpretations, explanations, evidence, and conclusions.
* Effectively communicate complex ideas.

**Opportunities:**
After EUREKA!, students will develop a poster (artifact) as well as have the opportunity to present at a scientific meeting (artifact), manuscript development and publication (artifact), or video development (artifact).

**Required Skills:**
Students should have software experience: basics of working on a laptop, either mac or pc., specific mathematics knowledge, specific genetics/biology knowledge of genetics or biology, and participate in all activities and respect deadlines.

**Additional Special Knowledge or Equipment Required:** N/A
Project Title: Invasive Ants  
Mentor: Dr. Sharon Bewick, Assistant Professor  
Department: Biological Sciences  
Project/Faculty URL: [https://bewicklab.weebly.com/](https://bewicklab.weebly.com/)

**Project Description:**
Fire ants? Needle ants? Argentine ants? What do all of these ant species have in common? They're all invasive. None of them are supposed to be here... but they are! Some are annoying when we're trying to have a picnic or play baseball (that's you, fire ants). Others threaten to destroy native ant communities (needle ants, for example). We'll be looking at the prevalence of invasive ant species in the Southeast. Depending on where the student is located, they may sample for invasive ants in their own backyard. Alternately, if they are located close to Clemson, we may be able to share some of our samples from Great Smoky Mountains National Park, where we are looking at whether invasive ants are using the recent fires and other disturbed areas to gain access to the park.

**Student Involvement:**
Students will start out collecting ants from litter in their own backyard (or the park down the street). Students will use this experience to learn how to ID ants to genus, and how to recognize some of the most problematic invasive species. Once students have learned to ID invasive ants, and provided they are located nearby to Clemson University, they will be given samples of ants collected from leaf litter in Great Smoky Mountains National Park. Students will then get to sort through these samples, ID the ants in them, and help us look for invasives - both from disturbed areas and from areas with intact forest!

**Opportunities:**
Students who enjoy this work will be welcome to stay on and do research in the Bewick lab, where we do work on a lot of different insect species in the Southeast, particularly looking at ecology of insects and their associated microbes in Great Smoky Mountains National Park. If the pandemic ever ends, students that are part of the Bewick lab will get to do fieldwork in different forests in the Southeast.

**Required Skills:**
Students should have an interest in ant ecology, good fine motor skills, and a keen eye.

**Additional Special Knowledge or Equipment Required:** Microscopes and other equipment will be purchased by Dr. Bewick and mailed directly to students.
**Project Title:** Development of Novel Antibacterials  
**Mentor:** Dr. Dev Arya, Professor  
**Department:** Chemistry  
**Project/Faculty URL:** [http://www.clemson.edu/science/departments/chemistry/people/faculty/arya.html](http://www.clemson.edu/science/departments/chemistry/people/faculty/arya.html)

**Project Description:**  
Drug resistance to current antimicrobials is a major health concern in the 21st century. This project will focus on discovery of new target sites in the genome of pathogenic bacteria. The project will involve looking for new sites of intervention in the bacteria genome, and approaches of targeting nucleic acid and enzyme targets selective to bacteria.

**Student Involvement:**  
The interns will work with graduate students to:  
1. Read the literature to understand the existing antibacterial market and areas of concern  
2. Learn preliminary chemical and biochemical techniques for synthesis and testing of new drug candidates

**Opportunities:**  
After EUREKA!, there will be other opportunities for further lab research.

**Required Skills:**  
Students must have an ability to read scientific literature, ask questions, have a desire to learn, critique, question, and write analytical reports to summarize readings.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Understanding Lunar Regolith-Tool Interaction for In Situ Characterization of Lunar Regolith

**Mentor:** Dr. Qiushi Chen, Associate Professor

**Department:** Civil Engineering

**Project/Faculty URL:** [https://www.clemson.edu/cecas/departments/ce/people/faculty/chen.html](https://www.clemson.edu/cecas/departments/ce/people/faculty/chen.html)

**Project Description:**
NASA's Artemis program aims to land the first woman and next men on the Moon by 2024 while simultaneously working toward sustainable lunar exploration in the mid- to late 2020s. A key component of NASA's Lunar program is to develop efficient tools for automated drilling, sampling, and in situ resource characterization and utilization. This project aims to improve our understanding of interactions between exploration tools and Lunar regolith for the purpose of in situ characterization of Lunar regolith.

**Student Involvement:**
The research interns will work as a team and work closely with the faculty mentor and the graduate student. The interns will (1) gain an in-depth understanding of and be able to explain the scientific challenges facing NASA Moon exploration missions, as related to the in situ characterization of lunar regolith; (2) survey the state-of-the-art Lunar drilling tools and understand their fundamentals; (3) use provided computer simulation software to create a working lunar regolith-drilling tool model; (4) process and analyze computer data; (5) improve technical reading, oral, and written skills through literature survey, project presentation and report.

**Opportunities:**
There are two ways for students to get continuous involvement in this research: 1) through the faculty mentor's creative inquiry project (#1016 Martian and Lunar Soil Simulants - Characterizations and Feasibility as Building Blocks); 2) through the fellowship and paid internship opportunities offered annually by NASA SC Space consortium ([https://scspacegrant.cofc.edu/scholarships-and-fellowships](https://scspacegrant.cofc.edu/scholarships-and-fellowships)).
**Required Skills:**
Students should be familiar with Microsoft office suites, which will be used for research report and presentation, data processing, and visualization as well as be able to learn new computer simulation software.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Autonomous Fire Assessment Methods  
**Mentor:** Dr. M.Z. Naser, Assistant Professor  
**Department:** Civil Engineering  
**Project/Faculty URL:** [https://www.clemson.edu/cecas/departments/ce/people/faculty/naser.html](https://www.clemson.edu/cecas/departments/ce/people/faculty/naser.html)

**Project Description:**  
This project will use artificial intelligence to develop new methods that can autonomously evaluate structural members for fire hazard and fire effects.

**Student Involvement:**  
The research will include items on data collection and using AI algorithms to evaluate thermal and structural response of structures.

**Opportunities:**  
There is the possibility to continue researching in my group and being part of future publications.

**Required Skills:**  
Basic coding knowledge is needed (any programming language will be fine).

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Use of Technology in Classroom and Students' Performance  
**Mentor:** Dr. Miren Ivankovic, Visiting Professor  
**Department:** Economics  
**Project/Faculty URL:** [https://www.clemson.edu/business/about/profiles/mivanko](https://www.clemson.edu/business/about/profiles/mivanko)

**Project Description:**  
A study was conducted concerning two course sections of the same class, each with about 40 students. One class was allowed the use of laptops and cell phones. One class was allowed only paper and pen. Students outcomes (grades) were observed.

**Student Involvement:**  
A student would work with Dr. Ivankovic to review the data collected by engaging the student in statistical analysis, literature review, process of writing a research paper, etc.

**Opportunities:**  
The outcomes include expanding on this research as well as presenting at a conference, if possible.

**Required Skills:**  
Students should have a good knowledge of statistics, especially the test of 2 samples, ANOVA table, and regression analysis. Knowledge of Excel or Minitab would be sufficient. Students should also have critical and analytical thinking skills.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Hardware-Oriented AI Security  
**Mentor:** Dr. Yingjie Lao, Assistant Professor  
**Department:** Electrical and Computer Engineering  
**Project/Faculty URL:** http://ylao.people.clemson.edu/

**Project Description:**  
This group will conduct research on the vulnerability of artificial intelligence (AI) especially deep neural networks (DNNs) from the hardware aspect. Possible topics include weight perturbation for degrading adversarial robustness, backdoor attacks, watermarking, fault attacks, etc.

**Student Involvement:**  
The research intern will either work individually on a research project or work with a graduate student, depending on the background.

**Opportunities:**  
My CAREER project includes a budget for undergraduate research, so there is an opportunity to continue the project beyond this summer.

**Required Skills:**  
Basic programming skills are required. Understandings of machine learning, security, hardware, and knowledge of machine learning frameworks such as TensorFlow and Pytorch will be a plus.

**Additional Special Knowledge or Equipment Required:** N/A
Project Title: Academic Continuity in Aviation Technology Programs during COVID-19
Mentor: Dr. Eliza Gallagher, Assistant Professor
Department: Engineering and Science Education
Project/Faculty URL: http://tinyurl.com/eliza-gallagher

Project Description:
This project, funded by the National Science Foundation, is an exploration of how aviation technology programs at two-year colleges avoided, absorbed, or adapted to academic disruptions from March 2020 through now. We are currently collecting and analyzing interview data from faculty, students, and administrators nationwide. Over the summer we will be interpreting and contextualizing those results both for presentations and publications, and also developing a survey to be distributed nationwide.

Student Involvement:
Interns could be involved in any or all of: 1) developing survey items, 2) piloting the survey instrument, 3) analyzing results of the pilot administration, and 4) disseminating results. Interns will work collaboratively within a research team including graduate students, faculty members, a postdoctoral researcher, and potentially rising seniors at GSSM through the SPRI program.

Opportunities:
Students wishing to continue with the project during the 2021-2022 academic year will be able to enroll in a Creative Inquiry course for class credit.

Required Skills:
We will provide all necessary training in ethical human subjects research and qualitative or quantitative data collection and analysis techniques. We have a strong preference for students planning to major or minor in psychology, sociology, anthropology, or education to complement the STEM backgrounds of other project team members.

Additional Special Knowledge or Equipment Required: N/A
Project Title: Achieving Critical Transformations in Undergraduate Programs in STEM (ACT UP STEM)

Mentor: Dr. Matthew Voigt, Assistant Professor

Department: Engineering and Science Education

Project/Faculty URL: https://www.clemson.edu/cecas/departments/ese/people/esed-faculty/voigt.html

Project Description: Drawing on quantitative and qualitative data, this project examines how to support equity and inclusion in undergraduate STEM courses. This project is part of two larger National Science Foundation (NSF) projects across the united states (SEMINAL: https://www.aplu.org/projects-and-initiatives/stem-education/seminal/ and PtC: https://www.maa.org/programs-and-communities/curriculum%20resources/progress-through-calculus) to help promote active learning and success in introductory math courses. This project is an example of discipline-based educational research whereby individuals use a variety of research methods such as statistical analysis and thematic analysis (e.g., examining themes in data) to discover new findings to promote changes in STEM to foster inclusive practices.

Student Involvement: Research teams would engage in mathematical exploration of student instructional surveys from over 20,000 undergraduate students across the United States. The teams will build models to better understand the relationships between different survey items, generate descriptive statistics, and visual representations of data. The teams would also learn about STEM education research, situate their work in literature and relevant theories. Students would also get the chance to understand the structure and dynamics of undergraduate courses and receive mentoring from graduate students.

Opportunities: As an ongoing project, students would have opportunities to continue analysis of data and assist in additional data collection.
**Required Skills:**
Familiarity using Microsoft Excel and introductory mathematical or statistical knowledge will aid the participants (e.g., calculating means, standard deviations, knowing about bar charts, boxplots). More advanced knowledge and interest will be supported.

**Additional Special Knowledge or Equipment Required:** N/A
Project Title: Bodies in the Middle: Black Women and Sexual Violence
Mentor: Dr. Maya Hislop, Assistant Professor
Department: English
Project/Faculty URL: https://www.clemson.edu/caah/departments/english/faculty-and-staff/facultyBio.html?id=2232

Project Description:
My book project Bodies in the Middle: Black Women and Sexual Violence examines a history and literature of sexual violence with Black women of the twentieth century at the center. Integral to my work as a researcher of the history of specific legal cases and social justice movements involving Black women as victims of sexually violent crimes is to bring to bear the history of sexual violence and white supremacy in the nation more generally. Rape and racism are embedded deeply in the bedrock of our nation, rooted in enslavement as the blueprint for white male individualism and citizenship, continuing on into the development of segregation law, and well into our contemporary carceral system as well as modern immigration laws. Alongside my book project is an upper-level literature course I've developed titled, Reading Sexual Violence and White Supremacy. This literature course is a crucial part of my book as I make the case that trauma-centered pedagogy in addition to the anti-rape/anti-racist social justice movements and literature that I track are all integral parts of the whole that is black women using education, their own bodies and/or the law to create justice for themselves. An essential piece of the course, Reading Sexual Violence and White Supremacy is a unit on the history of these entangled forms of oppression at Clemson University. Just like every state, every city, and every county in the country, every university has its own story to tell about sexual violence and/or white supremacy. Clemson's story may begin with Benjamin Tillman or it may go as far back as the history of enslavement at Clemson. And that history continues in ways that are both subtle and explicit. One example being that the two very vocal and public forms of protest on Clemson's campus in 2020 were dedicated to either ending gendered oppression or ending racial oppression: the protest for the movement for black lives that occurred in June 2020 and the sit-in for survivors of sexual assault in Fall 2020. I have seen time and again where these movements have been separate and divided. However, I do believe that a slow bridging of the gap is occurring as several CMETOO leaders attended the BLM protest or were supportive and vice versa. But how is Clemson cataloging the history of sexual violence and white supremacy and/or the history of the social justice movements against systemic forms of racial and/or gendered oppression? This is where the project that I am proposing for EUREKA! comes in. The first thing that I would ask from my interns is that they help me to continue building an archive of the history of sexual violence and/or white supremacy at Clemson. So far, my esteemed colleague Rhondda Thomas has done an incredible job accessing, collecting, and publicizing the history of Black life at Clemson, from the history of enslavement to musicians on campus, from convict labor to student life. And we are so fortunate to now have not only her fantastic book, Call My Name, but the digital archive of the Call My Name Facebook page as well. But there is no archive that
details the combined history of sexual and racial oppression and/or liberation at Clemson. I have begun to build such an archive from any related stories, headlines, images, etc. that I have found in Tiger Prints, the digital archive for the student newspaper that dates all the way back to 1907. Given that some of the collection work has already begun, it will be easier for students jumping into the project because we have a few groups of materials to look at: Tiger Prints and the university police's crime logs. The student(s) and I will enlist the help of Special Collections librarian Krista Oldham in identifying additional university archives to investigate. Another area of investigation will be to collect oral histories from black female alumna. The second layer of the project is building a website that would house any and all stories, images, videos, etc. that tell the story of sexual violence and white supremacy at Clemson, centering the lives of Black women at Clemson and in the surrounding area. The website would be the beginning of starting a conversation around the issues of rape and racism at the university.

**Student Involvement:**

The research intern will be tasked with collecting sources that seem relevant to the history of rape and/or racism at Clemson as well as with beginning the work of building a website dedicated to housing these sources and telling a story about this history. Students will largely be reading through historic newspaper issues and university police logs and highlighting any and all mentions of the history of sexual violence and/or white supremacy and/or related keywords. Students will also be able to begin conducting interviews with black alumna about their experiences at Clemson. The building of the website will likely be a much longer-term project, but I'm very excited to garner student involvement in these early developmental stages of the process. The students who work on this project will play a large role in what it might look like and what interactivity it may have, etc.

**Opportunities:**

Upon completing their research, students will have the opportunity to continue collaborating on the building of the website archive, they will have the opportunity to work on presentations of their findings at national conferences in fields of History, American Studies, and/or Literature studies.
**Required Skills:**
Excellent reading skills and comfort with Google Drive are essential. Any experience at all in HTML or another coding language might be helpful but is not required. Some intermediate knowledge of American history and, specifically, one or more courses on, familiarity with readings on, and/or direct experience of the subjects of gender, race, identity, nationality, and/or sex/sexuality. A comfort with and/or willingness to read potentially violent and/or traumatic accounts is required. Any experience interviewing human subjects is greatly encouraged, but not required.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title**: Disability Studies: A Digital Archive  
**Mentor**: Dr. Clare Mullaney, Assistant Professor  
**Department**: English  
**Project/Faculty URL**: [https://www.clemson.edu/caah/departments/english/faculty-and-staff/facultyBio.html?id=4587](https://www.clemson.edu/caah/departments/english/faculty-and-staff/facultyBio.html?id=4587)  

**Project Description:**  
In the introduction to his keynote address at the University of Michigan's "This/Ability" conference in 1995, disability scholar and activist Paul Longmore explained: "Every so often participants in social-change movements need to pause, look back over their past efforts, and look forward to try to forecast where they are headed. We need on occasion to review and sum up in order to continue to move ahead with clear purpose." This project aims to create a new and comprehensive digital archive that documents the growth of disability studies as an academic field. Following the disability rights movement of the 1960s and 70s, disability took on new meaning in the context of academic scholarship. For the first time, disability was studied outside of a medical framework, which often privileges the erasure of impairment through rehabilitation or cure. Emphasis was instead placed on reducing stigma, at fixing the social structures that disable some people while enabling others. Building off of the work of a state-of-the-field conference, "Disability Studies: A History," which I organized at the University of Pennsylvania in March 2017, this archive traces how the reframing of disability as a cultural and political category emerged as a critical field of academic study. We will search for, assess, and organize a diverse range of materials--e-mail and letter exchanges between professors, lecture recordings, campus photographs, and event and programming posters. What did the first disability studies syllabus look like? How have these documents changed over time? How did students and professors demand that academic classrooms be made accessible? Ultimately, this ever-evolving archive will provide a roadmap for future developments in disability studies and other minority fields.

**Student Involvement:**  
Interns will assist in gathering artifacts from existing online platforms and sorting material that gets submitted to the archival team through a call to the disability studies community. Together, we will have conversations about how to categorize these artifacts. What, for instance, are the general organizing labels that we might use to structure the collection? What metadata is necessary for researchers to locate artifacts relevant to their interests? We will also explore how to make these collections accessible to disabled users. In exploring multi-modal methods of presentation, we will discuss how to use description practices to make visual material available to a blind or visually impaired students and teachers.
Opportunities:
While this archival work is in its early stages, my hope is that the project will expand over the coming years, and I would love to have this summer's inaugural interns continue to stay involved in the project whether through mentoring future, first-year students or continuing to volunteer in accruing and sorting through new materials. Because disability studies is an established but continually evolving field, I am confident there will be opportunities for students to bring their new knowledge to academic programming related to disability and campus activist initiatives. Such skills acquired from the summer will also benefit students interested in pursuing social justice and non-profit work.

Required Skills:
This project is best suited to students who are invested in pursuing questions related to history, identity, and community. We will spend our first meetings discussing what archives are and how they document the past to make sense of our present. We'll ask: what has been left out of archives and what has been brought in? We will also consider the ways that disability has been represented in history and how the growing field of disability studies has both challenged and extended those representations. Aside from an investment in these humanistic questions, no previous knowledge is acquired. However, if students arrive at Clemson with expertise in website design, digitization, coding, or archives, that is a plus!

Additional Special Knowledge or Equipment Required:  N/A
Project Title: Bioinformatics Investigation of Metabolism and Encystation in the Intestinal Parasite Entamoeba Histolytica

Mentor: Dr. Cheryl Ingram-Smith, Associate Professor
Department: Genetics and Biochemistry
Project/Faculty URL: http://www.clemson.edu/centers-institutes/epic/people/ingram-smith.html

Project Description:
Entamoeba histolytica is an intestinal parasite that infects 500 million to 1 billion people each year. An estimated 10-20% of those infected develop amoebic dysentery characterized by severe diarrhea lasting several weeks. Little is known about why some infections lead to illness but others remain asymptomatic. E. histolytica assumes two forms, trophozoites and cysts. Trophozoites are the form that lives in the human body and causes illness, and cysts are a dormant form surrounded by a protective shell that is found in the environment. Infection occurs by consuming food and water contaminated with these cysts. The cysts pass through the stomach and revert to the trophozoite form in the small intestine, and then pass to the large intestine where they remain to continue growing and dividing. A subpopulation of trophozoites in the large intestine will convert to the cyst form to be passed to the environment and continue the infection cycle.

Our lab is studying the changes in metabolism that E. histolytica undergoes between the small and large intestines, which are very different environments in terms of the nutrients available. We are also investigating what factors signal E. histolytica to change from the trophozoite form to the cyst form. This aspect is all the more interesting in that only a subset of the population changes. The rest of the population continues growing and dividing in the large intestine even as cysts are expelled daily into the environment in feces.

In this project, we will use data generated in the lab as well as data published in the scientific literature to examine the changes in E. histolytica gene expression under different growth conditions. We will also use data from the related species Entamoeba invadens, a reptile pathogen which has been a model for studying cyst formation. These investigations are expected to lead to targets for further experimental study.

Student Involvement:
The interns will use computational/bioinformatics approaches to analyze experimental data. There are vast bodies of transcriptomics data for E. histolytica and E. invadens showing transcript levels under different growth conditions including...
during differentiation of E. invadens from the trophozoite form to the cyst form and back to the trophozoite form. Interns will use this data to identify genes that may play a role in sensing and responding to environmental signals for these changes. They will then delve into the scientific literature to determine what is known about the function of the genes they have identified. These literature investigations will extend beyond Entamoeba into Giardia and other parasites. Published data regarding Giardia may be of particular interest due to similarities between it and Entamoeba.

Opportunities:
EUREKA! interns may be invited to continue their research in the lab. This would likely be in-person wet-lab research and may begin immediately in the fall or at a later date depending on the student's schedule and space in the lab.

Required Skills:
A basic knowledge and interest in biology is the only requirement. All other skills needed will be taught as the project progresses.

Additional Special Knowledge or Equipment Required: N/A
Project Title: Role of Non-Coding Variants in Severe COVID-19  
Mentor: Dr. Lela Lackey, Assistant Professor 
Department: Genetics and Biochemistry  
Project/Faculty URL: http://www.researchingrna.com

Project Description:  
One of the simplest ways to identify functional genetic variants is by looking specifically at regions of the genome that code for proteins. This approach has identified thousands of variants that cause or contribute to human disease. However, this has left many variants in non-coding regions uncharacterized. In fact, the majority of variants identified in non-biased screens, like genome-wide associated studies, are within non-coding regions. This project is focused on categorizing genetic variants associated with several COVID-19 into different types of non-coding and coding variants. These variants are annotated by the Covid-19 Host Genetics Initiative (https://app.covid19hg.org/). Understanding how non-coding variants impact biology is a major focus of research and we know RNA sequence and structural elements that influence biological function. We will evaluate these variants for their impact on known important sequence and structure motifs, like splice sites. Future in-person laboratory work is possible based on the results of this project.

Student Involvement:  
As part of this project, interns would learn how to access and analyze genetic data and combine these data sets with other bioinformatic data to look for patterns. This is an independent project in the lab, but intern(s) would be mentored by myself and other lab members.

Opportunities:  
The research intern(s) would be strongly encouraged to continue research in the laboratory to further develop the project.

Required Skills:  
Minimal prior experience is required. Interest in learning bioinformatics techniques, genetics and molecular biology is a must!

Additional Special Knowledge or Equipment Required: N/A
**Project Title:** Crop Genetic Engineering for Enhanced Performance Under Environmental Adversities  
**Mentor:** Dr. Hong Luo, Professor  
**Department:** Genetics and Biochemistry  
**Project/Faculty URL:** http://www.clemson.edu/cafls/faculty_staff/profiles/hluo

**Project Description:**
Environmental stress is one of the most important factors impacting agriculture production. Development of novel molecular strategies to genetically engineer important crops will lead to new cultivars with beneficial new traits, enhancing crop yield. This project focuses on manipulation of expression of several stress-related candidate genes in transgenic rice and turfgrass plants to achieve enhanced plant performance under adverse environmental conditions such as drought and salt stress, improving agriculture production and economy. A series of online powerpoint presentations and literature reading and discussion sessions will be organized thoroughly introducing to the students the principles of gene cloning, biotechnology approaches for plant genetic engineering and transgenic analysis to evaluate improved crop performance under adverse environmental conditions.

**Student Involvement:**
The students will read and discuss related research papers on plant molecular biology, plant genetic engineering and molecular mechanisms of plant-environment interaction. They will participate in all the online presentations and discussions, and actively interact with myself, graduate students, and post-doc researcher to become familiar with the basics about scientific research, gene cloning, gene functional characterization, and chimeric gene construction as well as plant genetic transformation and transgenic analysis.

**Opportunities:**
The students could continue their research in the lab and gain more hands-on 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 students to be involved in this online project. Knowledge learnt from high school biology course will be good enough to participate in the project. The students will be trained to learn basic molecular and cell biology techniques including DNA and RNA extraction, DNA cloning, plasmid construction, PCR, plant tissue culture, and plant genetic transformation.

**Additional Special Knowledge or Equipment Required:** N/A
Project Title: Identification of Virulence Genes in the Fungal Pathogen Cryptococcus
Mentor: Dr. Kerry Smith, Professor
Department: Genetics and Biochemistry
Project/Faculty URL: https://www.clemson.edu/centers-institutes/epic/people/smith.html

Project Description:
Invasive fungal infections cause nearly one and a half million deaths annually, accounting for nearly 50% of all AIDS-related deaths. Cryptococcus neoformans, an invasive opportunistic pathogen of the central nervous system, is the most frequent cause of fungal meningitis. The CDC estimates the yearly burden of cryptococcal meningitis to be nearly one million cases with greater than 190,000 deaths. AIDS is a major risk factor and mortality rates in AIDS patients range from 55-70% in Latin America and sub-Saharan Africa. Exposure to Cryptococcus is common, as it is an environmental fungus found in the soil that can enter the lungs through inhalation and disseminate to the central nervous system in susceptible individuals. An increased rate of infection occurs in individuals with impaired cell-mediated immunity, particularly those with AIDS and recipients of immunosuppressive therapy. The widespread availability of antiretroviral therapy in developed countries has helped improve the immune systems of many HIV patients to decrease their susceptibility to infection. However, cryptococcal meningitis is still a major problem in resource-limited regions of the world such as sub-Saharan Africa where HIV prevalence is high and access to healthcare is limited. Despite the global significance of cryptococcal meningitis, current treatments are inadequate as the gold standard therapy is based on half century old drugs that have a wide range of liabilities and shortcomings.

Metabolic adaptability and flexibility are important attributes for fungal pathogens to successfully infect and cause disease. Although carbon metabolism is critical for virulence in Cryptococcus very little is known about which carbon sources are utilized during infection. Our long-term goal is to provide a better understanding of how Cryptococcus can adapt its metabolism to survive in the changing environments encountered during infection.

Macrophages, which present a first line of host defense against Cryptococcus infection, provide a glucose- and amino acid-poor environment, and nonpreferred carbon sources such as lactate and acetate are likely important early in establishment of a pulmonary infection. Thus, genes whose products are necessary for the utilization of acetate may have an important role for Cryptococcus infection. We are using genetic, biochemical, and computational approaches to identify and characterize genes required for the utilization of acetate.
**Student Involvement:**
The student intern will utilize computational approaches to analyze data from genomics, transcriptomics, proteomics, and metabolomics experiments to make new discoveries in Cryptococcus biology and acetate metabolism. Possible projects could include computational approaches in: (1) the identification of novel virulence factors, (2) the characterization of the interplay between metabolic pathways during virulence, (3) the identification and characterization of genes necessary for acetate utilization, (4) the identification of important protein modifications, etc. At the beginning of the project, the mentor will discuss possible projects and the student intern will have the opportunity to choose their favorite. Throughout the internship, the intern will be able to not only interact directly with the mentor but also work with PhD students who may have a related dissertation project.

**Opportunities:**
Following the EUREKA! internship, the student will have the opportunity to continue research in the lab. This wet lab opportunity would provide the student with experience in a variety of genetic, biochemical, and molecular and cellular techniques that can be utilized to study the discoveries that were made during the EUREKA! internship. Hopefully, the student will enjoy their summer experience and will want to perform their Departmental Honors Research in the lab.

**Required Skills:**
Students should have enthusiasm for research, basic biology and chemistry knowledge, and general computer knowledge.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** AI in Biomedicine: Prediction of Novel Human Disease Genes by Genomic Data Mining  
**Mentor:** Dr. Liangjiang (LJ) Wang, Associate Professor  
**Department:** Genetics and Biochemistry  
**Project/Faculty URL:** https://www.clemson.edu/science/departments/genetics-biochemistry/people/profiles/liangjw

**Project Description:**

In the human genome, most genes actually do not encode proteins; they are non-coding RNA genes. The largest class of non-coding genes is known as long non-coding RNAs (lncRNAs), which are transcripts greater in length than 200 nucleotides, but with no protein-coding capacity. While some lncRNAs have been demonstrated to be key regulators of gene expression and 3D genome organization, most lncRNAs are still uncharacterized. We have thus been developing artificial intelligence (AI) and machine learning approaches for the functional annotation of human lncRNAs through mining the vast amount of genetic and genomic data (“biological big data”). Our recent studies demonstrate that genomic data mining can give insights into RNA functions and provide valuable information for experimental studies of candidate lncRNAs.

This research project will focus on the identification and functional analysis of novel candidate lncRNAs associated with human diseases, including intellectual disability (ID) and autism spectrum disorders (ASD). ID and ASD are clinically and genetically heterogeneous complex disorders, affecting up to 3% and 1% of the human population, respectively. ID is characterized by diminished intellectual capacity and adaptive reasoning, whereas ASD is recognized by impaired social communications and restrictive or repetitive behavior. Both disorders originate in early childhood, and involve a large number of genes essential for normal brain development and function. However, in most cases of ID or ASD, the specific genetic factors of the disorders are still unable to be determined. Until recently, only protein-coding genes were studied for their involvement in ID and ASD. It is thus likely that many of these disease-causing genetic factors may reside in lncRNAs, which are enriched in the brain. The research interns will learn how to build machine learning models for candidate disease gene prediction, and then utilize publicly available genetic and genomic data to further characterize and prioritize the candidate lncRNAs. The high-priority candidates identified in this project can not only provide new insight into the roles of lncRNAs in genetic brain disorders, but may also be further developed as biomarkers.
**Student Involvement:**
Research interns will be directly involved in the project. Each intern student, under the supervision of a graduate student, will learn how to build a machine learning model for candidate disease gene prediction and prioritization. They will also contribute to the further evaluation and curation of novel candidate lncRNAs associated with genetic brain disorders.

**Opportunities:**
The data analysis skills learned through this project can be useful for future careers in biomedical data science, 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. Although prior experience with computational research is not required, the interns are expected to be willing to learn computer programming and basic machine learning techniques used in genomic data mining.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:**  COVID-19 and the Crises of French Politics

**Mentor:**  Dr. Eric Touya, Professor of French

**Department:**  Languages

**Project/Faculty URL:**  https://www.clemson.edu/caah/departments/languages/about-contact/faculty-and-staff/facultyBio.html?id=589

**Project Description:**
The aim of the project is to explore how the COVID-19 crisis makes visible the current socio-economic situation in France. We analyze how the health crisis reveals unresolved issues impacting French politics pertaining to the EU and France's sovereignty, globalization and France's lack of competitiveness in economics and scientific research, the overall decline in the standard of living, the rise of violence and populism, and the future of democracy. We explore these crises from a broad range of political perspectives, in a current French, EU, and global context.

**Student Involvement:**
The research intern will be guided to do research on the project described above. S/He will complete a 30-35 pages paper and other assignments required by the program. The research content may be adapted to meet the intern's specific interests. The intern will receive specific guidelines regarding his/her project, and guidance through the process.

**Opportunities:**
Students can present their paper at a conference and/or submit it for publication.

**Required Skills:**
An interest in French and European politics and in the experience/impact of COVID-19 outside the US will assist the intern in this project.

**Additional Special Knowledge or Equipment Required:**  N/A
**Project Title:** College Student Information Seeking Behaviors in the Social Media Era: A Library and Information Sciences Systematic Review  
**Mentor:** Maggie Albro, Assistant Librarian  
**Department:** Libraries  
**Project/Faculty URL:** [https://clemson.libguides.com/prf.php?account_id=41900](https://clemson.libguides.com/prf.php?account_id=41900)

**Project Description:**
Social media contains information with varying levels of credibility that is then consumed by users who interpret this information based on their critical discernment skills and personal worldview. When combined with the flood of doctored or digitally enhanced text and images online, this creates an information landscape that can have a demonstrable impact on social media user understandings of information credibility. Among college student populations, social media use is highly prevalent meaning the presence of altered information (text and images) can impact the lens through which these students view reality in both personal and professional contexts.

Library and information sciences disciplines grapple with these complex understandings of the intersections of information access, retrieval, and subsequent information (or evidence) driven actions. Particularly in the contemporary era of information distortion, evaluation of sources is an essential practice in determining the quality of the evidence and making unbiased decisions based on the highest quality information accessible.

As an avenue of research, systematic reviews are an intensive, controlled methodology for evaluating the evidence relating to a specific practice or intervention. This project will make use of the methodology by creating a structured research question, determining if there is enough literature to support a review, and developing and registering a protocol.

**Student Involvement:**
Research interns will work as a team to develop and hone the specifics of the research question being investigated according to established procedures used when conducting a systematic review. Then, the interns will work with the lead researchers to develop a protocol for the systematic review based upon PRISMA reporting guidelines.
Opportunities:
This project will continue beyond the completion of the EUREKA! program. Students will be invited to assist with completing the systematic review process. Students who continue with the project will gain experience in drafting a scholarly manuscript for publication. All EUREKA! research interns will be listed as co-authors on the final published protocol and manuscript that will be published in a peer-reviewed scholarly journal. There is potential for other related opportunities in conference presentations and/or posters based upon systematic review results.

Required Skills:
Students must have an interest in library and information science as well as basic database searching knowledge.

Additional Special Knowledge or Equipment Required: N/A
**Project Title:** Groups and Geometry  
**Mentor:** Dr. Martin Schmoll, Associate Professor  
**Department:** Mathematical and Statistical Sciences  
**Project/Faculty URL:** [https://mthsc.clemson.edu/directory/view_person.py?person_id=73](https://mthsc.clemson.edu/directory/view_person.py?person_id=73)

**Project Description:**  
We will study a few sections of standard textbooks on geometric group theory and apply it to study objects related to the research of the organizer: Group actions on particular graphs and polygonal surfaces and their parameter spaces.

**Student Involvement:**  
Students will participate by reading and discussing some text book pages and learning how to apply the learned material to questions on surfaces. They will also learn how to discuss and present mathematics.

**Opportunities:**  
The interns will be able to add some lines on their vita which help particularly to get admitted to graduate school. In the best case they will have a publication.

**Required Skills:**  
It is enough to know the concept of a group and some linear algebra. A lot of scientific curiosity and some stamina to overcome hurdles and difficulties.

**Additional Special Knowledge or Equipment Required:** N/A
Project Title: Smart Shoe Insole for Detecting Gait Phases with Powered Lower-Limb Exoskeletons
Mentor: Dr. Ge Lv, Assistant Professor
Department: Mechanical and Bioengineering Department
Project/Faculty URL: http://www.l.clemson.edu/cecas/departments/me/people/faculty/Lv.html

Project Description:
This project is about placing force sensing resistors on a shoe insole to detect gait phases (i.e., different postures during a step) for powered exoskeletons.

When humans walk, different parts of their feet will make contact with the ground during different time periods within a step. By properly placing force sensing resistors (FSRs) on a shoe insole based on biomechanics studies, we will be able to measure the ground reaction forces between human feet and the ground as people walk. The FSRs can transform these forces into voltages, which can then be used as indicators for detecting the current gait phase. For example, when human's leg finishes swinging and lands on the ground, the heel will be the first contact point. Therefore, the FSR located at the heel part of the shoe insole will be pressed. With the use of a microprocessor, we can communicate with the sensor and the force it measured.

Through combining multiple FSRs and necessary electronics, we can create a detecting logic, based on which an indicator can be generated and sent to the powered lower-limb exoskeleton. The exoskeleton can then choose the corresponding controller to assist its users.

Student Involvement:
The research interns will mainly accomplish the following tasks:
1. Read research papers on biomechanics of human walking. Understand the pressure trajectory of human foot during walking.
2. Order appropriate numbers and types of FSRs and shoe insoles. Place FSRs along the trajectory found in Task 1.
3. Order the Adriuno microprocessor and connect it to the FSRs. Program in C Language to read the voltage signal sent by the FSR and transform it into force (the transform equation will be available from the FSR's vendor).
4. Create a gait phase detection logic combining the readings of multiple FSRs. Generate an indicator based on the logic obtained.

The research interns will work individually or in team. They can choose to accomplish all four tasks above by themselves or in teams.
**Opportunities:**
The students can continue to work in my research lab throughout their studies here, which will have a lot of cool projects on human locomotion and assistive devices.

**Required Skills:**
Students must have basic electronics knowledge, C language programming (preliminary) experience, and basic mechanical assemble ability.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Atomistic Modeling of Dislocation Climb through an Interstitial Mechanism  
**Mentor:** Dr. Enrique Martinez Saez, Associate Professor  
**Department:** Mechanical Engineering  
**Project/Faculty URL:** [https://www.clemson.edu/cecas/departments/mse/people/faculty/saez.html](https://www.clemson.edu/cecas/departments/mse/people/faculty/saez.html)

**Project Description:**  
Dislocations are line defects in solid materials which movement leads to permanent deformation. Understanding how these dislocations move is hence paramount to understand plastic deformation and to be able to predict the materials response under loading. In this project, we will be using atomistic computer simulations to analyze one particular type of dislocation movement called climb. Climb involves the interaction of dislocations with other types of defects. The goal of this project is to understand how the applied load modifies such interaction using computational models and how they compare with theoretical developments.

**Student Involvement:**  
The interns will learn to use a molecular dynamics code to model dislocations at the atomic scale. The interns will familiarize with high-performance computing systems where the simulations will be run and with analysis tools to visualize the results. The interns will also learn some elasticity theory needed to analyze the results and some simple coding to help with the analysis.

**Opportunities:**  
There might be an option for the students to keep working in the group after the EUREKA! Program.

**Required Skills:**  
A solid mathematical background is desirable but not required. The only requirement is enthusiasm for learning.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Molecularly Informed Design of Polymer Nanocomposites for Wastewater Filtration

**Mentor:** Dr. Zhaoxu Meng, Assistant Professor

**Department:** Mechanical Engineering

**Project/Faculty URL:** [https://cecas.clemson.edu/~zmeng/](https://cecas.clemson.edu/~zmeng/)

**Project Description:**

The project involves applying computer simulations on Clemson's Palmetto high-performance computing cluster (one of the best in the nation!) and materials science knowledge to design and characterize novel polymer-based nanocomposites, which has huge potential to be used as advanced filtration materials in the form of nanofibers. For instance, nanofibers arranged as thin, non-woven mats are characteristically ideal wastewater filtration materials that can be applied in long-duration, deep-space human explorations. This project is ideal for a fully online research experience. All we need is a computer connected to the network.

**Student Involvement:**

Research interns will work as a team and receive guidance from graduate students and Dr. Meng remotely (through Zoom meetings and recorded lectures) to construct the molecular models for polymer-based nanocomposites and use specific simulation packages to characterize the structure-property relationships of these models. The simulations will be conducted on the Palmetto high-performance computing cluster.

**Opportunities:**

Students will have the opportunity to keep working as research interns in Dr. Meng's group, attend conferences with full support, and publish journal articles.

**Required Skills:**

No specific skills, experiences, or knowledge are required. Experiences in MATLAB software and LINUX OS will be a plus.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Microscale Mixing of Non-Newtonian Fluids  
**Mentor:** Dr. Xiangchun Xuan, Professor  
**Department:** Mechanical Engineering  
**Project/Faculty URL:** [https://www.clemson.edu/cecas/departments/me/people/faculty/xuan.html](https://www.clemson.edu/cecas/departments/me/people/faculty/xuan.html)

**Project Description:**  
Microfluidic devices have been widely used in many biomedical and chemical applications. Mixing samples is usually a necessary step in these devices, which, however, becomes difficult because of the laminar flow feature in microchannels. The majority of the current studies on microscale mixing has been focused on the use of Newtonian fluids despite the fact that almost all chemical and biological fluids are actually non-Newtonian fluids. This project is aimed to study the micromixing of polymer solutions in microchannels.

**Student Involvement:**  
The research intern(s) will be involved in the microchannel fabrication, microfluidic experiment, microscale imaging, and image processing/analysis.

**Opportunities:**  
The intern(s) will be given opportunities to present their work in the annual APS-DFD meeting. The intern(s) can also continue research in my Creative Inquiry program.

**Required Skills:**  
There are no prior skills required for this project.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Computational Cardiovascular Research  
**Mentor:** Dr. Ethan Kung, Associate Professor  
**Department:** Mechanical Engineering / Bioengineering  
**Project/Faculty URL:** http://www.cmerl.com

**Project Description:**
In this project students will use computational methods to help solve clinical problems related to the cardiovascular field. This may include simulations to model the cardiovascular system, potentially constructing patient-specific models, and analysis of clinical database to identify trends and regression models. The project may extend to computational modeling of related medical devices. For Summer 2021 it is most likely that we will be building 3D anatomic models of carotid bifurcation from patient imaging data.

**Student Involvement:**
Students will learn how to use new software to perform computer simulations and data analyses to answer scientific or clinical questions. The computational models that we employ include low-order circuits models, high-order 3D finite element models, and artificial intelligence based regression modeling.

**Opportunities:**
After the program, students will have the opportunity to continue related research in Creative Inquiry or summer research.

**Required Skills:**
Students must have the ability to learn to use new engineering software and hardware, and be able to learn basic data processing and coding in Matlab. The ability to grasp new scientific concepts is also helpful.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Research in U.S. Constitutional Law  
**Mentor:** Cary Kaye, Lecturer  
**Department:** Philosophy and Religion  
**Project/Faculty URL:** [https://www.clemson.edu/caah/departments/philosophy-religion/people/facultyBio.html?id=4194](https://www.clemson.edu/caah/departments/philosophy-religion/people/facultyBio.html?id=4194)

**Project Description:**  
Each summer I perform legal research into two topics in U.S. constitutional law. This year, the topics are (1) whether compulsory vaccination exceeds Congress's authority under the Commerce Clause and (2) whether compulsory vaccination violates liberty and privacy rights under the Due Process Clause of the Fifth Amendment. I will teach the students how to do and how to write up legal research.

**Student Involvement:**  
Each student will perform legal research into one of the specific topic in U.S. constitutional law listed above.

**Opportunities:**  
Students who have completed this experience will be exceptionally well prepared for the Philosophy Department's Moot Court Creative Inquiry and will also be better prepared for constitutional law classes generally. They should be better prepared for law-related internship opportunities as well.

**Required Skills:**  
Previous experience with Lexis or Westlaw would be a plus, but is not required. An understanding of the structure of the U.S. federal court system is a plus, but not required. Experience with Microsoft Word, Google Docs, and OneNote would each be helpful, but is not required.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Plant Virus Genome Sequence Mining for Improved Diagnostic Assays  
**Mentor:** Dr. Elizabeth Cieniewicz, Assistant Professor  
**Department:** Plant and Environmental Sciences  
**Project/Faculty URL:** [https://cieniewiczviruslab.weebly.com/](https://cieniewiczviruslab.weebly.com/)

**Project Description:**  
This project will be conducted remotely using publicly available genome sequence data from various viruses of peach trees. Virus populations accumulate mutations and differences, and therefore current diagnostic procedures do not always capture the new variants of a virus. This will assist future diagnosis and research efforts to manage disease caused by viruses in fruit trees.

**Student Involvement:**  
In short, the student(s) will work with Dr. Cieniewicz to gather sequences, produce sequence alignments to determine highly conserved regions, and then design and/or optimize diagnostic protocols for plant viruses. We will eventually test them in the lab.

**Opportunities:**  
Opportunities for undergraduate research in the Cieniewicz lab are available each semester, either for credit or paid positions (depending on availability of funding). This would involve molecular virology research in the lab, greenhouse experiments, and potentially field work in peach orchards or at the Musser Fruit Research Farm.

**Required Skills:**  
Basic biology background is required, but no specific virology, pathology, or genomics background is required. The only requirement is a positive attitude and eagerness to learn more about agriculture, plant pathology, and genomics.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Climate Resilient Crops for Food Security

**Mentor:** Dr. Sruthi Narayanan, Assistant Professor

**Department:** Plant and Environmental Sciences

**Project/Faculty URL:** https://www.clemson.edu/cafls/faculty_staff/profiles/SKUTTY

**Project Description:**
Climate models predict continued warming and increased frequency, duration, and intensity of droughts across the southeast U.S. Between 2000 and 2019, South Carolina experienced drought [Moderate (D1) - Exceptional (D4)] every year except 2014. In 2015, 35 counties in South Carolina were declared as primary disaster areas due to drought by the U.S. Department of Agriculture. Our research focuses on understanding crop response and adaptation to changing environmental conditions (water and temperature) in order to develop climate resilient crop varieties. 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 can do literature review and participate in some crop science webinars and our lab meetings virtually. Our team can train them in some data analysis (e.g., soil volumetric water content and in situ root image analysis), if they perform the assigned tasks skillfully, we can continue involving them in data analysis. 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.

**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:**
Passion for plant science, ability to work as a team, and basic computer and software skills (to connect to us remotely) are required.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Turning Perennial Cotton into an Annual: A Novel Strategy to Increase Cotton Fiber Yield by Remobilization of Reserves  
**Mentor:** Dr. Sachin Rustgi, Assistant Professor  
**Department:** Plant and Environmental Sciences  
**Project/Faculty URL:** [https://www.clemson.edu/cafls/faculty_staff/profiles/srustgi](https://www.clemson.edu/cafls/faculty_staff/profiles/srustgi)

**Project Description:**
Cotton is one of the most important textiles and oilseed crops worldwide. Despite the economic importance and demand for natural fiber, the cotton yield gain has remained stagnant over the years. We offer a novel strategy to improve cotton productivity by altering its growth habit from perennial to annual by identifying and stacking in a single genotype the high-expression alleles of the cotton floral induction and meristem-identity genes that determine shoot architecture and regrowth, and hence productivity. To attain this target, we aim to decipher the genetic regulation of the expression differences for the floral induction and the meristem-identity genes observed in a collection of highly diverse cotton lines. Identify molecular markers associated with the expression traits for the cotton FT, LFY, FUL, AP1, and SOC1 genes, and identify genes that determine the expression patterns of these genes. Once identified, the genotypes carrying high-expression alleles of different floral induction and meristem-identity genes will serve as the germplasm to breed for the annual growth habit, and molecular markers/genes associated with the gene-expression traits will serve as tools to select for this trait.

**Student Involvement:**
This research project would be a team effort involving at least two interns, where the first intern will retrieve the published DNA sequences of the cotton floral induction and meristem identity genes (FT, LFY, SOC1, AP1, and FUL) from the public database and perform sequence similarity searches (BLAST) against the cotton genomic DNAs sequence to identify other members of the gene family to which the genes of interest belong. The intern will study the phylogenetic relationship among the sequences belonging to a gene family and study the expression pattern of each of these genes virtually using bioinformatic tools.

The second intern will identify the genes responsible for the expression (e) QTLs (genomic regions flanked by DNA markers that regulate expression of the floral induction and meristem identity genes - earlier identified by our group) by tracing the origins of associated DNA markers from genes or random genomic regions via performing blast searches against the cotton genomic DNA sequences. Annotate the gene with DNA markers by performing searches against the databases that allow...
predicting the gene functions. Gene will be clustered into groups based on their functions, such as transcription factors, non-coding RNA genes, etc. The expression patterns of the genes with DNA markers will also be studied using the bioinformatics tools, and the co-expression networks of these genes with the cotton floral induction and meristem identity genes (studied by the first intern) will be developed.

In parallel, the two interns will blast the DNA sequences of the cotton FT, FUL, LFY, AP1, and SOC1 genes against the cotton genomic DNA sequences to retrieve the promoter sequence (1000bp upstream of the start codon) for each of these genes and search them for the distribution of signal sequences (required for transcription initiation and progression) and transcription factor binding sites using online tools and study the correspondence between gene annotations (studied by the second intern) and the promoter elements in the cotton FT, LFY, SOC1, AP1, and FUL genes. This analysis will allow the shortlisting of a few genes responsible for eQTLs whose functions will be confined later via gene silencing.

**Opportunities:**

The research project targets the following research areas - bioinformatics, molecular breeding, molecular biology, to name a few. These are very active areas of research, which are in high demand both in academia and industry. Thus, this research training is expected to open up several career opportunities for the participant(s).

**Required Skills:**

Basic understanding of the principles of genetics, molecular biology, and bioinformatic tools will be an advantage.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Psychology of Religion, Spirituality, and Meaning  
**Mentor:** Dr. Job Chen, Assistant Professor  
**Department:** Psychology  
**Project/Faculty URL:** https://www.clemson.edu/cbshs/faculty-staff/profiles/ZHUOC

**Project Description:**
Students have opportunities to work, under the supervision of Dr. Job Chen, on several projects related to religion, spirituality, and psychological wellbeing. In broad terms, we study attitudes and behaviors influenced by strong beliefs and profound experiences. We use mixed methods including psychological measures (e.g., survey), experimental manipulation, and qualitative interviews.

Among the many available projects, one is to study the influence of moral disengagement on doing immoral behaviors. We will design both script-based scenarios and in-person behavioral experiments to investigate the causal mechanism of moral disengaging rhetorics.

Another study is an interdisciplinary endeavor between architectural design and psychology. In this project, we will examine the impact of built environment on human perception of time and dweller's well-being. We will design experiments in which different built environmental elements are manipulated in drawings (e.g., a room with a window view vs. a room with a pictorial view) and study people's response to them.

We will also have projects that are tied to specific religious traditions. We are doing ground-breaking work in understanding psychology of Taoism and Sufism.

Motivated students are also encouraged to explore their own interest along this broad line and I will support their endeavor.

**Student Involvement:**
In these studies, students will work closely with the supervising professor and his PhD students to design studies, collect data from human subjects, analyze and interpret data. Students will have opportunities to present some of these results at national, professional conferences in the Fall or next year, should the research results be produced in a timely manner.
Opportunities:
Students can choose to stay with my research team if they are enrolled students at Clemson by signing up as a team member of my Creative Inquiry. Students will, in that way, receive continuous support from me and from the CI to pursue their academic interest. Opportunities include conference presentation and networking, research publications, and a recommendation letter at the time of graduate school application for those who have committed to doing research for more than two semesters.

Required Skills:
There is no specific knowledge is required other than an intrinsic interest in the topics being pursued.

Additional Special Knowledge or Equipment Required: N/A
**Project Title:** Data-Driven Privacy Protection in Voice Personal Assistants  
**Mentor:** Dr. Long Cheng, Assistant Professor  
**Department:** School of Computing  
**Project/Faculty URL:** https://people.computing.clemson.edu/~lcheng2/

**Project Description:**  
Virtual Personal Assistants (VPA) such as Amazon Alexa have been seamlessly integrated into our daily life. With the emergence of the Amazon Alexa ecosystem, third-party developers are allowed to build new skills and publish them to the skills store, which greatly extends the functionalities of VPA. However, recent researchers have demonstrated the ease of publishing malicious skills in VPA platforms, e.g., unscrupulous developers could publish skills to eavesdrop on user conversations without users' knowledge, or trick users into handing over sensitive information. Unfortunately, few research efforts have been undertaken to understand and mitigate potential privacy risks brought by VPA to users. The goals of this project are to: i) develop a data-driven approach to characterizing potential privacy issues in VPA systems by analyzing user-review data, and identifying privacy-violating skills through dynamic analysis of suspicious skills; and ii) explore new attribute inference attacks in skills and develop a data-driven approach to protecting users from these risks.

**Student Involvement:**  
Research interns will contribute to the data collection from VPA voice-app stores, data analysis to characterize potential privacy issues in VPA systems.

**Opportunities:**  
There may be an opportunity to work with the research group in the future to co-author papers and attend conferences.

**Required Skills:**  
It is ideal that students have some basic Python programming skills.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** COVID-linked Cyber-harassment Detection  
**Mentor:** Dr. Long Cheng, Assistant Professor  
**Department:** School of Computing  
**Project/Faculty URL:** https://people.computing.clemson.edu/~lcheng2/

**Project Description:**  
The social and economic destabilization caused by COVID-19 has produced a range of emotions in people, including fear, anxiety, and even hostility. COVID-19-related cyber-harassment is increasingly occurring on social media that target people based on race/ethnicity, age, social class, immigrant status, and political ideology. Because COVID-19-related cyber-harassment is a new phenomenon, it is important to explore how and where it spreads online, as well as whether it will persist beyond the peak of the pandemic. This research will create a valuable large-scale multimodal dataset of COVID-19-related cyber-harassment that can be shared with the broader research community. It will develop machine learning methods to provide a timely and necessary understanding of the sources of COVID-19-related cyber-harassment, how and where it circulates online, and individual and situational factors associated with COVID-19-related cyber-harassment.

**Student Involvement:**  
Research interns will contribute to data collection of a multimodal dataset of COVID-19-related cyber-harassment.

**Opportunities:**  
There may be an opportunity to work with the research group in the future to co-author papers and attend conferences.

**Required Skills:**  
Ideally, students have some basic Python programming skills, and machine learning knowledge.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Light Stage Development for Computer Graphics, Material Rendering, and Facial Acquisition

**Mentor:** Dr. Eric Patterson, Associate Professor, Visual Computing; Associate Director, Digital Production Arts

**Department:** School of Computing

**Project/Faculty URL:** http://cs.clemson.edu/~ekp

**Project Description:**
As part of my work with Visual Computing and Digital Production Arts, I am constructing a controlled variable-lighting sphere or "Light Stage," one of just a few in the world, and similar to those linked here: https://vgl.ict.usc.edu/LightStages/ and http://wp.doc.ic.ac.uk/rgi/project/multispectral-light-stage/.

The apparatus will be used in computer-graphics research for material acquisition of light-reflectance and transmittance data for rendering; in research regarding the human face and digital doubles for film visual effects; and in photogrammetry studies for building objects in 3D space. Even after construction, we will be working on software and hardware improvements for its use, and one of the first projects that will take advantage of it will start this summer -- an NSF funded project studying and modeling feathers of birds and other dinosaurs for physically accurate rendering. The apparatus will also be used in new methods for 3D facial capture for digital human representation.

**Student Involvement:**
Research students working with me will develop and build tools for the device that is currently nearing completion at the Zucker Family Graduate Education Center in Charleston, SC.

Work will involve some level of computer-graphics and rendering and may be adjusted to the level of the student. I could involve 2 to 3 students with related project work as individuals or a team. Students would be building tools with Python and working with image and computer-graphics data.

**Opportunities:**
Students will have the opportunity for further work in the lab or related projects, exposure to Visual Computing and Digital Production Arts, and develop skills to enable future software or hardware development projects.
**Required Skills:**
Students should have Python and/or C++ or other programming background of some kind (even if an early-stage programmer). Some familiarity with basic vector math and computer-graphics is preferred but not strictly necessary.

**Additional Special Knowledge or Equipment Required:** N/A
**Project Title:** Clinician Well-Being and Resilience During COVID-19  
**Mentor:** Ms. Janice Lanham, Senior Lecturer  
**Department:** School of Nursing  
**Project/Faculty URL:** https://www.clemson.edu/health-research/faculty/lanham.html

**Project Description:**  
Resilience is vital for undergraduate students pursuing health professions. The healthcare environment has become more complex, along with the increasing demands of the global pandemic. Self-care activities can support the development of resilience in the college student population. The purpose of this study will be to explore and describe self-care practices, health-promoting behaviors, and resilience among students, faculty, and staff in a prelicensure baccalaureate program for undergraduate nursing students.

**Student Involvement:**  
1. Become familiar with an existing body of research relevant to their project's topic.  
2. Define research ethics and practice responsible conduct in research, e.g. complete Citi Training.  
3. Use library and other tools, e.g. The Connor-Davidson Resilience Scale to search for an existing body of literature relevant to a research question.  
4. Apply problem-solving skills to constructively address research challenges.  
5. Work collaboratively with other research interns, using listening and communication skills.  
6. Work autonomously in an effective manner by setting and meeting deadlines.  
7. Perform basic data analysis.  
8. Communicate confidently and constructively with college faculty as mentors.  
9. Present research findings, e.g. digital poster, to professionals in the field and to broader audiences through research presentations, e.g. EUREKA! Poster Forum.

**Opportunities:**  
1. Continue this work as a Creative Inquiry, e.g. pilot study, manuscript publication, podium/poster presentation at local, state, or regional conference.  
2. Expand project into a Departmental Honors Research Project, e.g. research proposal, pilot study, pursue grant support, manuscript publication, podium/poster presentation at local, state, or regional conference.
**Required Skills:**
No previous skills, experiences, or knowledge is required.

**Additional Special Knowledge or Equipment Required:** N/A