

2026 EUREKA! Project List

The table below contains the projects available for the 2026 EUREKA! Program. Project details are available on the pages following the table. The “Project Title” in this table will hyperlink you to the project information. The “Project Title” on the later pages will hyperlink you to the project or mentor website. The “Department” on the later pages will hyperlink you to the department’s website. If you do not see a project or department that interests you, you will have the option to suggest one through your application. Please email us at eureka@clermson.edu with any questions.

*Indicates the project has **Required** Skills / Prerequisites. Please pay special attention to these as you will be responsible for ensuring you meet those requirements.

Department	Project Title
Agricultural Sciences	Exploring the Adoption of Conservation Practices Among South Carolina Farmers
Biological Sciences	Developing a Recombinant Vaccine Against <i>Histomonas meleagridis</i> using Bacterial Expression Systems*
Biological Sciences	Introduction to Genomics and Bioinformatics for Honors Students interested in Medicine, Veterinary and Conservation Biology Science*
Chemical and Biomolecular Engineering	Cancer Research <ol style="list-style-type: none"> 1. Elucidate temporal changes in the breast tumor secretome 2. Microfluidic approach to evaluate the effect of biophysical deformation on cancer cell phenotype 3. Investigation on the role of hemp extracts on the enzymatic activity of members of the ubiquitin-proteasome system (UPS)
Chemistry	Designing Better Pharmaceuticals and Cleaning up the World!
Environmental Engineering & Earth Sciences	Beyond Tailpipes and Batteries: Comparing Tire-Wear Impacts Across Gasoline, Hybrid, Plug-in Hybrid, and Battery Electric Cars Using a Life-Cycle Perspective*
Genetics and Biochemistry	Understanding the Genetic Basis of Fungal-Bacterial Interactions during Infection
Genetics and Biochemistry	Biochemical Characterization of Mutated DNA Repair Genes
Genetics and Biochemistry	Gene Regulation during Cyst Formation in the Human Pathogen <i>Entamoeba histolytica</i>

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Department	Project Title
Genetics and Biochemistry	Role of Metabolism in the Pathogenesis of the Fungus Cryptococcus neoformans*
Genetics and Biochemistry	What Did Ancient Dogs Look Like? *
Materials Science and Engineering	Characterization of Energy Materials using 3D X-ray Imaging*
Mechanical Engineering	Cardiovascular Flow Experiments and Computational Modeling*
Mechanical Engineering	Experimental Studies on Spherical Flames: Applications in Aerospace Propulsion*
Political Science	Networks of Recognition: How Transnational Advocacy Shapes Indigenous Peoples' Rights
School of Computing	AI Research* <ol style="list-style-type: none"> 1. Privacy Compliance in IoT 2. Trustworthy AI 3. AI for Healthcare Applications
School of Computing	Bring Clemson to Life in 3D! *
School of Computing	Spam Detection using Large Language Model*



Project Title: Exploring the Adoption of Conservation Practices Among South Carolina Farmers

Mentor: Anastasia Thayer, Assistant Professor

Department: Agricultural Sciences

Delivery Option: Either In-Person or Online

Project Description:

The Climate-Smart Grown in SC program is an interdisciplinary project that incentivizes farmers to implement selected conservation practices (CS) on leafy green, peanut, and beef cattle farms across South Carolina. In addition to incentivizing adoption, the project's implementation, research, and outreach components mean that team members are also involved with measuring carbon and greenhouse gas (GHG) benefits associated with the CS practices and understanding the potential markets for the resulting commodities.

The intern(s) will work with the market development team to understand the current adoption and challenges of conservation practices on operations enrolled in the program. Using data from a survey of producers enrolled in the program, the intern(s) will summarize survey results and work with researchers to present the findings of the survey. Through this internship, students will have an opportunity to learn about agricultural systems, the relevant practices, and the benefits and challenges of adopting new production practices.

Student Involvement:

The intern(s) will analyze survey data collected from 225 South Carolina farmers to understand the motivations, challenges, and barriers to continued adoption of conservation practices. The intern(s) will work with the researchers to summarize the data and form a relevant, specific research question to be explored during the internship. Through this process, the intern(s) will learn how to 1) clean, code, and summarize survey data, 2) generate research questions, and 3) use survey data to answer research questions. By the end of the internship, the intern(s) should have a working understanding of relevant conservation practices adopted in various production systems, the benefits of adoption for ecosystem health, as well as some of the challenges with adoption. The survey questions have a wide scope and could allow students to explore a wide range of topics related to adoption, risk management, marketing and market outlets as well as environmental beliefs.

**Required Skills / Prerequisites:**

No specific skills are required to complete this project.

Expected Outcomes:

The intern(s) will: 1) analyze results of the producer survey to answer questions related to conservation practice adoption or other questions of interest, 2) synthesize findings to answer research question 3) create relevant output to communicate findings such as poster, blog post, other written material.

In a previous EUREKA! project, a student found an interesting correlation between conservation practice adoption and crop rotation for peanut producers! There are numerous projects possible using this data. We are finishing year 3 of the Climate Smart Grown in SC program. In the remaining 2 years, there are additional opportunities for engagement with students for research and continuing the project.

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Project Title: Developing a Recombinant Vaccine Against *Histomonas meleagridis* using Bacterial Expression Systems

Mentor: Zhicheng Dou, Associate Professor

Department: Biological Sciences

Delivery Option: In-Person Only

Project Description:

Histomonas meleagridis is a tiny parasite that causes "Blackhead Disease" in poultry, especially turkeys. This disease is devastating to farmers because it is highly contagious, often fatal for the birds, and currently has no approved vaccine or effective treatment. As the poultry industry grows, finding a way to protect these animals is a high priority for food security and animal welfare.

The goal of this project is to create a recombinant vaccine. Instead of using the actual parasite (which could be dangerous), we identify a group of specific, harmless proteins from the surface of the parasite that the bird's immune system can recognize. To produce enough of this protein to create a vaccine, we use a prokaryotic (bacterial) expression system. Essentially, we utilize common laboratory bacteria, like *E. coli*, to read the parasite's genetic information and mass-produce the target protein for us.

As a summer intern, the student will engage in the fundamental lab skills of molecular biology. You will learn and apply several key research techniques: (1) Transformation: introducing that DNA vector carrying the parasite's genes into bacteria, like *E. coli*, (2) Protein Induction: triggering the bacteria to begin manufacturing the vaccine protein, and (3) Analysis: using techniques like SDS-PAGE (a way to see proteins by size) to verify that our "tiny factories" successfully created the right product. By the end of the summer, you will have moved from a theoretical genetic sequence to a tangible protein candidate from the initial design to the final laboratory results.

Student Involvement:

The intern's involvement will be intensive and highly focused on the expression and analysis phases of the research. To ensure the students have concrete results for their poster by the end of the time, they will work with pre-designed



genetic constructs. Rather than spending weeks trying to build the DNA, the intern will hit the ground running by expressing the parasite's genes in *E. coli* and assessing the protein production.

The intern will be responsible for the daily "care and feeding" of their bacterial cultures and the subsequent analysis of the proteins they produce. Specifically, the student will: (1) Perform Bacterial Transformation: In the first week, the intern will physically move the vaccine DNA into *E. coli* cells and grow them on agar plates, learning how to maintain a sterile "aseptic" environment to prevent contamination, (2) Manage Protein Induction: The intern will transition to liquid cultures, monitoring the growth of the bacteria in real-time. They will be responsible for adding specific chemical triggers to "turn on" the protein production at the exact right moment, (C) Conduct Protein Analysis (The "Results"): During the final weeks, the student will break open the bacteria and use SDS-PAGE (gel electrophoresis) to separate the proteins by size. This allows them to physically see a "band" on a gel that proves the vaccine candidate was successfully created. They will finish by using a Western Blot to confirm that the protein they created is exactly what was intended.

While the intern will be at the bench performing these tasks individually, they will be embedded in the lab team's culture. They will participate in weekly "troubleshooting" sessions where they will present their data, even if an experiment didn't go as planned, to learn how scientists adjust their methods. By the end of Week 4, the intern will have a completed draft of their research poster, featuring the images of the protein gels they personally ran. This ensures they leave the internship not just with a list of skills, but with a visual representation of their contribution to the fight against Blackhead Disease, ready for presentation in the fall.

Required Skills / Prerequisites:

Students should have a strong foundational interest in biology including the "Central Dogma" of Biology: A basic understanding of how DNA is transcribed into RNA and translated into proteins. They should know that a gene is a set of instructions for a protein. Students should also know microbiology basics and understand how to use scientific units. Students should have completed high school biology or similar lab. They should be familiar with basic lab safety and common equipment like glass beakers and scales. Students will be required to maintain a detailed laboratory notebook, which is a critical professional skill. They should be comfortable using software like PowerPoint or Google Slides to organize information. Students should also have fine motor coordination for micropipetting, attention to detail, and communication skills.

Expected Outcomes:

By the end of this intensive experience, the intern will have transitioned from a classroom learner to a contributing member of a research team. The primary outcome is the mastery of a "Gene-to-Protein" workflow, a cornerstone of biotechnology.

Tangible Skills & Knowledge

- **Molecular Lab Mastery:** The intern will be proficient in aseptic (sterile) technique, precision micropipetting, and the operation of specialized equipment such as thermal cyclers (PCR), centrifuges, and Fast Protein Liquid Chromatography.
- **Protein Analytics:** They will gain the ability to run and interpret SDS-PAGE gels and Western Blots, allowing them to "see" and verify the molecular products they created.
- **Digital Research Tools:** Interns will learn to use industry-standard software like LabArchive (electronic notebook) and ImageJ (for quantifying protein bands), skills that are highly sought after in both academic and industrial labs.

Professional Outcomes

- **Presentations:** Beyond the campus poster forum, the intern will have a polished abstract and results ready for submission to the South Carolina Academy of Science (SCAS). This provides a formal line for their resume under "Professional Presentations."
- **Authorship Potential:** While this program is short, high-quality data generated by the intern may be included in future peer-reviewed publications. In such cases, the intern would be recognized as a contributing author or cited in the acknowledgments.
- **Scientific Communication:** The intern will be expected to explain the "Big Picture" of their research by translating complex vaccine design into language accessible to the general public, like their parents and friends without high-level biological sciences background.

Future Opportunities & Career Trajectory



- Completion of this project serves as a strategic "springboard" for several professional paths:
- Advanced Academic Research: This experience is designed to be a gateway. Many interns use the skills gained here to secure multi-year research positions or pursue Honors Thesis opportunities, either within my lab or in other biological science-related labs across Clemson University.

Competitive National Internships: This project provides the high-level technical foundation required for elite programs. By demonstrating a command of contemporary molecular biology, students become much more competitive candidates for prestigious external summer programs, such as SURF (Summer Undergraduate Research Fellowship), the Amgen Scholars Program, or the NIH Summer Internship Program (SIP).

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Project Title: [Introduction to Genomics and Bioinformatics for Honors Students interested in Medicine, Veterinary and Conservation Biology Science](#)

Mentor: J. Antonio Baeza, Associate Professor

Department: [Biological Sciences](#)

Delivery Option: Online Only

Project Description:

This 5-week course is designed for students who want a strong and practical introduction to bioinformatics and genomics. The course focuses on how DNA and RNA sequencing data are generated, analyzed, and interpreted. Students will learn the basics of modern sequencing platforms and gain hands-on experience analyzing real biological data using user-friendly bioinformatics tools—no prior coding experience is required.

This course is especially important for students interested in medicine, veterinary medicine, conservation, and the biological sciences. Genomics and bioinformatics are now central to understanding disease, biodiversity, evolution, and environmental change. Whether your goal is medical school, veterinary school, or a research-focused career in biology, this course will give you essential skills and confidence to succeed.

As part of the course, students will work on a small research project and produce a concrete artifact, such as a scientific poster. This poster will be presented in a scientific meeting–style setting, helping students build experience and confidence in sharing scientific results.

This course is the one you should take if you want to be competitive and successful when applying to medical school, veterinary school, or advanced programs in the biological sciences. It builds foundational skills early, demystifies genomics, and shows students how modern biology really works—through data, discovery, and clear scientific thinking.

Student Involvement:

Students in this course will be actively involved in every step of the genomic research process. This is a hands-on, project-based course, where learning happens by doing. Each undergraduate intern student will work with their own



sequencing dataset—one dataset per student—allowing them to take full ownership of a real scientific project from start to finish.

The biological datasets will come from vertebrate or invertebrate species that are either of conservation concern or are relevant to human health, such as parasites. This gives students experience working on questions that matter in the real world, including biodiversity protection and disease biology.

Throughout the course, students will (1) learn how biological samples are collected and processed through bench work, including an introduction to laboratory methods used to prepare DNA for sequencing, (2) understand how sequencing data are generated, including the principles behind modern DNA sequencing platforms, and (3) explore how raw sequencing data look and what challenges they contain.

Students will then analyze their own dataset step by step, including (1) data cleaning, to remove low-quality sequences, (2) data decontamination, to identify and remove unwanted DNA from bacteria, hosts, or environmental sources, (3) genome assembly, with special emphasis on mitochondrial genome (mitogenome) assembly, (4) genome annotation, identifying genes and functional regions, especially within the mitochondrial genome, and (5) additional analyses to describe the main features of the genome, such as gene content, genome structure, and basic evolutionary patterns.

Students will not simply follow instructions—they will be encouraged to ask questions, make decisions, and interpret results. Along the way, they will learn how scientists think, troubleshoot problems, and connect data to biological meaning.

By the end of the course, each student will have completed a full genomic analysis of their species and will use their results to create a scientific poster. This poster will communicate their research question, methods, results, and conclusions, and will be presented in a scientific meeting–style setting.

This level of involvement gives students early exposure to real research, builds independence, and provides concrete experience that strengthens applications to medical school, veterinary school, and programs in the biological sciences.

**Required Skills / Prerequisites:**

Students should have a basic understanding of biology.

Expected Outcomes:

Depending on student performance and level of engagement, students may have the opportunity to participate as a first author or co-author on a scientific publication. This level of involvement typically requires additional time beyond the course itself, often extending over multiple semesters. In such cases, students may enroll in Creative Inquiry credits under the supervision of the faculty member teaching the course to continue and formalize their research contributions.

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Project Title: Cancer Research

1. Elucidate temporal changes in the breast tumor secretome
2. Microfluidic approach to evaluate the effect of biophysical deformation on cancer cell phenotype
3. Investigation on the role of hemp extracts on the enzymatic activity of members of the ubiquitin-proteasome system (UPS)

Mentor: Adam Melvin, Associate Professor

Department: Chemical and Biomolecular Engineering

Delivery Option: In-Person Only

Project Description:

The three proposed projects will work on ongoing research in the lab which is focused on the development of novel tools and technologies to interrogate and investigate biological systems. The first two projects will focus on the development, optimization, and use of microfluidic technology to study various aspects of metastatic cancer. The first project (breast secretome) will use a microfluidic device to perform dynamic co-culture studies between cancer, stromal, and immune cells found in the breast tumor microenvironment to study how cell-to-cell communication enhances cancer metastasis and drug resistance. The second project (deformation) will leverage a microfluidic approach to determine how biophysical deformation in the vasculature alters the behavior of cancer cells after metastatic spread. Specifically, we are looking at changes in intracellular signaling and cell migration. The third project (hemp extracts) will look at the use of plant extracts as alternative therapeutics to treat enzymes associated with cancer. This project specifically evaluates how hemp and its bioactive compounds alter the activity of two enzymes associated with protein degradation.

Student Involvement:

The undergraduate interns will be directly involved in all aspects of the project including cell culture, device fabrication, experimental design, data collection, data analysis, and light microscopy. The interns will work directly with current graduate and undergraduate students working on these projects. The idea is for the interns to start working in the lab immediately after training and to directly contribute to all aspects of the project.



Required Skills / Prerequisites:

No specific skills are required to complete this project.

Expected Outcomes:

Ideally, the interns will be able to present their work at local and national meetings. Additionally, it would be great if the students continued working on the projects through the Creative Inquiry program. Prior EUREKA! students have all continued on their projects and are on track to be co-authors on the manuscripts resulting from their work.

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Project Title: [Designing Better Pharmaceuticals and Cleaning up the World!](#)

Mentor: William Pennington, Alumni Professor of Chemistry

Department: [Chemistry](#)

Delivery Option: In-Person Only

Project Description:

Our research is focused on crystal design using intermolecular contacts (hydrogen bonding and halogen bonding) to develop cocrystalline materials and deep eutectic solvents. These materials are used for various applications including remediation of toxic waste materials such as radioactive iodine and organoiodines produced in nuclear fuel processing and "forever chemicals" - perfluorinated alkyl substances (PFAS), rational modification of the properties of pharmaceuticals, and development of designer solvents (deep eutectic solvents, DES) to replace toxic organic solvents to be used in chemical synthesis and industrial processes.

Student Involvement:

Each student will be assigned a chemical system to explore under the guidance of a graduate student. The EUREKA! student will combine two materials, either by physical grinding or dissolution in solvent to grow cocrystals or produce liquid DES. Based on the observed result, the material will be characterized by X-ray diffraction analysis, spectroscopic techniques and thermal analytical methods. The student will be a "hands-on" participant in all aspects of the work.

Required Skills / Prerequisites:

No specific skills are required to complete this project.

Expected Outcomes:

Our students typically get coauthor credit on one or more papers published in peer-reviewed journals and are encouraged and supported to present their results at regional or local conferences and symposia.

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Project Title: Beyond Tailpipes and Batteries: Comparing Tire-Wear Impacts Across Gasoline, Hybrid, Plug-in Hybrid, and Battery Electric Cars Using a Life-Cycle Perspective

Mentor: Mik Carbajales-Dale, Professor

Department: Environmental Engineering & Earth Sciences

Delivery Option: In-Person Only

Project Description:

Electric vehicles (EVs) can reduce tailpipe pollution, but they may also shift some environmental impacts to other sources. One important example is tire wear—tiny particles released as tires rub against the road. These particles can contain microplastics and harmful chemicals and can travel through the air or be carried by rainwater into streams and lakes.

Building on our previous work comparing different vehicle technologies, this project extends the analysis to focus on vehicle tires and tire-wear pollution (https://e3sa.sites.clemson.edu/Projects/Vehicle_LCA.html). In this 5-week project, students will compare tire-wear pollution across gasoline cars, hybrid cars, plug-in hybrid cars, and battery electric cars using a whole-life perspective, sometimes called life-cycle assessment (LCA). This means students will be considering impacts from raw material extraction, manufacturing, and vehicle use—not just tailpipe emissions. Because EVs are often heavier due to their batteries, tire wear may be higher in some situations. At the same time, tire design, driving habits, and road conditions also influence wear. Students will conduct a literature review and build a simple comparison data table and summary figures from published studies, highlighting what we know well and what is still uncertain. As electricity gets cleaner over time, non-tailpipe impacts like tire wear may become a larger part of a vehicle’s overall environmental footprint—making this topic increasingly important to study.

Students will build core research skills, including finding reliable scientific sources, summarizing findings in clear, non-technical language, organizing data in spreadsheets, creating simple charts, and (as time allows) trying basic statistical analysis and simple whole-life comparisons (LCA-style thinking). By the end of the program, students will produce a poster summarizing what is known, what remains uncertain, and the key takeaways about tire wear as an emerging environmental issue in the transportation sector.



Student Involvement:

Interns will complete a structured, literature-based research project comparing tire-wear pollution across gasoline, hybrid, plug-in hybrid, and battery electric vehicles. They will (1) find and read reliable research articles and reports, (2) extract key values and findings into a spreadsheet (with units, study context, and citations), (3) build a simple comparison dataset and summary figures (tables/plots), and (4) create a poster that summarizes what is known, what remains uncertain, and key takeaways.

Each intern will work independently on an assigned component and contribute results to a shared spreadsheet and shared set of figures. Assigned components will be defined at the start of the program to avoid overlap and ensure each intern has clear responsibilities. Interns will meet with the mentor at least once per week for guidance, feedback, and progress check-ins.

Required Skills / Prerequisites:

Basic computer skills are expected, including comfort with spreadsheets (Excel or Google Sheets). Interns should be willing to read and summarize research articles in clear, non-technical language, keep organized notes, and carefully record sources/citations. It is preferred, but not required, for students to have experience with basic data analysis and visualization (simple charts) or introductory statistics/programming.

Expected Outcomes:

In addition to the poster, interns will produce a well-organized spreadsheet dataset summarizing published research on tire-wear pollution (with units, context, and citations) and a brief written summary of key findings and uncertainties. Interns will learn how to find and evaluate reliable sources, summarize research in clear non-technical language, organize data, and create simple charts; as time allows, they will also gain introductory exposure to basic statistics and life-cycle assessment (LCA) methods.

After the program, interested students may have opportunities to continue with our research group during the academic year (depending on project funding) and potentially develop their work into a conference poster, an undergraduate research presentation, or contributions to a future journal paper.

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Project Title: Understanding the Genetic Basis of Fungal-Bacterial Interactions during Infection

Mentor: Stephen Dolan, Assistant Professor

Department: Genetics and Biochemistry

Delivery Option: In-Person Only

Project Description:

Fungal infections have a major impact on human health and global agriculture, yet we still know surprisingly little about how fungi actually function. How do they find nutrients? How do they cause disease? How do they interact with other microbes? These unanswered questions make fungal biology an exciting and rapidly growing field of research.

Our lab studies how microbes behave during infection, with a focus on uncovering the specific roles of individual genes. We are particularly interested in respiratory infections in people with cystic fibrosis (CF). In CF, thick mucus in the lungs creates an environment where bacteria and fungi can thrive and interact in complex ways. Two key players we study are the fungus *Aspergillus fumigatus* and the bacterium *Pseudomonas aeruginosa* — organisms that frequently co-infect CF patients and influence each other's behavior.

As an undergraduate researcher in this EUREKA! project, you won't just follow a recipe — you'll contribute to real scientific discovery. You will: (1) analyze gene expression data from infection sites, (2) identify new genes that may play a role in microbial interactions, (3) design and perform laboratory screening assays to test gene function, and (4) learn modern genetic and microbiology techniques.

This experience will give you hands-on training in data analysis, experimental design, and molecular biology while helping answer important questions about how microbes interact during infection. If you're curious about genetics, microbiology, infectious disease, or biomedical research, this is an opportunity to be part of meaningful, cutting-edge science early in your undergraduate career.

Student Involvement:

Undergraduate interns will participate in a structured, team-based research project focused on identifying and characterizing microbial genes involved in fungal–bacterial interactions during respiratory infection.



Students will work in small teams, but each intern will be responsible for 1–2 specific candidate genes and will generate their own dataset.

Students will analyze pre-generated RNA-seq data from infection models, identify differentially expressed genes in *Aspergillus fumigatus* or *Pseudomonas aeruginosa*, and conduct a literature review and functional annotation. Then, they will select 1–2 candidate genes for testing. Students will construct or obtain gene deletion/overexpression strains and perform PCR and gel electrophoresis to confirm genetic changes. Next students will perform growth, stress response, biofilm, and/or co-culture interaction assays. They will then collect quantitative data and analyze results to prepare for their final presentation.

By the end of the program, each intern will have taken a gene from computational identification to experimental functional testing, contributing directly to ongoing lab research.

Required Skills / Prerequisites:

No specific skills are required to complete this project.

Expected Outcomes:

By the end of the program, interns will be able to analyze RNA-seq gene expression data and identify candidate genes, use basic bioinformatics tools for gene annotation and literature review, perform core molecular biology techniques (PCR, gel electrophoresis, strain validation), conduct microbial growth and interaction assays, analyze quantitative data and generate publication-quality figures, and present scientific results clearly in written and oral formats. Students will also gain experience in experimental design, troubleshooting, and collaborative research.

After the project, student-generated data may contribute to ongoing manuscripts. Continued involvement in the lab may lead to conference presentations or co-authorship on publications. Students may have opportunities to remain in the lab for future research or honors thesis work. Participants will be well positioned for strong letters of recommendation and competitive applications to graduate, medical, or professional programs.

Overall, interns will leave with meaningful research experience and practical skills in microbial genetics and infection biology.

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Project Title: [Biochemical Characterization of Mutated DNA Repair Genes](#)

Mentor: Michael Sehorn, Associate Professor

Department: [Genetics and Biochemistry](#)

Delivery Option: In-Person only

Project Description:

The focus of the research in the Sehorn lab involves the DNA repair proteins that promote genome stability. We have a number of DNA repair proteins in the lab that we are interested in understanding how they contribute to the maintenance of the genome. We introduce mutations into the genes that encode the DNA repair proteins, we express and purify the variant proteins and determine the effect of the mutation on the activity of the DNA repair protein. To do this, we perform multiple types of experiments that test different activities of the DNA repair proteins.

Student Involvement:

The overall plan of a project in the Sehorn lab starts with the student doing polymerase chain reaction (PCR) to amplify a DNA repair gene. The student will use PCR to introduce a specific mutation into the DNA repair gene. After sequencing the mutated gene to ensure the mutation is present, the student will optimize expression of the DNA repair protein encoded by the mutated gene. If time permits, the student will purify the variant DNA repair protein and perform biochemical assays on this protein. The results of these experiments will be compared to the results of the unmutated DNA repair protein. This will allow the student to determine if the mutation they introduced into the gene resulted in a protein that has altered activity. The student will work with a teammate, but each person will do the experiments individually.

Required Skills / Prerequisites:

No specific skills are required to complete this project.

Expected Outcomes:

After the EUREKA! program is over, the student will have the opportunity to continue conducting research in the lab until they graduate from Clemson University. The short-term goal for the EUREKA! student is for them to get acquainted with the lab and learn some lab techniques. The long-term goal for the student after EUREKA! program is over, is to have the student work on a project, completing a significant amount of research that could be a part of a manuscript



that is submitted for peer review and publication. If the student enjoys the research and gets along with the people in the lab, we will ask the student to join the lab for the entire time.

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Project Title: [Gene Regulation during Cyst Formation in the Human Pathogen Entamoeba histolytica](#)

Mentor: Cheryl Ingram-Smith, Associate Professor

Department: [Genetics and Biochemistry](#)

Delivery Option: Online Only

Project Description:

Entamoeba histolytica is a pathogen that causes amoebic dysentery in ~100 million people each year. It has two forms, the infectious cyst and the growing amoeba. The amoebas grow in the large intestine and can convert to the cyst form, which are then shed into the environment in feces to spread disease through contaminated food and water. My lab studies how Entamoeba converts between these two forms. We are particularly interested in how this is triggered and what genes play a role early in the conversion of amoeba to cyst. A key trigger seems to be lack of glucose, a nutritional stress. Results from the scientific literature suggest that other stresses may also be able to trigger cyst formation, or at least some aspects of it. We have a large data set showing which genes are turned up and which genes are turned down early during cyst formation. There are also data sets showing genes that are turned up or down under certain stress conditions. The EUREKA! student will work with these data set to find genes that are turned up during both cyst formation and other stress conditions to help us define the link between cyst formation and stress response.

Student Involvement:

The EUREKA student will work with me online to delve into the gene expression data sets to identify genes that are upregulated during cyst formation and under other stresses. The student will then delve deeper into genes of interest to help identify a potential role. For instance, they will figure out whether there are similar genes in other pathogens that can form cysts, look through the scientific literature to understand what similar genes do in other organisms, etc. This will be a guided investigation that allows the student the freedom to follow interesting leads and propose new ideas for how this process works.

Required Skills / Prerequisites:

No specific skills are required to complete this project.



Expected Outcomes:

The student may have the opportunity to continue on this project, either through computer work or in the lab doing wet-lab experiments.

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Project Title: Role of Metabolism in the Pathogenesis of the Fungus *Cryptococcus neoformans*

Mentor: Kerry Smith, Professor

Department: Genetics and Biochemistry

Delivery Option: Online Only

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 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.

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 carbon 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 program, the mentor will discuss possible projects and the student intern will have the opportunity to choose their favorite.

Required Skills / Prerequisites:

Students should have basic biology and chemistry knowledge as well as general computer knowledge.

Expected Outcomes:

The goal of the EUREKA! internship in the Smith laboratory is to result in an increased interest for research. The expected outcome is that the intern will present their research to the scientific community. First, the intern will have the opportunity to present (talk or poster) their research at national scientific conferences such as the annual Cellular Biology of Eukaryotic Pathogens held at Clemson in October. Second, the expectation is that the intern's research will be published on its own or as part of a greater study. These opportunities will help the student as s/he pursues a career in research and/or medicine. Finally, the student's research will also assist my laboratory in gaining and/or sustaining federal research funds.

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Project Title: [What Did Ancient Dogs Look Like?](#)

Mentor: Kelsey Witt Dillon, Assistant Professor

Department: [Genetics and Biochemistry](#)

Delivery Option: Online Only

Project Description:

Most of the genetic variants that contribute to the differences we see in modern dogs (coat color, fur texture, ear shape, and more) are well-known. People have sequenced the genomes of ancient dogs from all over the world, many of them thousands of years old, but focus more on the big picture of how they relate to other dog populations and less on what they looked like. Do they share genetic variants with living dogs, or have changes to their genes that are different? Do they look like modern dog breeds, or something totally new? The goal of this project is to find out!

Student Involvement:

Interns will use research publications and online resources to create a list of genes of interest and the genetic variants of those genes that cause phenotypic variation in modern dogs. Interns will then use the UCSC genome browser to identify the genomic positions these variants are located at. Interns will then use common genomic tools to process a variant call file (VCF), one of the most common ways to store large amounts of genomic data and identify which of the ancient individuals (and some modern breed dogs) have which variants. If any of the ancient dogs have genetic variants at these genes, interns will examine whether these variants would have a possible impact on gene function using computational genomic tools.

Required Skills / Prerequisites:

Basic knowledge of genetics (base pairs, inheritance, heterozygosity vs. homozygosity) is important. Knowledge of programming (any language/experience level) is also a plus but not required.

Expected Outcomes:

Students will learn about dogs, dog domestication, and the genetics underlying dog phenotypes. Students will gain familiarity with working on a computational cluster, large genomics datasets, and some common genomic analysis tools. Students will also gain presentation skills including making figures in R (a mathematical programming language). This work can be built on beyond the summer and could result in scientific publications! [Back to Index](#)



Project Title: [Characterization of Energy Materials using 3D X-ray Imaging](#)

Mentor: Dong Hou, Assistant Professor

Department: [Materials Science and Engineering](#)

Delivery Option: Either In-Person or Online

Project Description:

This project develops advanced three-dimensional (3D) X-ray imaging methods to characterize ceramic-based energy materials and clarify structure-property relationships governing performance and degradation in electrochemical energy storage systems. High-performance batteries and related devices require precise control of synthesis, processing, and microstructural evolution. However, key mechanisms, such as phase transformations, intercalation-induced strain, particle fracture, and interfacial reactions, occur within complex 3D architectures that are not fully captured by conventional two-dimensional techniques.

The objective is to establish a nondestructive 3D imaging framework capable of resolving particle-scale and microstructural changes during processing and electrochemical cycling. Quantitative analysis will measure porosity, particle size distribution, crack propagation, and interface characteristics to identify degradation pathways. Research activities include sample preparation, high-resolution data acquisition, image reconstruction, segmentation, and statistical analysis. Research activities will be conducted primarily in the PI's laboratory and the X-Ray Advanced Imaging of Materials and Structures (X-ray AIMS) Lab at the Advanced Materials Innovation Complex (AMIC) at Clemson University. Outcomes will enhance understanding of failure mechanisms and support process optimization, quality control, and the design of more durable, high-efficiency energy storage materials.

Student Involvement:

The project combines structured laboratory work with quantitative data analysis in a clearly defined framework. Tasks are modular, including sample preparation, imaging acquisition, reconstruction, and analysis. It will allow progressive skill development while contributing to research objectives. The visual nature of 3D imaging facilitates rapid understanding of structure–property relationships. With supervision, an intern can assist in experiments, process datasets, and support interpretation.

**Required Skills / Prerequisites:**

Preferred preparation includes coursework in materials science, physics, chemistry, mechanical engineering, or related STEM disciplines. Familiarity with laboratory safety, microscopy concepts, or data analysis tools (e.g., MATLAB or Python) is beneficial but not required.

Expected Outcomes:

The intern will gain hands-on experience in 3D X-ray materials characterization, including sample preparation, imaging parameter optimization, and laboratory safety practices. The experience provides direct exposure to advanced instrumentation, interdisciplinary collaboration, and experimental design. Participation in data interpretation and technical discussions will strengthen analytical and communication skills, preparing the student for graduate study or careers in energy, manufacturing, and advanced materials research.

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Project Title: [Cardiovascular Flow Experiments and Computational Modeling](#)

Mentor: Ethan Kung, Associate Professor

Department: [Mechanical Engineering](#)

Delivery Option: Either In-Person or Online

Project Description:

Projects range between benchtop-experimental and computational modeling of the cardiovascular system and related medical devices. The projects can involve conducting experiments relating to the cardiovascular system. The setup of a suitable testing environment for medical devices may involve the use of actuators and sensors, and the creation of 3D computer models of patient anatomy. Students may work to calibrate, prototype, and test devices that can improve the capabilities of a benchtop experiment which generates realistic pressure and flow waveforms mimicking human cardiovascular system. The ultimate purpose of such experiments is to provide a realistic benchtop environment that can be used to test cardiovascular medical devices and surgeries. The project may extend to computational modeling and machine learning data analysis of the cardiovascular system and related medical devices.

Student Involvement:

In-person students will learn about how to conduct benchtop flow experiments and carry out technical work relating to obtaining accurate flow and pressure measurements, and prototyping solutions for how to generate proper pressure and flow in experiments. They will implement a combination of actuators and sensors to realize the design solution in a physical construction of the device prototype.

Remote/online participants will perform computational modeling, simulations, and data analyses to answer scientific or clinical questions. The computational models that we employ include low-order circuits models to high-order 3D finite element models, as well as machine learning models.

Both in-person and online students will work individually or as teams depending on the project scope, meet weekly with the research supervisor, and present their findings through a poster presentation at the end of the summer program.

**Required Skills / Prerequisites:**

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 Python or similar platforms.

Expected Outcomes:

Students will develop hands-on research experience in cardiovascular biomedical engineering. They will gain competency in experimental methods, computational modeling, and/or data analysis depending on their project focus. In-person students will learn laboratory skills including working with sensors, actuators, flow measurement systems, and pressure measurement equipment. Online students will develop skills in computational modeling, scientific programming, and data analysis.

All students will learn how to present their research findings through poster presentations and potentially at professional meetings such as the SC Academy of Science. Students will have the opportunity to continue their research through Creative Inquiry or summer research programs after the EUREKA! program concludes. Depending on the progress and quality of work, students may contribute to research publications or conference presentations.

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Project Title: [Experimental Studies on Spherical Flames: Applications in Aerospace Propulsion](#)

Mentor: Yuhao Xu, Assistant Professor

Department: [Mechanical Engineering](#)

Delivery Option: In-Person Only

Project Description:

This project allows students to engage in hands-on research in liquid fuel combustion, critical technologies for future aerospace propulsion and space exploration, aligning with challenges faced in missions like NASA's Lunar and Martian exploration efforts. As space missions become increasingly complex, understanding combustion processes and waste management in reduced-gravity environments is critical to advancing propulsion systems and ensuring sustainable space habitats. By studying the combustion of liquid fuels (e.g., Sustainable Aviation Fuels) in high pressure, they will explore ways to improve performance and reduce emissions in propulsion systems. Through innovative experiments, students will study how pressure, temperature, and gravity affect combustion and oxidation processes. They will gain valuable skills in experimental design, data analysis, and scientific communication while contributing to research with real-world applications. This project will prepare students for successful careers in engineering, research, and space technology.

Student Involvement:

Students will begin with an introduction and literature review. They will learn the fundamentals of droplet combustion, supercritical oxidation, and their relevance to aerospace propulsion and waste reclamation for space exploration. Secondly, they will explore lab safety and equipment training where they will gain hands-on experience with combustion experimental setup, safety protocols, and equipment handling. Next they will work in teams to design initial experiments, including fuel selection and parameter identification (e.g., pressure, temperature, fuel compositions). They will then calibrate instruments like cameras, temperature sensors, and pressure gauges to ensure accurate data collection and conduct preliminary fuel testing via small-scale tests on various liquid fuels, such as Sustainable Aviation Fuels (SAFs), to qualitatively observe combustion and oxidation dynamics. Finally, they will analyze initial results to obtain quantitative measurements, review initial results with the team and discuss potential modifications to improve the experiment design.



Required Skills / Prerequisites:

Students should have a solid understanding of high school physics.

Expected Outcomes:

Interns can work on conference presentations and/or journal publications with doctoral students. After EUREKA! they can continue to do research in our lab as undergraduate researchers or potentially intern at NASA Glenn Research Center as an undergraduate student.

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Project Title: Networks of Recognition: How Transnational Advocacy Shapes Indigenous Peoples' Rights

Mentor: Tara Trask, Senior Lecturer

Department: Political Science

Delivery Option: Either In-Person or Online

Project Description:

What is the status of indigenous rights around the world? What are the consequences? How do we improve outcomes for indigenous peoples around the world, given the complexity of political, social, logistical, and environmental factors? Various case studies have begun to explore the realm of indigenous rights and how it may be similar to and different from other areas of where human rights organizations advocate internationally. Yet, the extent to which these advocacy networks produce measurable improvements in indigenous peoples' rights protections remains contested. This project examines how networks of human rights organizations (HROs) influence the adoption and implementation of Indigenous rights at the national level. What works? What gets ignored? How do these organizations strategize for best effect?

This project builds a new dataset of HRO advocacy on indigenous rights issues. This allows for new quantitative (statistical analysis) on HRO framing of the issue or other strategies and the impact on legal recognition, land rights protections, and other indigenous rights' outcomes. By identifying the conditions under which advocacy networks are most effective, the project contributes to broader debates in international relations and comparative politics about how non-state actors influence behavior and the diffusion of human rights norms. It also provides insight into the mechanisms through which indigenous movements leverage global networks to secure domestic political change.

Student Involvement:

The student will help develop, compile, and code a dataset on human rights organizations' (e.g. Human Rights Watch) advocacy on indigenous rights issues. Weekly meetings will have two components: a) Updating on the practicalities of the dataset being coded and how the coding scheme might need to be adjusted for better relevance to the research



goals, b) Exploration of the particular research paper/project that will utilize this data. The latter will be adjusted based on the research intern(s) particular interests within the realm of indigenous rights / global human rights advocacy.

Required Skills / Prerequisites:

No specific skills are required to complete this project.

Expected Outcomes:

Intern(s) will be well-versed in the practicalities of quantitative political science research, including synthesis of existing literature, data collection, and statistical analysis. Students will become familiar with using software for data analysis (either R or STATA). Students could plan to continue developing their project to present at professional political science conferences (e.g. the Midwest Political Science Association Annual Meeting).

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Project Title: [AI Research](#)

1. Privacy Compliance in IoT
2. Trustworthy AI
3. AI for Healthcare Applications

Mentor: Long Cheng, Associate Professor**Department:** [School of Computing](#)**Delivery Option:** Either In-Person or Online**Project Description:**

Privacy Compliance in IoT: Many open platforms across web, IoT, virtual reality, and autonomous vehicle domains allow third-party developers to publish apps in various marketplaces. These apps often collect large amounts of personal data, making compliance with privacy regulations (e.g., GDPR, HIPAA, and CCPA) and proper user consent essential. Software developers should provide transparent privacy policies describing data collection purposes, scope, and retention. Privacy non-compliance can result in significant fines. In this project, students will conduct a privacy compliance analysis of selected platforms, such as the Chrome Web Store, Amazon Alexa Skills Store, and Samsung SmartThings App Store.

Trustworthy AI: Artificial Intelligence (AI) is increasingly used in safety- and security-critical domains such as healthcare, autonomous systems, and cybersecurity. However, AI systems often suffer from issues related to privacy leakage, adversarial vulnerabilities, and lack of interpretability, raising concerns about their trustworthiness. In this project, students will conduct hands-on research on topics such as AI robustness against adversarial attacks, privacy-preserving machine learning, and explainable AI techniques.

AI for Healthcare Applications: Artificial Intelligence (AI) is increasingly prominent in healthcare, with the potential to improve disease diagnosis, treatment planning, and patient care. Generative AI models, such as large language models (LLMs), have demonstrated strong clinical knowledge and are emerging as valuable tools for healthcare applications. In this project, students will investigate the capabilities and limitations of AI for healthcare applications.

**Student Involvement:**

Privacy Compliance in IoT: Students will conduct a privacy compliance analysis of selected platforms.

Trustworthy AI: Students will analyze real-world AI models and datasets, implement experimental frameworks, and evaluate the trustworthiness of AI systems in selected application domains.

AI for Healthcare Applications: Students will investigate the capabilities and limitations of AI for healthcare applications.

Required Skills / Prerequisites:

Students should have a basic knowledge of Python.

Expected Outcomes:

The research work may lead to a paper publication. Students may also continue to conduct research with the lab after EUREKA!

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Project Title: [Bring Clemson to Life in 3D!](#)

Mentor: Siyu Huang, Assistant Professor

Department: [School of Computing](#)

Delivery Option: Either In-Person or Online

Project Description:

Have you ever wondered how movies and video games create lifelike 3D worlds? In this project, you'll dive into Novel View Synthesis (NVS), an exciting field of 3D computer vision that turns regular photos or videos taken by your smartphone into 3D scene models. You'll start by learning the basics of how computers "see and understand" the world in 3D and get hands-on experience with cutting-edge tools and software. Then, you'll take photos of landmarks and objects on Clemson's campus by yourself. Using the learned skills, you'll transform those images into 3D models. The resulting 3D models will be visualized in simulators such as Unreal Engine, where students will present their work and explore interactive 3D environments.

Student Involvement:

Students will learn basic 3D vision knowledge and try 3D deep learning software/tools individually, work in a team to take photos on Clemson campus and build photorealistic 3D models.

Required Skills / Prerequisites:

Basic knowledge in deep learning and Python are recommended but not necessary.

Expected Outcomes:

Students will present 3D demos in the presentation, and potentially submit papers to AI conferences/journals. Excellent students are welcome to work in Dr. Huang's lab after the summer.

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Project Title: [Spam Detection using Large Language Model](#)

Mentor: Kai Liu, Assistant Professor

Department: [School of Computing](#)

Delivery Option: Either In-Person or Online

Project Description:

In this project, we are going to use modern AI tools -- large language models (LLMs) for spam detection. Different from traditional machine learning models such as Naive Bayes, Logistic regression, LLM-based method has the potential to achieve state-of-the-art performance. By implementing the model and comparing with other methods, intern students will find the power of LLMs and AI.

Student Involvement:

Intern(s) will use pretrained LLMs such as GPT-2, Qwen for spam detection by using finetuning, in addition to comparison with other methods (non LLM-based).

Required Skills / Prerequisites:

Students should have a basic knowledge of Python or being willing to learn how to use it.

Expected Outcomes:

The intern(s) has chance to share their research in the form of a paper at a workshop or conference.

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