First Year Fralin Undergraduate Research Fellowship Projects List

Thank you for your interest in the First Year FURF Program, designed to provide first year students early exposure to research in your chosen discipline! Below you'll find the list of projects you can express your interest in when submitting your application. Students from all majors are welcome to apply, and **you may select projects from outside your major/college.**

Projects Organized by College

College of Agriculture & Life Sciences Projects

ID Number: 1

Academic College: Agriculture and Life Sciences

Research project title: Imitation Learning for Robotics through Vision-Language-Action Models

Description of project: This project develops low-cost automation solutions for agriculture using imitation learning techniques. Students will work with vision-language-action (VLA) models that learn agricultural tasks by observing human demonstrations. The research focuses on creating robotic systems that can understand visual scenes, interpret natural language instructions, and execute appropriate actions for tasks like crop monitoring, selective harvesting, or pest identification. By combining computer vision, natural language processing, and robotics, this project aims to make agricultural automation more accessible to small-scale farmers through cost-effective, adaptable robotic solutions that can learn new tasks without extensive reprogramming.

Research goals: Students will embark on a comprehensive journey into cutting-edge AI and robotics research, gaining hands-on experience with technologies that represent the future of agricultural automation. The research experience begins with building foundational understanding of machine learning principles, particularly focusing on imitation learning and reinforcement learning techniques that enable robots to learn from human demonstrations. As students progress, they will delve into computer vision methods specifically designed for agricultural environments, learning how machines can interpret complex visual scenes involving crops, soil conditions, and farming equipment. The project offers extensive exposure to natural language processing techniques that allow robots to understand and respond to human instructions, bridging the gap between human intuition and machine execution. Students will gain practical programming experience in robot control systems, learning how to translate high-level decisions into precise mechanical actions. Throughout the research, students will develop critical skills in data collection and preprocessing, understanding how real-world agricultural data must be gathered, cleaned, and structured for machine learning applications. Beyond technical skills, students will engage in comprehensive literature review of current vision-language-action models and agricultural robotics research, developing the ability to synthesize existing knowledge and identify research gaps. They will learn experimental design principles and hypothesis testing methodologies while building competency in data analysis and visualization techniques essential for research communication. The experience includes substantial technical writing and presentation opportunities, preparing students for future academic and

professional endeavors. The practical dimension of the research ensures students understand real-world constraints in agricultural automation, learning to balance theoretical possibilities with economic realities and practical limitations. Students will work toward developing solutions that prioritize cost-effectiveness and accessibility, considering how advanced AI technologies can benefit small-scale farming operations rather than only large industrial agriculture.

Mentoring style: I approach mentorship as a collaborative partnership designed to foster intellectual curiosity, technical competence, and research independence while providing the support structure necessary for meaningful learning. My mentoring philosophy centers on creating an environment where students feel empowered to explore complex ideas, take calculated risks, and develop confidence in their ability to contribute to cutting-edge research. The mentoring structure begins with weekly one-on-one meetings where we discuss progress, address challenges, and plan next steps in detail. These sessions provide dedicated time for deep technical discussions, troubleshooting experimental difficulties, and exploring broader implications of the research. I supplement these individual meetings with bi-weekly group sessions that include other lab members, exposing students to diverse perspectives and fostering collaborative problem-solving skills. Monthly milestone reviews provide opportunities to step back from day-to-day tasks and assess overall progress while adjusting goals based on emerging interests and discoveries. My hands-on guidance philosophy emphasizes scaffolded learning, beginning with intensive support during initial weeks as students build foundational knowledge through carefully selected tutorials and readings. I work closely with students during this period, engaging in collaborative coding sessions that build technical skills while demonstrating professional development practices. As students gain confidence and competence, I gradually transition toward supporting independent problem-solving while maintaining availability for guidance and support. This approach includes joint troubleshooting sessions where we work together to overcome experimental challenges, treating obstacles as learning opportunities rather than frustrations. Professional development forms an integral component of my mentoring approach, with opportunities for students to present their work at lab meetings and potentially at academic conferences. I provide detailed guidance on technical writing and research communication, helping students develop skills essential for academic and professional success. The mentoring relationship includes discussions of research ethics and responsible AI development, ensuring students understand the broader implications of their work. I actively facilitate networking opportunities within the agricultural robotics community, helping students build professional relationships that extend beyond our immediate research collaboration. Throughout the mentoring relationship, I maintain regular check-ins about academic balance and overall well-being, recognizing that research

success depends on students' holistic development. I work to provide flexible scheduling that accommodates course loads and personal commitments while maintaining research momentum. My mentoring approach is inherently personalized, adapting learning experiences based on individual student interests, career goals, and learning styles.

E**xperience or skills needed:** Understanding that this program specifically targets first-year students with limited research experience, I prioritize enthusiasm, intellectual curiosity, and foundational aptitude over specific technical expertise. The ideal student candidate demonstrates strong performance in introductory programming courses, with Python experience preferred but proficiency in any programming language providing adequate foundation for success. Mathematical preparation including exposure to calculus and linear algebra proves helpful for understanding machine learning concepts, though these skills can be developed during the research experience for motivated students. Most importantly, I seek students with genuine interest in robotics, artificial intelligence, or agricultural applications, recognizing that passion for the subject matter drives learning more effectively than prior experience. Students who demonstrate curiosity about how technology can address real-world problems and improve people's lives tend to thrive in this interdisciplinary research environment. The ability to think systematically about complex problems while maintaining enthusiasm for learning through trial and error represents essential qualities for research success.

Restrictions or time constraints for this project: There is no specific restrictions on time. It is anticipated to remotely work 5 hours/week

ID Number: 3

Academic College: Agriculture and Life Sciences

Research project title: Measuring the biostimulant effect of amino acids on the growth of plants

Description of project: Biostimulants are products used in agriculture to increase crop resilience and production. Yet, their mode of action remains unclear. This project aims to identify the conditions in which amino acids (brought as protein hydrolysates) have a biostimulant effect on the growth and drought resistance of soybeans and the model plant Arabidopsis. Plants will be sown on soil, regularly treated with amino acids, and response will be measured as leaf surface area and plant dry weight at the end of the experiments.

Research goals: The student will learn how to grow plants for research, acquire (measurements) and analyze data (statistics), formulate hypotheses that will be tested in subsequent experiments.

Mentoring style: I will directly supervise train and guide the student for the experiments to be performed. I expect the student to take ownership of the project and will welcome suggestions and ideas to set up the experiments.

E**xperience or skills needed:** No specific skills are required; only motivation and thriving for acquiring high quality data and paying attention to details.

Restrictions or time constraints for this project: Ability to work 3 times per week to take care of the plants and for data acquisition.

ID Number: 10

Academic College: Agriculture and Life Sciences

Research project title: Non-destructive sensing and robotic automation for intelligent seafood processing

Description of project: This research will dive into AI-driven sensing and automation using hyperspectral imaging and robotics, to improve the labor efficiency and production consistency of seafoods.

Research goals: 1. Develop machine learning pipelines for hyperspectral imaging processing 2. Validation of model performance using lab data for seafood quality and safety sensing. 3. Engage with stakeholders to disseminate the findings to the industry need and

Mentoring style: Weekly meetings will be setup to guide students through this process and provide technical training as needed.

E**xperience or skills needed:** Basic python programming is preferred but not required.

Restrictions or time constraints for this project: No restrictions in time and scheduling, flexible depending on student's weekly course load.

ID Number: 11

Academic College: Agriculture and Life Sciences

Research project title: Advancing holistic well-being in community and academic settings

Description of project: Depending on the student's background and desired training and skills, they would be matched within one of several evidence-informed or evidence-based programs my lab is developing, adapting, testing, and scaling. They would be responsible for adapting program materials, attending sessions and contributing to implementation fidelity checks as well as attendance tracking and follow up emails; data collection (and where feasible, analysis).

Research goals: They can expect to learn teamwork, professional development (interfacing with community participants), and application of classroom learnings to program materials. They may also have the opportunity to learn mixed methods data collection (e.g., administering and analyzing Flourishing Index, Yoga Self Efficacy Scale and 1:1 interviews or focus groups).

Mentoring style: I would interview the student for them to learn about the lab ethos and projects; the entire lab meets monthly for cohesion building, professional development, and project updates; the students meet with PhD students or my program manager weekly.

E**xperience or skills needed:** Self reflection, time management, strong communication skills (predominantly written)

Restrictions or time constraints for this project: No, our work is mostly virtual with the exception of in person monthly lab meetings.

ID Number: 14

Academic College: Agriculture and Life Sciences

Research project title: Civic Well-Being Literature Review

Description of project: Student will review existing literature on civic well-being, at the community level. These may be efforts to enhance citizenship skills; grow civic identity; understand policy; engage with issues; participate in service and leadership; strengthen communities; and better enable people to converse, collaborate, and act collectively for the common good. Students will categorize findings, highlight research-based practices, and organize findings in a white paper with an associated inventory or matrix. The findings will inform future program development in Virginia Tech Outreach, and Virginia Cooperative Extension.

Research goals: Students will learn to perform a systematic literature review, using multiple sources, to identify themes, to distinguish and sort information that is evidence-based, and to prepare information for multiple audiences.

Mentoring style: I have a long history of mentoring students, and we regularly work with graduate and undergraduate students on projects, and in the classroom. We will meet to clarify expectations, schedule regular check-ins, identify ways to share data and documents, and clarify final deliverables.

E**xperience or skills needed:** Students should have an interest in civic life, community issues, public policy, or related areas. Students should have good basic research skills (even if simply the ability to gather information on a topic across multiple sources and draw conclusions). Good comprehension and writing skills will be useful (the ability to review source documents or web-based resources and write a concise summary)

Restrictions or time constraints for this project: No. Flexible.

ID Number: 29

Academic College: Agriculture and Life Sciences

Research project title: Dissecting Plant Science: Propagation of embryogenic callus for enhancing single-cell regeneration

Description of project: Embryogenic callus consists of rapidly dividing totipotent cells capable of regenerating whole plants. In our lab, we induce embryogenic calli from Arabidopsis thaliana seeds germinated on nutrient medium, followed by dissection to isolate the embryogenic tissue. We hypothesize that incorporating this tissue into our single-cell regeneration protocol will significantly improve regeneration efficiency, providing a more robust platform for plant developmental studies and genetic engineering.

Research goals: The student will be responsible for creating and maintaining a pipeline of embryogenic calli for use in the lab's single-cell regeneration work. The student will learn sterile technique, microscopy, nutrient medium preparation, lab notebook management, and scientific communication skills. There will be an opportunity to present their work in lab meetings and/or at the Dennis Dean Undergraduate Research and Creative Scholarship Conference as a poster. Additionally, there is potential for the student's involvement on a single-cell regeneration project.

Mentoring style: Mentorship will begin with hands-on, one-on-one training until the student feels confident working independently. Daily check-ins at the start or end of each lab day will provide space for setting goals, reviewing progress, and addressing questions. I view mentorship as a collaborative process that goes beyond teaching protocols, I aim to help students understand not just "what" they're doing or "how", but "why" each step matters. Within this project, I want the student to develop both technical skills and critical thinking.

E**xperience or skills needed:** The ideal student will be curious, self-motivated, and open to learning through both guidance and independent exploration. I encourage questions and aim to foster a supportive environment, but it's important that the student feels comfortable not knowing everything and sees uncertainty as a natural part of the research process.

Restrictions or time constraints for this project: This project is best suited for a student who can commit to spending 2–3 consecutive hours in the lab at least once a week to perform callus dissections.

ID Number: 34

Academic College: Agriculture and Life Sciences

Research project title: Timing is Everything: Smart Pest Management in Horticulture

Description of project: Insects go through specific annual phenological events in relation to cumulative growing-degree days since diapause. The growing degree-day / developmental stage relationship has been developed for many significant pests. One major challenge in pest management is predicting when pest insects will go through the specific stage of development at which they can be targeted by insecticides or other control methods, as it depends on local weather conditions. This research aims to develop a spreadsheet model to predict when significant developmental stages of pests are locally present to increase the efficacy of chemical control or employ less environmentally hazardous control methods.

Research goals: In basic science, the student will learn about the developmental processes of insect pests and horticultural plants in relation to temperature. In applied science, the student will learn about various chemical and physical control methods, and the importance of timing the control method to when the application will be effective based on the development of the insect. The student will also learn about data collection and targeting presentation of data to the audience.

Mentoring style: I believe that students thrive when they have a well-rounded understanding of the research program and the importance of the outcome to stakeholders. Similarly, it is important for them to feel included and valued in their contribution. I would start mentoring by explaining the project and see what information might help them understand the research goals. From there I would encourage them to look at some resources to get them familiar with insect pests, horticultural plant species, and fundamentals of chemical control depending on their needs. I would encourage them to ask questions for their understanding as well as to strengthen the research. For mentoring outside of the specifics of this research, I have a background in natural resources, ecology, pest management, and agriculture and I enjoy sharing the diversity of educational experiences, careers, and projects that have shaped my journey.

E**xperience or skills needed:** It would be good if the student had some experience in identification of common horticultural plant species (eg boxwood, crape myrtle, redbud), and willingness to go to the field to observe plants and insects/insect damage. Many of the species of interest are present on campus.

Restrictions or time constraints for this project: There are no real time constraints, the student can do the data model verification and computer work any day.

ID Number: 42

Academic College: Agriculture and Life Sciences

Research project title: Ticks as vectors of disease

Description of project: Identification of ticks as vector

Research goals: The students will focus on ticks that can serve as arthropod vectors of diseases such as Lyme disease or tick-borne viruses. Initially (due to the start of the Spring semester being in winter months) this will be lab-based, with specific research goals aimed at competency using a microscope, dichotamous keys, and learning to identify biobanked specimens of different species and life-stage, and understand how we process them. Into the warmer months of the Spring semester, the student will be involved in field collections of ticks from the environment, with the specific research goal of basic field skills, understanding the principles of biological survey and sample recording and storage. The labwork will be conducted in a BSL-2 laboratory, and thus appropriate online training for Environmental Health and Safety should expected and competency of the student to work safely demonstrated..

Mentoring style: The first-year research student will keep a log of activities performed and skills learnt, meeting with the mentor (either the lab PI or postdoc) each week. Mentorship is a key opportunity for mentees to learn under guidance, receive feedback, perspective and assistance, while mentors can learn from the interests and challenges faced by students and share expertise and knowledge. I thus view mentorship as a two-way process. The aims for this specific project are to foster an interest in research and vector-borne disease for students with no previous research experience; the hope is that they gain new skills, insight, share their progress, and contribute to being part of an active research lab.

E**xperience or skills needed:** Attention to detail, Reliability, Interest in biology/ecology, bugs, and both laboratory and outdoor fieldwork

Restrictions or time constraints for this project: Not specifically

ID Number: 49

Academic College: Agriculture and Life Sciences

Research project title: Understanding bioactive compounds in blueberries

Description of project: The focus of the project is on bioactive compounds in plants, particularly monotropein, a nutraceutical compound found in blueberries. The ultimate goal is to better understand the genes involved in monotropein production and explore strategies to enhance its concentration in blueberries for potential health and nutritional benefits.

Research goals: This undergraduate research project introduces students to both plant biology, while working with crops such as blueberries. Students will spend about 5 hours per week engaged in hands-on activities that range from plant growth and maintenance to laboratory-based molecular experiments.

Mentoring style: The undergraduate student will work with a graduate student on this project. They will oversee their day-to-day activities. I will also check-in weekly with the student to see about progress and any challenges they have faced. Overall I view mentorship as a key foundation of success and should be tailored to the needs to the student.

E**xperience or skills needed:** As part of the project, students will gain experience with: Plant handling and growth techniques (growing media, maintaining experimental plants), molecular biology methods such as DNA/RNA extraction, PCR, and other fundamental wet-lab techniques, data analysis and statistics, including working with molecular and plant data to draw meaningful conclusions.

Restrictions or time constraints for this project: This project is designed for first-year undergraduates and does not require prior research experience -just curiosity, motivation, and an interest in learning how plants and molecular biology connect to human health. There is flexibility on the days of the week or times the student will come in but it during normal business hours.

ID Number: 51

Academic College: Agriculture and Life Sciences

Research project title: Increasing Undergraduate Research Opportunities through the Virginia Governor's School for Agriculture

Description of project: Through this project, undergraduate researchers will gain hands-on experience analyzing and presenting data from the 2025 Virginia Governor's School for Agriculture, while also having the chance to shape future research projects connected to the 2026 program, a signature experience of the Department of Agricultural, Leadership, and Community Education in the College of Agriculture and Life Sciences.

Research goals: 1. Learn about past and current research projects connected to the Virginia Governor's School for Agriculture (VGSA). 2. Build research skills by analyzing qualitative data, identifying key themes, and practicing basic data coding. 3. Develop communication skills by sharing research findings with others. 4. Design a research project idea that could be carried out with the 2026 Virginia Governor's School for Agriculture cohort.

Mentoring style: At Virginia Tech, I teach classes in teacher preparation and youth program management, direct the Teaching and Learning in Agriculture minor, and lead a section of undergraduate research. I enjoy mentoring students—whether it's through academic projects, career planning, or connecting classroom learning to real-world opportunities. In this project, I will provide guidance at every step, from navigating research tools to developing strong writing skills, ensuring students feel supported as they grow into confident researchers.

E**xperience or skills needed:** Having some basic familiarity with finding scholarly sources in databases and practicing clear, academic writing will make it easier to get started and feel confident in this project.

Restrictions or time constraints for this project: I am willing to find a mutually agreeable time to meet each week, generally between the hours of 10 am-4 pm.

ID Number: 59

Academic College: Agriculture and Life Sciences

Research project title: Champions of Cold Tolerance

Description of project: This project examines the establishment rate of seeded varieties of improved, cold-tolerant bermudagrass and zoysiagrass under various dormant-seeding regimes. This project has the potential to help turfgrass professionals and land managers, across the Mid-Atlantic region, identify optimal seeding practices for warm-season turfgrasses during the mid-to-late winter and early spring, which is typically a slower period in the turfgrass-management industry. The findings of this project may be advantageous for maximizing stand establishment ahead of the intense demand of spring sports and the summer's heat.

Research goals: The student will learn the importance of establishing turfgrasses from seed, BMPs for spreader calibration, and will learn how to utilize weather and climate data to justify turfgrass-management decisions. The student should expect to become extremely familiar with the scientific method, and will learn firsthand how field research can translate to practical application for turfgrass professionals.

Mentoring style: Student will meet weekly / bi-weekly with myself as the project advisor as I take mentorship and training to be significant value and importance in the research process. I, along with other members of VT Turfgrass Science program, will assist the student in all treatment applications and I will train the student in collecting data in the field. The student can expect to collect data and both they and I together will write a research report from their findings, which will be considered for submission in peer-review publication at a later date.

E**xperience or skills needed:** None, but experience in Microsoft Word (or equivalent) is preferred along with excellent time-management and communication skills.

Restrictions or time constraints for this project: Student should be willing to work outside and sometimes in cold temperatures (i.e., mid-February). Student should expect to work outside in all kinds of weather (except for downpouring rain), and occasionally on weekends if necessary..

ID Number: 61

Academic College: Agriculture and Life Sciences

Research project title: Effect of acute low energy availability (LEA) on determinants/markers of iron status in female runners

Description of project: Low Energy Availability (LEA; or consuming less calories than needed) is a common problem in some athletes, particularly female athletes in certain sports. LEA often goes hand-in-hand with low iron status, but the stress of LEA can interfere with detection of common markers of iron deficiency. This project will utilize previously collected data in female runners with 5-days of experimentally induced LEA to attempt to better understand markers of iron status under these conditions.

Research goals: Assist in data entry and analysis, Learn to conduct a targeted literature review. Gain skills in critical analysis of literature and in scientific writing.

Mentoring style: The student will work with me and a recently graduated doctoral student weekly during lab meetings and bi-weekly for individual guidance and discussion.

E**xperience or skills needed:** Interest in LEA in athletes; Interest in iron status and metabolism. Likes to write and reading about science in the human body.

Restrictions or time constraints for this project: Needs to be able to attend lab meetings (Monday afternoon, with some flexibility); Should have some larger blocks of time available to work on project during the week.

ID Number: 62

Academic College: Agriculture and Life Sciences

Research project title: Ultra processed foods and iodine status in middle-aged adults

Description of project: Iodine status in the U.S. population is generally thought to be adequate, which is commonly attributed to use of iodized salt. Data from the National Health and Nutrition Examination Survey, however, have indicated a downward trend in the iodine status of the US population since 2007 that has paralleled an upward trend in consumption of ultra-processed foods (UPF), which are high in salt but not iodized salt. This study will measure the iodine content of two standardized diets, one high in UPF and the other containing "homemade" recipes and no UPF for 6-weeks on iodine status.

Research goals: Assist in data entry and analysis, Learn to conduct a targeted literature review. Gain skills in critical analysis of literature and in scientific writing.

Mentoring style: Meet with the students weekly during lab meeting and at least bi-weekly for individual feedback on project.

E**xperience or skills needed:** Interest in iodine, thyroid disorders and/or ultra-processed foods. Likes to write and read about science in the human body

Restrictions or time constraints for this project: Must be able to attend lab meetings on Monday afternoon; Should have some larger blocks of time available to work on project during the week.

College of Architecture, Arts, and Design

ID Number: 36

Academic College: Architecture, Arts, and Design

Research project title: TEAM Malawi

Description of project: Students enrolled in this section of IDS 4994 will leverage the Biodesign Process (Figure 1, below) to identify and invent solutions to high-priority projects in sub-Saharan Africa. All of these projects are underpinned by the UN Sustainable Development Goals (SDGs), with a focus on SDG #3: Good Health & Wellbeing, SDG #9: Industry, Innovation, and Infrastructure, and SDG #10: Reduced Inequalities. Students will be assigned to one of these projects based on alignment with skills and interests.

Research goals: Learning Objectives: After completing this course, students will be able to: 1. Describe challenges with health innovation infrastructure in low resource settings. 2. Demonstrate cultural competencies through collaboration with partners in Malawi. 3. Describe and employ core design research processes to identify needs and opportunities in one of four problem areas provided: Hydroponics, Radio Receivers, Healthcare Communication, and Community Based Childcare Centers, Recycled Paper Products, Cultural Preservation of Tumbuka Healing Practices. 4. Identify themes from research that lead to the development of high-priority concepts appropriate for low resource settings. 5. Build a low- to medium-fidelity prototype of most promising concepts to evaluate with quantitative and qualitative analysis methods appropriate to the product, system, or service of inquiry. 6. Document research, design, and analysis process.

Mentoring style: Students will be working with faculty and peer groups to achieve outcomes related to long running projects. As such, first year students will learn from a variety of members of the Virginia Tech community across disciplines, as well as meeting international partners.

E**xperience or skills needed:** We are looking for curios students interested in contributing to healthy communities, education, creative industries, and entrepreneurship. No previous experience required, but time management and an interest in service are benefit.

Restrictions or time constraints for this project: In general, we have a once a month meeting with all student groups working on TEAM Malawi projects. Individual projects usually have one student meeting a week to advance research. There are travel opportunities available for TEAM Malawi, but not required, for all student participants.

ID Number: 52

Academic College: Architecture, Arts, and Design

Research project title: Vision for Amonate, VA: challenges and opportunities for a rural community

Description of project: Learn to write a peer-review journal article for the Special Issue "Current Challenges in Sustainable Urban, Rural and Regional Development"

Research goals: There are 5 main goals for the students: learn how to ethically deal with human data; develop survey analysis skills; learn how to visualize data, develop skills to translate data into strategies, develop writing skills.

Mentoring style: agreement on timetable and location, as well as on mentorship principles; 1st meeting: project explanation, goals and expected outcomes; Following sessions: meeting at the start and end of the session, setting learning tasks and working tasks, discussing the results together; Last session: presentation of the results via a PowerPoint; reflection on the mentorship and hopefully article submission.

E**xperience or skills needed:** No specific skills and experience required except for curiosity, thirst for learning, professional behavior (punctuality, proper clothing, politeness, etc.)

Restrictions or time constraints for this project: no

College of Engineering

ID Number: 15

Academic College: Engineering

Research project title: Prediction Oracles for Learning-Augmented Algorithms

Description of project: This project aims to build practical prediction models that feed into learning-augmented algorithms (LAAs). In the LAA framework, an algorithm receives auxiliary information from a machine-learned oracle and uses it in a robust way to outperform traditional worst-case algorithms. Most existing work treats these oracles abstractly and rarely shows how the predictions can be trained from real data. Our goal is to close that gap by designing and training concrete models, with a particular focus on prompt-based prediction techniques, and by evaluating how well these models improve algorithmic performance in practice.

Research goals: Triangle counting is an important tool in biological network analysis. It is used, for example, to detect protein complexes, community structure, and functional modules. Learning-augmented algorithms speed up triangle counting by giving the algorithm an oracle that predicts the *heaviness* of each edge, meaning the number of triangles that contain that edge. Previous theoretical work on LAAs assumes such an oracle but does not show how to build one from data. Goals: (1) Collect and preprocess real biological network data, such as protein-protein interaction graphs. (2) Train a model that predicts edge heaviness; possible approaches include graph neural networks, gradient-boosted trees, or prompt-based large language models adapted to graphs. (3) Integrate these predictions into a standard (streaming) triangle-counting routine and measure speed-ups and accuracy. (4) Release code, trained models, and a reproducible benchmark. (5) If time and interests allow, study how prediction error influences worst-case guarantees. The student is expected to work on data preparation, model training, and experimental evaluation (optionally, algorithm design too). Through this process the student will gain experience in graph machine learning, learning-augmented algorithm design, and reproducible research. A research paper (suitable for a top-tier ML conference) is a goal for this project, and there is room for theoretical exploration of robustness if the student is interested.

Mentoring style: I view mentorship as a gradual transfer of ownership. At the start I provide close guidance and clear structure (more hands-on approach); as the student builds expertise, I step back so they can drive the project with confidence. Plan for this project: (a) In the first two weeks we choose reading materials on triangle counting, graph ML, and learning-augmented algorithms. We also set up the coding environment and gather data. (b) We review progress, debug roadblocks, and adjust milestones in our weekly one-to-one

meetings. I give written feedback on code, experiments, and the overall progress. (c) We define three checkpoints: (1) baseline model trained, (2) integration with the triangle-counting algorithm, and (3) full benchmark with reproducible scripts. (4) I encourage the student to submit a short paper or poster to a workshop, practice conference-style talks, and make him/herself familiar with the state of the art ML architecture. By the end of the project the student should feel comfortable designing experiments, collaborating through version control, and communicating results in writing and presentations.

E**xperience or skills needed:** The only prerequisites are basic coding skills in Python and a willingness to learn. Students should feel comfortable writing and debugging small programs and be ready to pick up standard tools for working with machine-learning models (for example PyTorch or TensorFlow). No prior research experience is expected; curiosity and persistence are much more important. I will guide the student through the necessary background in machine learning and graph algorithms during the project.

Restrictions or time constraints for this project: The schedule is flexible. We will set meeting times that fit the student's availability.

ID Number: 20

Academic College: Engineering

Research project title: Satellite power systems and circuit boards: build, test, evaluate

Description of project: Learn to solder (through-hole and surface-mount) circuit boards designed to fly in space onboard nanosatellites. Test and evaluate assembled circuit boards using electronics measurement equipment. Gain familiarity with the Python programming language to evaluate data and present results. Opportunities to modify circuit board design using KiCAD tools. Design and execute test deployments to evaluate circuit board performance before flight.

Research goals: (i) Surface-mount solder power management chips and passive components to unpopulated PCBs and demonstrate functionality using unit tests (ii) Learn and understand a simulator tool to predict power system performance (iii) Validate model predications with real-world measurements (iv) Design and execute real-world tests

Mentoring style: The goal of mentorship is to guide development of new skills. Successful mentorship requires regular meetings and communication. Project goals should be flexible in order to support maximum success.

E**xperience or skills needed:** Prior soldering experience is helpful but not required. Experience with a text-based programming language or scripting interface would be very beneficial. Above all, a student must have an excitement to learn and a drive to embrace the "research mindset," which is independent from the typical classroom environment.

Restrictions or time constraints for this project: Access to all necessary equipment and materials will be available any time of day at the faculty's lab space. Students are free to use other campus lab resources if desired. Participants will attend weekly meetings with the specific schedule to be determined based on mutual convenience.

ID Number: 21

Academic College: Engineering

Research project title: DBWorkout - Enhancing SQL Education Through Gamification and Real-Time Collaboration

Description of project: The DBWorkout project focuses on developing a web-based, interactive SQL learning platform that integrates gamification, real-time collaboration, and automated feedback to enhance student engagement and understanding. By refining the platform's features and assessing its educational potential, the project aims to explore how these elements can improve SQL instruction, motivate learners, and deepen comprehension. Students will contribute to the design and refinement of DBWorkout while analyzing its impact on student engagement and learning outcomes, ultimately documenting best practices for integrating gamification and collaboration in computer science education.

Research goals: In the DBWorkout research project, students will focus on the following specific research goals: Design and Refine Gamified Features: Students will work on creating and improving gamified elements for SQL learning, exploring how gameplay can enhance student motivation and learning. Analyze Real-Time Collaborative Tools: They will examine the effectiveness of collaborative features in promoting peer interaction and engagement in an educational context. Synthesize Research on Gamification and Learning Theories: Students will dive into existing research on gamification and learning theories, applying these insights to refine DBWorkout's design. Evaluate Student Engagement and Learning Outcomes: Through user feedback and testing, students will assess the platform’s impact on student engagement and learning. Document Best Practices: They will create a guide based on their findings, offering actionable strategies for implementing gamification and collaboration in SQL or other computer science educational settings. Through this process, students will gain hands-on experience in educational technology design, gamification principles, and collaborative learning tools.

Mentoring style: For the DBWorkout project, my mentoring approach will focus on: Active Collaboration: Regular check-ins where students discuss challenges and brainstorm solutions, with my feedback guiding their work. Hands-on Learning: Giving students autonomy while providing support on technical skills (e.g., gamification design, UI) and educational theories (e.g., gamification in learning). Personalized Growth: Tailoring feedback to students’ strengths and interests, helping them develop in areas like UX design, research, and collaboration tools. Regular Check-ins and Feedback: Weekly meetings to track progress and provide constructive feedback, ensuring continuous growth. Mentorship, for

me, is about empowering students to take initiative, learn from mistakes, and grow into confident developers and researchers.

E**xperience or skills needed:** or first-year students, the following skills and qualities will help ensure success in the DBWorkout project: Basic Programming Skills: Familiarity with SQL and web development (HTML, CSS, JavaScript) is a plus, but not required. Interest in Educational Technology: A curiosity about enhancing learning through technology, especially gamification and collaboration. Problem-Solving and Critical Thinking: Ability to think creatively and analytically to solve challenges. Teamwork and Collaboration: Openness to working with others and contributing to a team. Strong Communication Skills: Ability to clearly discuss ideas and document the research process. Willingness to Learn: A commitment to learning new concepts and tools. Curiosity and a desire to engage with new technologies will be the most important traits for success.

Restrictions or time constraints for this project: There are no specific time restrictions for the DBWorkout project, but students should be available during regular business hours (M-F, 8-5) for weekly meetings and research activities. The exact schedule will be determined based on mutual convenience, with flexibility for remote participation. The student will need to allocate time for independent work on the project, including design and iteration tasks, testing, and feedback collection. Regular communication and collaboration will be key, but there is no fixed day or time requirement beyond the weekly meetings.

ID Number: 22

Academic College: Engineering

Research project title: LLM-Assisted HCI Research - Bridging Human-Centered Design and Artificial Intelligence

Description of project: This independent study explores the role of large language models (LLMs) in Human-Computer Interaction (HCI), comparing LLM-based assessments with traditional human evaluations. Students will learn standard HCI methods and design LLM simulations to mimic human evaluation behaviors. The project aims to develop a deeper understanding of HCI while investigating how LLMs can be integrated into human-centered design processes. Deliverables include reports on HCI methods, LLM simulations, a comparative study, and a final presentation on the project's findings, methodologies, and conclusions.

Research goals: Students will focus on the following research goals: Understanding HCI Methods: Students will learn core human-computer interaction principles and methodologies, including how they are used in design, evaluation, and testing. Simulating LLMs in HCI: Students will design simulations that leverage LLMs to mimic human-centered design evaluations, helping them explore the potential of AI in HCI research. Comparing Human and AI Approaches: Students will critically compare human-driven and LLM-driven evaluations, analyzing similarities, differences, and effectiveness in assessing HCI processes. Integrating AI into Human-Centered Design: Students will explore how LLMs can be integrated into HCI and human-centered design processes to improve user experiences and design outcomes. Report Writing and Presentation Skills: The project will also help students enhance their skills in documenting research findings, reporting methodologies, and delivering final presentations on the research outcomes. Students can expect to gain practical experience with HCI techniques, AI tools, and learn how these fields intersect to improve design processes. They will also develop valuable skills in critical thinking, research methodology, and communication.

Mentoring style: In mentoring students for the "LLM-Assisted HCI Research" project, my approach will focus on guiding students to think critically, encouraging independent problem-solving, and providing structured feedback while fostering a collaborative environment. Here's how I plan to mentor: Active Guidance and Support: I'll meet regularly with students to provide feedback on their work, guide them through the process of learning HCI methods, and help them design effective LLM simulations. I'll encourage their creative thinking and guide them when challenges arise, ensuring they don't feel overwhelmed. Skill Development: I aim to help students build a strong foundation in both HCI principles and

LLM technologies. I'll provide resources, readings, and hands-on exercises to help them understand the theoretical and practical aspects of the project. Encouraging Autonomy: While I will provide support, I want students to take ownership of their work. I'll encourage them to explore new ideas, design experiments, and critically evaluate results. This will help them develop confidence in their research skills. Collaborative Learning: I view mentorship as a partnership. I will foster a collaborative learning environment where students feel comfortable asking questions, sharing insights, and discussing their ideas with me and their peers. Reflection and Growth: Throughout the project, I'll guide students to reflect on their progress, challenges, and learning. I'll offer constructive feedback to help them grow both academically and professionally, preparing them for future research and career opportunities.

E**xperience or skills needed:** For first-year students with no prior research experience, the following skills and qualities will help ensure success in the "LLM-Assisted HCI Research" project: Interest in HCI and AI: Students should have a genuine curiosity about human-computer interaction and artificial intelligence, particularly how AI can be integrated into human-centered design processes. Critical Thinking: Students should be able to approach problems analytically, evaluate information critically, and draw meaningful conclusions based on evidence. Strong Communication Skills: Clear writing and verbal communication are essential, as students will need to document their findings, design simulations, and present their research. Willingness to Learn: Since the project introduces new concepts, students should be eager to learn about HCI methods, AI tools, and the intersection of these fields. Collaboration and Teamwork: The ability to collaborate, share ideas, and work effectively in a team environment will be crucial, especially when discussing research insights and building simulations. Prompting Large Language Models (LLMs): Students should be open to learning how to effectively prompt LLMs to simulate human-centered design evaluations and analyze AI-generated responses. Familiarity with how LLMs respond to different inputs will be part of the research process. Overall, while prior research experience is not required, students should have a strong interest in HCI and AI, critical thinking abilities, a readiness to learn new research methods, and an openness to working with LLMs for simulation and evaluation tasks.

Restrictions or time constraints for this project: There are no specific day or time restrictions for the "LLM-Assisted HCI Research" project, but students should be available during regular business hours (M-F, 8-5) for weekly meetings and research activities. The exact schedule will be determined based on mutual convenience, with flexibility for remote participation. Students will need to allocate time for independent work on the project, including designing LLM simulations, gathering data, and analyzing results. Regular

communication and collaboration will be key, but there is no fixed day or time requirement beyond the weekly meetings.

ID Number: 23

Academic College: Engineering

Research project title: LLM-Assisted Usability Evaluation of Smart Classrooms: A Proof-of-Concept Using Spatial Layout, Posture, and Proximity Analyses

Description of project: This research project explores the use of Large Language Models (LLMs) to evaluate the usability of smart classrooms by analyzing spatial layout, posture, and proximity to assess classroom effectiveness. Students will collect visual data, generate pose-based data using tools like OpenPose, and create interpretive narratives using LLMs to summarize classroom usage patterns. These AI-generated insights will be compared with human observations and survey data to evaluate classroom usability. The project combines methods from human-computer interaction, environmental design, and AI to develop a novel framework for data-informed classroom design decisions.

Research goals: In the "LLM-Assisted Usability Evaluation of Smart Classrooms" research project, students will focus on the following specific research goals: Understanding Spatial and Ergonomic Factors: Students will learn how classroom layout and posture affect engagement and usability in smart classrooms, exploring how physical space impacts learning environments. Pose Detection and Visual Annotation: Students will gain hands-on experience using tools like OpenPose for pose detection, image annotation, and spatial layout analysis to understand classroom dynamics. Using LLMs for Data Interpretation: Students will learn how to design and refine LLM prompts to generate narratives that interpret visual data on classroom use, integrating AI into usability assessments. Comparing AI and Human Insights: The project will involve comparing AI-generated usability narratives with human observations to evaluate alignment and improve classroom design decisions. Technical Implementation: Students will gain practical experience with Python-based image processing tools and pose estimation libraries to analyze real-world data. Research and Academic Writing: Students will develop skills in research documentation, report writing, and presenting findings through formal academic reports and final presentations. Through this project, students will acquire interdisciplinary research skills that combine human-computer interaction (HCI), environmental design, and AI to address classroom usability challenges.

Mentoring style: In mentoring students for the "LLM-Assisted Usability Evaluation of Smart Classrooms" project, my approach will involve: Guidance and Feedback: Regular meetings to provide constructive feedback and support technical challenges. Hands-on Learning: Assisting students in using pose detection tools (e.g., OpenPose) and LLMs to analyze classroom data. Independent Problem-Solving: Encouraging students to explore different

approaches and develop critical thinking. Interdisciplinary Focus: Helping students integrate HCI, environmental design, and AI into their research. Reflective Learning: Supporting regular reflections to refine approaches and document progress. Communication Skills: Building confidence in presenting findings, writing reports, and collaborating. I view mentorship as a partnership, guiding students to grow academically, develop technical skills, and enhance their research and communication abilities.

E**xperience or skills needed:** For first-year students with no prior research experience, the following skills and qualities will help ensure success in the "LLM-Assisted Usability Evaluation of Smart Classrooms" project: Interest in HCI, AI, and Environmental Design: A strong curiosity about human-computer interaction, AI tools, and how classroom environments affect learning. Basic Python Development: Familiarity with Python, especially for developing dashboards and working with libraries like OpenPose for image processing and pose detection. Interest in Image Processing Techniques: A willingness to explore and apply image processing methods to analyze visual data from classrooms. LLM Prompting: Openness to learning how to effectively prompt Large Language Models (LLMs) to interpret visual data and generate insightful narratives. Analytical and Problem-Solving Skills: Ability to approach challenges analytically and think critically about research questions and methods. Attention to Detail: Careful attention to data collection, annotation, and interpretation to ensure accuracy and quality in the research process. Collaboration and Communication: Ability to work well in a team, share ideas, and communicate findings clearly through written reports and presentations. Curiosity and Enthusiasm: A genuine interest in learning interdisciplinary research methods and applying them to real-world challenges. While prior research experience isn’t required, applicants should be motivated to learn new concepts, explore AI tools, and contribute to innovative classroom design solutions.

Restrictions or time constraints for this project: There are no specific day or time restrictions for the "LLM-Assisted Usability Evaluation of Smart Classrooms" project. However, students should be available during regular business hours (M-F, 8-5) for weekly meetings and research activities. The exact schedule will be determined based on mutual convenience, with flexibility for remote participation. Students will need to allocate time for independent work on tasks like data collection, image processing, and LLM prompting. Regular communication and collaboration will be key, but there is no fixed day or time requirement beyond the weekly meetings.

ID Number: 25

Academic College: Engineering

Research project title: Rural Computer Science Education

Description of project: There are not enough computer science teachers in rural areas, which means that students in rural schools do not have access to adequate computer science education. This lack of preparation affects their ability to succeed in introductory computer science courses in college. To address this challenge, we aim to develop a computer science curriculum that is relevant to rural communities. Our study will explore the perspectives of rural students and teachers on identity and culture, and we will also create technical tools that are culturally relevant.

Research goals: During this research, the student will achieve the following: (1) Students will learn how to conduct a research literature review (2) Students will learn how to develop a working prototype and/or analyze a research study (3) Students will learn how to write for a research focused audience

Mentoring style: I have been mentoring undergraduate researchers for the last eight years. To enhance my mentoring skills, I took professional development courses at the University of Michigan, including the Mentoring Undergraduate and Graduate Students Course. In addition, I have created a mentoring plan and lab manual to assist new students in my lab. The mentoring plan is accessible on my lab's website https://reach.cs.vt.edu. Lastly, I use a customized Affinity Research Group Model program in my lab to help underrepresented minority undergraduate students get involved in research. The Affinity Research Group Model developed by Ann Gates.

E**xperience or skills needed:** We are seeking individuals passionate about our vision as a lab, who are adaptable, and willing to learn about human-computer interaction research.

Restrictions or time constraints for this project: none

ID Number: 26

Academic College: Engineering

Research project title: Immersive 3D Aircraft Visualization in Virtual Reality

Description of project: This project explores how virtual reality (VR) can transform aerospace engineering education and design by visualizing aircraft in interactive 3D environments. Using the Meta Quest 3 headset and open-source tools, the research fellow will develop a clickable, animated 3D model of an aircraft for web and VR display. The result will help designers and engineers understand aircraft layout, systems, and human interaction in new and intuitive ways.

Research goals: 1) Learn how to convert aircraft models from OpenVSP into interactive, animated 3D experiences using Blender and X3D, 2) Implement features like animated propellers, landing gear, and control surfaces, 3) Add “click to inspect” interactivity to highlight aircraft components and display relevant data, 4) Explore VR compatibility and how immersive visualization can aid design review, human factors assessment, and pilot training.

Mentoring style: Mentorship will be highly hands-on and supportive. We’ll start with step-by-step tutorials, weekly check-ins, and plenty of example projects to build from. You’ll be part of a broader research team, including visualization experts at VT ARC’s Visionarium and peers working on related projects.

E**xperience or skills needed:** No prior research experience is expected or required. The student should be: 1) Curious and excited about combining VR and design, 2) Familiar with the basics of any programming language. Everything else—3D modeling, X3D, VR workflows—will be taught. There’s a large open-source community, helpful documentation, and expert guidance available throughout the project.

Restrictions or time constraints for this project: No restrictions or time constraints for this project.

ID Number: 27

Academic College: Engineering

Research project title: Virginia Connected Corridor 26-27

Description of project: It is a year long Research Project with Virginia Transportation Research Council where VTTI address some work zone safety, smart mobility, traffic evaluation and other topics of interest and where there is an opportunity to involve students to support some of the data analysis, performance evalulation and metrics generation.

Research goals: Data Analysis related to safety on Work Zone Deployments

Mentoring style: Provide an overview for the research efforts focusing how the student can collaborate and support some research tasks in specific data analysis and system metric/performance evaluation during field deployments.

E**xperience or skills needed:** Some experience with Embedded Systems, programming languages (C++/Python, etc) and some experience with data analysis

Restrictions or time constraints for this project: During business hours are just fine

ID Number: 30

Academic College: Engineering

Research project title: Construction Product Waste Optimization for the Circular Economy

Description of project: Manufacturing modular construction products such as structural insulated panels generates volumes of multi-material waste that is difficult to recycle cost-effectively. Existing practice requires cutting apart scraps to recover valuable components while paying to dispose of the remains. This study investigates existing panelized building designs to predict waste generation from panel fabrication on future projects. The aim is to find alternatives to in-house waste processing via identifying complementary uses for panel waste as valuable input to other industrial or construction processes. If successful, the outcome would convert production waste from a liability into a value stream for panel manufacturers.

Research goals: Upon successfully completing this research, student will be able to: (1) Characterize panel cutoffs based on building design documents; (2) Create inventory of panel cutoffs by building type and descriptive parameters; (3) Quantify costs and benefits of current scrap recycling process; (4) Use pattern recognition algorithms to identify project types with high-value waste; and (5) Communicate progress, challenges, and results both orally and in writing to project team members. This year, there is also the opportunity to work with the research team to develop and pilot test new methods for breaking down panels for reuse.

Mentoring style: I believe effective research mentoring requires not only demonstrating and modeling useful task-specific skills, but also anchoring research experiences within a more general context where students may later be able to adapt those skills to other situations. In this project, critical context includes learning to interact safely and appropriately with stakeholders in an industrial environment and understanding the business drivers underlying the research goals. This project includes direct interaction with the professor and manufacturing staff to learn new skills (reviewing design documents, analyzing operational processes, estimating costs, etc.) essential for data collection and analysis in a manufacturing environment. Weekly meetings involve review of progress from previous week, addressing any problems or challenges, and setting goals for the next week. Student will regularly participate in and give brief progress updates to the research team throughout the semester.

E**xperience or skills needed:** This project is ideal for students interested in sustainable construction, manufacturing, waste management, and industrial operations. Desired skills include the ability to safely observe industrial processes and systematically record

observations, develop and analyze quantitative data sets based on observations and review of project data, and describe research activities in written form using a technical writing style. Required skills include the ability to use basic word processing and spreadsheet tools in a collaborative cloud environment, manage allocation of limited time to multiple tasks, and follow safety instructions.

Restrictions or time constraints for this project: In the beginning and end of the project, student would need to be available during times partner company plant is in operation (7:30 am – 4 pm, M-Th) to visit plant and observe operations, conduct interviews, and present findings. Otherwise, meeting times with research team can be arranged based on mutual convenience.

ID Number: 33

Academic College: Engineering

Research project title: Simulating a collaborative robotic manufacturing system using Nvidia Issac Sim

Description of project: This project aims to construct a dynamic virtual simulation of a collaborative robotics manufacturing scenario, such as 3D printing or robot-assisted assembly, using NVIDIA Isaac Sim. Students will evaluate system performance across different simulation setups.

Research goals: The research goal is to simulate a collaborative robotic manufacturing system and evaluate its performance in Nvidia Issac Sim. The learning objective is three-fold: 1. Define a dynamic, collaborative robotic manufacturing system; 2. Develop proficiency in the state-of-the-art robotic simulation software Issac Sim; 3. Evaluate and compare system performance using clear metrics, such as efficiency (e.g., task completion time).

Mentoring style: Mentorship is not only supervision but also a supportive, collaborative relationship. I will set clear expectations and provide initial guidelines to kickstart the project. Over time, the student will be encouraged to generate creative ideas, and I'll help shape those ideas through guided discussions and sharing of my experience. I will remain accessible to answer questions or, when appropriate, guide the student towards discovering the answers themselves.

E**xperience or skills needed:** Experience in installing computer software

Restrictions or time constraints for this project: No specific restrictions

ID Number: 37

Academic College: Engineering

Research project title: Construction Workforce Technology Training Needs and Challenges

Description of project: The construction industry is undergoing rapid digital transformation driven by Building Information Modeling (BIM), augmented and virtual reality (AR/VR), drones, robotics, laser scanning, reality capture, and data-driven project management tools. While these technologies offer measurable gains in productivity, safety, and quality, adoption is often slowed by workforce skill gaps. A shortage of trained workers, combined with generational shifts in the industry, means that many employees are not adequately prepared to leverage these tools in day-to-day operations. Understanding the training needs and barriers to adoption is essential to enabling workforce readiness and maximizing the return on technology investments.

Research goals: Students will need to identify and categorize the digital technologies relevant to a specific field in this case construction, develop questionnaires to collect input on the needs and challenges, conduct data analysis, learn how to present output in the format of publications or presentations.

Mentoring style: The student will be an integral part of the research , participating in all project phases, including participant recruitment, data collection, data analysis, dissemination of project findings via publications and outreach activities. I will continuously meet with the student to evaluate their skills, work progress, and areas for improvement.

E**xperience or skills needed:** Ability to read journal papers and summarize findings.

Restrictions or time constraints for this project: No restrictions.

ID Number: 44

Academic College: Engineering

Research project title: Development of Low Cost, Austenitic, Ductile Irons

Description of project: Ductile irons can be easily cast into complex shapes. Austenitic ductile irons have numerous desirable properties, such as excellent fatigue life and high energy absorbing capability. Nickel is typically used to produce austenitic ductile iron but is expensive. This projects aims to replace nickel with manganese and aluminum.

Research goals: The research goal is to develop a low cost, austenitic, ductile iron. Preliminary experiments have been performed to validate the concept but much more work is needed. Students will work at the Kroehling Advanced Materials Foundry (making molds, melting and treating ductile iron, and pouring ductile iron) and in the materials characterization labs in Holden Hall and the NCFL (mechanical testing, X-ray diffraction, optical microscopy, and scanning electron microscopy).

Mentoring style: The students will work with me and other undergraduate students on this project. The foundry is inherently dangerous so extensive safety training (online and in-person) is required. I will personally supervise/mentor the students at the foundry and my undergraduate team will primarily support the students when doing materials characterization. The students will be invited to participate in professional society conferences and foundry plant visits.

E**xperience or skills needed:** Students must be willing to work in a foundry (training and safety equipment will be provided) to produce material for characterization and willing to work in very clean environments to perform characterization. Some of the characterization equipment is very expensive and appears to be difficult to operate so the students must be serious about learning. As with most specialized skills, the equipment is not really that hard to operate if you are provided with good instruction and have a knowledgeable person available to answer questions. This project will provide skills in materials characterization that would benefit anyone that is interested in design (ME, AOE, CEE) or materials science/engineering (MSE, Chemistry).

Restrictions or time constraints for this project: No time constraints.

ID Number: 53

Academic College: Engineering

Research project title: Exploring the Impact of AI on Engineering Workforce

Description of project: This project explores how artificial intelligence (AI) is transforming the engineering workforce in industry. Students will investigate how AI tools are influencing engineering practices, required skills, and workforce development. The project is designed for first-year students with no prior research experience, offering opportunities to read scholarly articles, summarize key insights, and engage in discussions about the role of emerging technologies in engineering careers. By participating, students will gain an introduction to research processes, learn to critically evaluate technology's societal impacts, and contribute to understanding how engineers adapt to rapid technological change in professional settings.

Research goals: The student will 1) explore introductory readings on AI applications in engineering, especially in the engineering discipline that they are in, 2) identify ways AI is changing engineering practices and skills, 3) summarize and communicate findings in short written pieces, with the goal of expanding the writing to be a conference paper in the longer term (beyond Spring 2026 – the student doesn't need to commit at this point), and 4) learn the basics of literature review and research inquiry.

Mentoring style: I view mentorship as a collaborative, supportive process that helps students grow intellectually and professionally. Within this project, I will: 1) provide structured guidance through biweekly meetings, 2) offer clear and achievable tasks (e.g., readings, writing annotated bibliography), and 3) teach foundational research skills (e.g., how to ask questions, find credible sources). Overall, my goal is to foster curiosity, confidence, and research readiness, while helping the student see how their contributions connect to broader questions about engineering and society.

E**xperience or skills needed:** No prior experience or skills needed. I can teach all necessary skills.

Restrictions or time constraints for this project: None.

ID Number: 60

Academic College: Engineering

Research project title: Development of Focused Ultrasound (Histotripsy) Devices for the Non-invasive Treatment of Cancer

Description of project: The Therapeutic Ultrasound Lab is an interdisciplinary research group developing ultrasound for non-invasive tissue ablation, modulation, and regeneration. The goal of this research project will be to support the design, development, and testing of focused ultrasound devices for oncology applications.

Research goals: We are looking for a student to work on the design, construction, and testing of custom focused ultrasound systems being developed in our laboratory. The specific goals of the project will be tailored to support the design and fabrication of electronic driving systems and transducers for focused ultrasound (FUS) systems. These systems range from early-stage laboratory set-ups to clinical prototype systems designed for treating cancerous tumors using histotripsy and other FUS methods. The student will gain skills related to these topics and tasked with designing, building, and testing RF circuitry/components and FUS transducers. The student will also gain experience conducting scientific experiments related to electrical and FUS system performance while maintaining a clean, safe, and productive work environment.

Mentoring style: The student will have weekly meetings with a lead mentor within the Vlaisavljevich lab (research faculty, postdoctoral fellow, or graduate student) who will provide ongoing guidance and feedback to the student on this project. The student will also have monthly meetings with Dr. Vlaisavljevich, Dr. Maxwell, and/or other relevant team members that are working with the student including clinical collaborators or other researchers at VT partnering with us on these studies. The student will also attend weekly group meetings and join working groups within our lab for project specific training. Overall, the goal of a first-year research experience in our lab is to gain training in general research practices and subject area specific techniques while contributing to the development and fabrication of a novel medical device in development in our lab. The student will be working in a highly interdisciplinary environment in order to gain direct experience on medical device design, prototyping, testing, and in vivo validation studies. This highly interdisciplinary research experience will uniquely prepare them for a wide range of future opportunities across multiple disciplines. In addition, the student may have the opportunity to spend time interacting with clinical, industry, and non-profit partners that are collaborating with our teams, providing them with unique professional development experiences in addition to the core research training. As part of this, the student will gain experience in all aspects of

medical device development including regulatory processes, which will be important for their future careers in biomedical engineering and sciences. Finally, the student will gain experience documenting their work, presenting their research, and preparing scientific reports and manuscripts.

E**xperience or skills needed:** We are seeking motivated, creative individuals who are interested in the development of electronic driving systems and transducers for focused ultrasound (FUS) systems. Candidates should be comfortable approaching challenging problems and working independently or in small interdisciplinary teams. Candidates with a background or interest in circuit design, ECAD and PCB design, and digital logic experience including designs with FPGAs would be highly desired as well as candidates with strong programming skills (Verilog/VHDL, JavaScript, Python, MATLAB, and C++), good soldering skills, and knowledge of electrical testing equipment.

Restrictions or time constraints for this project: Schedule to be discussed with student prior to starting.

ID Number: 63

Academic College: Engineering

Research project title: From Science Fiction to Reality: How Will Flying Cars Change Future Transportation?

Description of project: This research aims to understand the impact of urban air mobility (UAM) or flying cars in urban and rural areas in the USA. Urban air mobility or air taxi services will start transporting passengers as soon as January 2026. Therefore, it is evident how this emerging mobility service will impact the existing mode choice behavior and who the potential customers will be. and possible vertiport (heliport) locations. We will use AI and Machine learning to understand this demand. This new mobility option will change the landscape of future transportation.

Research goals: 1. Literature review 2. Data Analysis 3. Report Writing

Mentoring style: I will meet with the student once every week for one hour. I will teach the student the skill set necessary to be successful in this project.

E**xperience or skills needed:** No prior research experience OR skills are required.

Restrictions or time constraints for this project: No restrictions or time constraints for this project.

ID Number: 64

Academic College: Engineering

Research project title: Biomechanics of animals

Description of project: Our lab studies how animals work from a biomechanical perspective. That means that we use fundamental tools of engineering, physics, and math to understand how an animal's form relates to its function. Our main focus is on snakes and insects, but we also study other animals: for instance, we are currently trying to understand how flying squid jump out of the water and fly the air. We do lots of research on snakes, centered on flying snakes and their relatives: how do they fly through the air? How do they jump? What limits other snakes from gliding?

Research goals: We understand that most freshman don't have a lot of research experience, if any. Our goal is to expose the student to the types of things that are involved in research, including experimental data collection, data analysis, problem solving, and presenting. In working on animal biomechanics, typically a student will learn to handle animals as well as technical equipment like high-speed cameras and motion capture systems.

Mentoring style: It takes experience in the lab to be able to lead a project, so we don't expect a new lab member to start out with their own project. Instead, we partner students with more experienced researchers, having them help with ongoing lab projects. Typically that means that on a day-to-day basis, the new lab member will be working with a Ph.D. student or postdoctoral researcher. ('Postdoc' means they've recently earned their Ph.D.) That said, as the head of the lab I am involved in all mentoring, so new lab members will also be interacting with me.

E**xperience or skills needed:** For freshman, we don't expect much in terms of prior skills: you'll learn in the lab. But students who have combined interests in physics or engineering and biology and a curiosity to understand how animals work usually fit best here.

Restrictions or time constraints for this project: No specific restrictions. Just a willingness to be curious and work hard!

ID Number: 65

Academic College: Engineering

Research project title: Computer Science as a Career (CSAC) Research Study

Description of project: This research study is part of a larger National Science Foundation (NSF) project focused on the success of low-income, academically talented college students in computer science. This qualitative study (led by Virginia Tech) investigates development of computing identity in a scholarship program targeting computer science students at three institutions in Texas. Two of them are community colleges in the Dallas/Fort Worth area, and the third is a regional comprehensive university which is a common transfer destination for the other two. The phenomenological study uses semi-structured interviews to capture the experiences of students in the scholarship program, related to both financial assistance and peripheral supports such as professional development meetings, coding camps, and computing related clubs.

Research goals: Participating in a qualitative research project focused on low-income computing students and their computing identity offers a student researcher a deeply enriching experience, both intellectually and personally. Through this work, the student researcher will gain firsthand exposure to the complexities of identity formation in computing, especially among students who face socioeconomic barriers. They'll develop a nuanced understanding of how factors like race, gender, access to technology, and community support shape a student's sense of belonging and persistence in the field. By conducting interviews, analyzing narratives, and engaging with lived experiences, the student researcher will sharpen their qualitative research skills—such as coding, thematic analysis, and empathetic listening and writing—while also cultivating cultural competence and ethical sensitivity. This project will allow them to witness how educational inequities manifest in real lives and how targeted interventions can make a meaningful difference. Ultimately, the student researcher will walk away with a stronger sense of purpose, a deeper appreciation for inclusive computing education, and the ability to translate research insights into actionable recommendations for educators and policymakers. It's not just research—it's a chance to contribute to equity, amplify marginalized voices, and grow as a scholar and advocate.

Mentoring style: Mentorship in this project will be two-tiered: I will provide direct guidance on research design, ethics, and analysis, while an experienced graduate student with industry experience will offer practical insights into computing careers and identity development. The student researcher will meet weekly with the full research team to foster collaboration and learning, and also have individual weekly check-ins to support personal

growth and skill-building. I view mentorship as a reciprocal, empowering relationship that encourages students to follow their interests within the project. This includes supporting pathways to present at conferences, co-author journal articles, and contribute to other scholarly publications.

Experience or skills needed: No experience is required, but students will have to understand the requirements of human subjects research. Students will learn to read and interpret interview data to extract meaning from participant experiences.

Restrictions or time constraints for this project: None

ID Number: 66

Academic College: Engineering

Research project title: Artificial Intelligence and Community College Workforce Development

Description of project: This NSF-funded project focuses on AI and workforce development by analyzing large-scale qualitative data from the nation's largest community college. The initiative explores how students engage with computing and develop professional identities, aiming to improve access and equity in tech education. A key outcome is the creation of a college-credit certificate program that equips learners with foundational AI skills. Virginia Tech leads the qualitative research component, examining computing identity formation among diverse student populations. The project bridges academic research and workforce needs, offering scalable insights to inform curriculum design, support systems, and inclusive pathways into AI-related careers.

Research goals: The student researcher will focus on analyzing large-scale qualitative data to explore how students develop computing identities within AI and workforce development contexts. They will learn to code transcripts, identify themes, and interpret patterns related to access, equity, and identity formation. The project emphasizes skill-building in qualitative methods, ethical research practices, and collaborative analysis. Students will also gain experience presenting findings, co-authoring publications, and contributing to broader conversations about inclusive computing education. By engaging deeply with real-world data, they'll develop a critical understanding of how computing education intersects with social and professional factors, preparing them for future research or industry roles.

Mentoring style: Mentorship in this project will be two-tiered, designed to provide both academic and professional support. As the faculty lead, I will guide the student researcher through the core elements of qualitative research—data analysis, ethical considerations, and scholarly writing—while encouraging them to pursue their own interests within the project. In parallel, an experienced graduate student with industry background will mentor them on practical applications of computing, career pathways, and identity development. Weekly team meetings will foster collaboration and shared learning, while individual check-ins will offer personalized support. I view mentorship as a dynamic, student-centered process that builds confidence, skills, and scholarly voice.

Experience or skills needed: No prior research experience is needed, but students should have strong attention to detail, curiosity, and critical thinking skills. They'll learn to use qualitative analysis software to code and interpret data, gaining hands-on experience with collaborative research and computing identity.

Restrictions or time constraints for this project: None

ID Number: 67

Academic College: Engineering

Research project title: Rural Latina/o/e/x Engineering and Computing Identity Study

Description of project: The Rural Latina/o/e/x Engineering and Computing Identity Study is a national, qualitative, phenomenological research project focused on understanding how rural Latina/o/e/x college students develop their identities in engineering and computing fields. Through in-depth interviews, the study explores students' lived experiences, challenges, and sources of support as they navigate academic and professional pathways. By centering voices often marginalized in STEM research, the project aims to uncover how cultural, geographic, and institutional factors shape identity formation. Findings will inform inclusive practices in education and workforce development, contributing to a more equitable understanding of who belongs and thrives in engineering and computing.

Research goals: The student researcher will focus on analyzing interview data to understand how rural Latina/o/e/x college students form engineering and computing identities. They will learn to use qualitative analysis software to code transcripts, identify themes, and interpret patterns through a phenomenological lens. The project emphasizes skill-building in qualitative methods, ethical research practices, and collaborative analysis. Students will gain experience working with a national dataset, contributing to team discussions, and potentially co-authoring publications or presenting at conferences. Through this work, they'll develop a deeper understanding of identity in STEM and build foundational research skills applicable to both academic and professional settings.

Mentoring style: Mentorship in this project will be two-tiered, designed to provide both academic and professional support. As the faculty lead, I will guide the student researcher through the core elements of qualitative research—data analysis, ethical considerations, and scholarly writing—while encouraging them to pursue their own interests within the project. Weekly team meetings will foster collaboration and shared learning, while individual check-ins will offer personalized support. I view mentorship as a dynamic, student-centered process that builds confidence, skills, and scholarly voice.

Experience or skills needed: No prior research experience is needed, but students should have strong attention to detail, curiosity, and critical thinking skills. They'll learn to use qualitative analysis software to code and interpret data, gaining hands-on experience with collaborative research.

Restrictions or time constraints for this project: None

College of Liberal Arts & Human Sciences

ID Number: 12

Academic College: Liberal Arts and Human Sciences

Research project title: Mining book archive

Description of project: I am completing a book on 19th century books about gold miners (mainly novels but some diaries) and plan to create a digital archive of the 100 or so books I have found. I would a student's help in creating that archive.

Research goals: Basic web page design, creating an interface for researchers and the public of documents of different kinds

Mentoring style: I have designed a webpage before and will share what I have learned with the student. The student will also get to see up close a professional research project in its final stages and learn about different document formats.

E**xperience or skills needed:** It would be great if the student had comfort with computers, though they don't need to have web design experience.

Restrictions or time constraints for this project: The timing of our meetings and the student work is flexible.

ID Number: 18

Academic College: Liberal Arts and Human Sciences

Research project title: Mapping Structural Ableism

Description of project: Student would work with a faculty member and grad student to read and sort material related to disability policy advocacy and disability-led organization missions.

Research goals: Student will get a broad view of advocacy from the disability community, as well as an understanding of structural ableism and other forms of ableism as we map and sort material. Student would also get a window into cross-disciplinary healthcare and policy research. Student would understand differences in humanities-based and social science-based research.

Mentoring style: Student would meet 2-3x a month with faculty member and a PhD student who are engaged as part of a larger healthcare-related project. Starting with a broad orientation and then flexible timing on task completion with regular check-ins. Both faculty member and grad student would also be sorting material, and we would be engaged in similar tasks and conversation with the policy and organization documents.

E**xperience or skills needed:** Student must be able to read and summarize, pulling out key points, without the use of AI. An interest in disability, healthcare, policy, or advocacy is a plus, but not a necessity. Would be particularly suitable for a student interested in the humanities-based analysis (political science, philosophy, history, etc.).

Restrictions or time constraints for this project: There would be one hour a week that we would agree upon with our small research group (faculty member, PhD student, FURF student), but other hours could be handled independently and with a student's own schedule.

ID Number: 31

Academic College: Liberal Arts and Human Sciences

Research project title: Down the AI Rabbit Hole: Testing Generative AI on Alice in Wonderland

Description of project: Coupling inventive methods and speculative ethnography with children's literature, the student will consider the good and bad futures associated with Artificial Intelligence by collecting a set of historical and political documents about Alice in Wonderland from the Library of Congress, then identifying a range of GenAI tools to use to interact with these documents to support source analysis. The student will be asked to build an AI Agent/Custom GPT and/or a work flow to support scaffolding primary sources, then test that platform to determine whether the AI hallucinates, reproduces bias, and/or to what extent it will decolonize texts.

Research goals: Students will participate in qualitative research using technocurious methodology. They will engage in specific research tasks including: 1) design and development of an independent research project, 2) creating a set of documents to analyze, 3) design and development of an AI agent, 4) analysis of GenAI outputs using speculative ethnography, 5) creating and tracking prompts using prompt logs, and 6) systematically documenting the research process (among others). While the nature of AI may prevent the full completion of a bounded project, a student who is selected to work on this project will have the opportunity to learn about the research process and gain skills that are applicable to research outside of this domain.

Mentoring style: We will design the project and the steps of the research in partnership, then I will meet with the student bi-weekly to walk through specific research activities, providing explicit steps to complete the work. I will provide opportunities to work with PhD students on the project as well as opportunities for presenting the work at a national conference and potentially publication. I view mentorship as a partnership between the faculty member and the student in which both participants are co-creators of knowledge.

E**xperience or skills needed:** Students do not need any specific skills, but a foundation in computer science with experience in building GenAI Agents or RAG (Retrieval-Augmented Generation) or in primary source analysis will help the student be successful in this project.

Restrictions or time constraints for this project: No, there are no constraints.

ID Number: 35

Academic College: Liberal Arts and Human Sciences

Research project title: Technocuriosity in Action: Exploring History, AI Agents, and Teaching America's History

Description of project: Students will be introduced to a new research method, technocuriosity, that is used to investigate Generative AI in education contexts writ large. The student will collect a set of historical documents about American History in honor of the 250th anniversary from digital archives, then identify a range of GenAI tools to use to interact with these documents to support source analysis. The student will be asked to build an AI Agent/Custom GPT and/or a work flow to support scaffolding historical documents, then test that platform to determine whether the AI hallucinates or reproduces inaccurate information and bias and to what extent it will decolonize texts.

Research goals: Students will participate in qualitative research using technocurious methodology. They will engage in specific research tasks including: 1) design and development of an independent research project, 2) creating a set of documents to analyze, 3) design and development of an AI agent, 4) analysis of GenAI outputs using speculative ethnography, 5) creating and tracking prompts using prompt logs, and 6) systematically documenting the research process (among others). While the nature of AI may prevent the full completion of a bounded project, a student who is selected to work on this project will have the opportunity to learn about the research process and gain skills that are applicable to research outside of this domain.

Mentoring style: We will design the project and the steps of the research in partnership, then I will meet with the student bi-weekly to walk through specific research activities, providing explicit steps to complete the work. I will provide opportunities to work with PhD students on the project as well as opportunities for presenting the work at a national conference and potentially publication. I view mentorship as a partnership between the faculty member and the student in which both participants are co-creators of knowledge.

E**xperience or skills needed:** . Students do not need any specific skills, but a foundation in computer science with experience in building GenAI Agents or RAG (Retrieval-Augmented Generation) or in primary source analysis will help the student be successful in this project.

Restrictions or time constraints for this project: No, there no constraints.

ID Number: 41

Academic College: Liberal Arts and Human Sciences

Research project title: Understanding the Experiences of Undergraduate Students from Rural Communities

Description of project: This research project will investigate the experiences of undergraduate students at Virginia Tech who come from rural communities and small towns. Specifically, the undergraduate researcher will work as a Rural Scholar in the Center for Rural Education and carry out a research project that will include a survey and interviews for data collection, analysis, and a presentation for suggested programming for the Center to better meet the needs of rural Hokies.

Research goals: The student will learn how to think critically about a complete research project including theory, research design, survey development, recruitment strategy, interviewing, data analysis, and presenting findings. The student will not only gain research skills but also become more engaged with the Center for Rural Education and the unique needs of rural students.

Mentoring style: I will meet with the student for a minimum of 1-hour weekly. I will also assign one of my doctoral GAs to help oversee the research project and provide additional mentoring. Mentoring will be an important aspect of this project and will be deeply valued and prioritized throughout the semester.

E**xperience or skills needed:** Ideally, the student will be from a rural community or small town. This will be an important aspect of the study, and I will mentor the student on thinking critically about how our subjectivities and positionalities influence our research.

Restrictions or time constraints for this project: There are no time restrictions or constraints.

ID Number: 46

Academic College: Liberal Arts and Human Sciences

Research project title: Southwest Virginia Language (SWVAL) Project

Description of project: Even though it's at the point between a lot of interesting physical, political and dialectal borders, language patterns in Southwest Virginia are largely unstudied! We're fixing through a number of different data collection types, getting locals' opinions about language in the area, and also getting recordings of their speech, which we then process and analyze for features of interest!

Research goals: They will primarily be processing speech recordings, preparing them so that we can pull out measurements and analyze linguistic variation. There may also be opportunities to conduct interviews, run experiments and/or participate in outreach activities.

Mentoring style: Students will join the Speech Lab, working with faculty and other students. Mentoring then is not just done by faculty, but also by peers. My favorite outcome for research assistants is when students find aspects of projects that they can take ownership on, moving from being an assistant to being a collaborator.

E**xperience or skills needed:** I don't require any previous skills or experience - I just value intellectual curiosity and self-motivation! For this particular project, students from SWVA would be especially welcome to join our team.

Restrictions or time constraints for this project: N/A

College of Natural Resources & Environment

ID Number: 17

Academic College: Natural Resources and Environment

Research project title: Mass Timber and the Transition to a Sustainable Bioeconomy

Description of project: This project explores the use of mass timber in modern construction as a pathway to a sustainable bioeconomy. The construction sector contributes significantly to global greenhouse gases, accounting for 39% of worldwide emissions. As researchers and policymakers seek alternatives, innovative materials are emerging to address these environmental challenges while meeting the demands of urban development. Utilizing systematic literature reviews, students will investigate how renewable wood-based materials can reduce carbon emissions, support rural economies, and transform the construction industry.

Research goals: The specific goal is to understand the economic, environmental, and market dynamics driving the transition from traditional construction to bio-based solutions. This project emphasizes learning by doing, encouraging students to link environmental innovation with economic opportunity.

Mentoring style: I view mentorship as a collaborative and supportive relationship that fosters curiosity, critical thinking, and personal growth. For this project, the accepted applicant will work with a team consisting of a fourth-year undergraduate and four professors. The combination of mentors from various academic stages and a multidisciplinary approach will more effectively guide students in exploring the intersection of sustainability, innovation, and business through the lens of mass timber construction. As the main mentor, my role will be to (1) encourage inquiry and discussion around sustainable materials and market trends, (2) provide access to relevant case studies and industry insights, and (3) support students in developing research, presentation, and teamwork skills.

E**xperience or skills needed:** While no prior research experience is required, students will benefit from having (1) curiosity about sustainability and innovation in business and construction, (2) basic communication and teamwork skills to collaborate effectively, (3) willingness to learn about new materials, markets, and environmental impacts, and (4) interest in real-world applications of business concepts, especially in the context of climate change and the bioeconomy. This project is designed to be an entry point into research, so enthusiasm, openness to feedback, and a growth mindset are more important than technical expertise.

Restrictions or time constraints for this project: There are no fixed time constraints for this project. Students are expected to conduct research during regular business hours (Monday–Friday, 8 AM–5 PM), but the specific schedule will be flexible and determined based on mutual availability. Occasional check-ins or meetings may be scheduled to support progress, but these will be arranged to accommodate the student's class schedule and other commitments.

ID Number: 47

Academic College: Natural Resources and Environment

Research project title: Seasonal Detections of the World's Smallest Carnivore, the Least Weasel (Mustela nivalis), on the Virginia Tech Campus

Description of project: Least Weasels are the world's smallest carnivore and reside on the Virginia Tech campus. Little is known about Least Weasels in the southern portion of their North American range, and climate change is predicted to impact them negatively. This project will utilize new sampling technology to photograph weasels entering a small wooden box in an attempt to search for food. Images will allow the students to determine activity patterns of Least Weasels and their main prey species, meadow voles, throughout the year. We anticipate that the results of this project will be publishable and presented at a conference.

Research goals: The student will recognize Least Weasels and at least 5 species of other small mammals that are potential prey items from camera photographs. The student will demonstrate constructing, deploying, maintaining, and checking weasel camera stations. Based on the time and date images were obtained, the student will analyze detection data to create detection probabilities, with my guidance. Lastly, the student will generate a plan for mowing and managing the Stroubles Creek Riparian area that could lessen impacts on Least Weasels. In addition to the actual project, the student will present their findings. Our project was the first in North America to use camera boxes to sample Least Weasels. Last year, an undergraduate student working on the project was invited to speak at an International Meeting and won the best student presentation at the Virginia Wildlife Society Meeting.

Mentoring style: A successful mentor coaches a student during their research project. I believe in extensively training undergraduate student researchers and allowing the student to explore the project based on their acquired knowledge. A student will identify new questions enabling the project to expand once they examine the data. Often, student questions address areas that researchers dedicated to the project have failed to ask or identify. A mentor should also be available to help new researchers. My office door is always open unless I am in class. All students know they are encouraged to ask for help and guidance during research projects. Additionally, weekly check-ins provide excellent feedback opportunities and allow us to identify potential problems early in the project. During the Least Weasel project, I will first introduce the student to Least Weasels and their natural history. We will read two recent papers on weasels and their current conservation concerns in addition to a book chapter. After reading the papers, the student and I will

discuss topics gained from the readings. Next, I will train the student to check camera traps and identify mammals. I will create a small mammal presentation where the student will practice their identifications with my coaching. Then, I will draft weekly goals for the first month of the project to help direct the initial work. Next, the student will develop detection models for Least Weasels with my guidance and coaching. Each week, we will meet and discuss project successes and challenges. As the project nears completion, I will coach the student on data analysis and presentation skills.

E**xperience or skills needed:** The Least Weasel project is ideal for a first-year student. The greatest skills a student will possess are a desire to learn and a passion for wildlife. During the project, the student will need to be able to identify not only weasels but other species of small mammals. I will train the student to recognize all mammal species that could be observed. Therefore, no background knowledge is needed. I will also provide background knowledge and guidance to help the student analyze data and prepare presentations.

Restrictions or time constraints for this project: There are no set schedules for the student to participate, which will allow a first-year student to work around their academic and personal commitments. We will check cameras on the Virginia Tech campus monthly, and then the student will work with me to identify the species of mammals observed. Both camera checks and photograph identification can occur when the student is available. Typically, an undergraduate student can view and categorize images within 15 hours (3 weeks), which allows another 5 hours each month for analysis. We usually acquire over 500 pictures each month, and a student should be able to categorize videos before the next camera check.

ID Number: 54

Academic College: Natural Resources and Environment

Research project title: Examining Urban Planners' Preparedness for Emerging AI Technologies: A Scoping Review of Literature

Description of project: The rapid advancement of AI technologies (e.g., OpenAI's ChatGPT and Google's Gemini) presents novel opportunities for local urban planners to adopt AI-driven smart city solutions that support human-centered, efficient, and optimized planning. However, a lack of actionable guidelines hampers the integration of these tools into everyday practice. This project conducts a scoping literature review to examine and synthesize current knowledge about planners' multifaceted perceptions, such as opportunities and ethical concerns, related to AI in planning as well as their AI literacy. The ultimate goal is to inform socially responsible and effective use of AI technologies in urban planning practice.

Research goals: (1) Explore how emerging AI technologies can be applied to innovative urban planning practices; (2) Learn how to search for scholarly literature using academic databases (e.g., Web of Science) and assess source quality (e.g., journal impact factor); (3) Develop critical thinking skills through the creation of an annotated bibliography; (4) Practice effective time management by independently developing and executing a semester-long research plan; (5) Strengthen academic communication skills by collaborating with a faculty mentor.

Mentoring style: This project is designed as a one-semester mentored research experience with weekly one-on-one meetings. (1) Weeks 1-2: Orientation, project overview, and collaborative development of a semester-long work plan. (2) Weeks 3-10: Conduct a scoping literature review, collect and evaluate relevant studies, and begin writing annotated bibliographies. (3) Weeks 11–14: Synthesize findings into a scoping review summary and prepare a final written product. (4) Week 15: Give a 20-minute presentation followed by a 10-minute Q&A. The presentation will be attended by senior undergraduate and graduate students in the research group to provide constructive feedback and encouragement. (5) My approach to mentorship emphasizes hands-on learning, critical thinking, and personalized guidance. I aim to support the student in developing both academic and teamwork skills.

E**xperience or skills needed:** No prior research experience is required. This project is ideal for students who are curious about the intersection of technology and society. A strong interest in emerging AI technologies, smart cities, and urban planning from a socio-technical perspective is highly encouraged. Motivation, openness to learning, and a proactive attitude are more important than technical expertise.

Restrictions or time constraints for this project: There are no strict time constraints. However, students are expected to participate in weekly meetings (in person or via Zoom) with scheduling based on mutual availability.

Pamplin College of Business

ID Number: 19

Academic College: Pamplin College of Business

Research project title: Self study

Description of project: A student who wants to work with me will be expected to have their own interests, and to be ready to read and put their ideas into practice. The project will be a literature-informed risk assessment of a scenario. The topic is up to the student. Previous students of mine have explored Formula 1, chatbots and OCD for college students, the business market of data brokers, social media and mental health of college students, incident response in hospitals, and AI bias in heart pain triage at emergency departments.

Research goals: Goal: to practice independent study and autonomy; learn about cybersecurity. Focus: develop research skills that can be used in further research as well as professional and personal spheres.

Mentoring style: Mentor: provides structure and accountability. Student: provides effort, a novel perspective, and does the work.

E**xperience or skills needed:** Intellect requires practice, and research skills are useful in any degree or job - I need students who want to be here and are willing to learn how to deal with being challenged.

Restrictions or time constraints for this project: Happy to accommodate the student's schedule where I can.

College of Science

ID Number: 2

Academic College: Science

Research project title: Machine-Learning-Based Molecular Dynamics Simulation

Description of project: Classical molecular dynamics (MD) simulation aims to model the motion of a many-body system on the basis of Newtonian mechanics. One challenge is to systematically construct coarse-grained models of a particle system, where groups of particles are mapped to coarse-grained beads, such that larger systems can be simulated with MD on a longer time scale. Machine-learning algorithms and generative AI can help address this challenge. In this project, we aim to explore the possibility of using algorithms based on neural networks to automatically coarse-grain molecular and polymer systems and develop many-body coarse-grained potentials suitable for MD simulations.

Research goals: The student will learn, under the guidance of my graduate students and me, how to write a Python and C/C++ code on the basis of neural networks and various machine-learning algorithms to implement coarse-grained molecular dynamics simulations.

Mentoring style: The student is expected to work with me and my graduate students and participate in project and group meetings. We will train the student on the basic physics underlying molecular dynamics simulation (e.g., Newtonian mechanics) and programming skills in Python. The student will also learn the basic ideas underlying machine learning and neural networks. The student will participate in active research in molecular modeling and soft matter and biological physics that can potentially lead to publications. The student will be treated as an intern that may one day grow into a STEM researcher.

E**xperience or skills needed:** The student is expected to have a basic understanding of mechanics (at the level of a high-school physics AP class). The student is preferred to have some experience on Python and/or C/C++ programming.

Restrictions or time constraints for this project: None

ID Number: 4

Academic College: Science

Research project title: First principles calculations of color center defects for quantum applications

Description of project: Performing first principles density functional theory modelling of ground and excited state properties of color center defects, including formation energies, emission wavelength, and spin properties. Student will be expected to create plots, text, and presentations to communicate their results.

Research goals: Understanding the basics of condensed matter and quantum materials research, programming skills (Fortran, python), and using high performance computing resources

Mentoring style: Students can expect to work closely with a more senior member of the group (postdoc or graduate student) and meet regularly with the PI.

E**xperience or skills needed:** Basic knowledge of programming, and basic knowledge of physics/math (particularly geometry). Knowledge of quantum, extensive coding experience, or AI/ML experience is a plus.

Restrictions or time constraints for this project: Student determines own schedule, but to be successful they should put 5 hours/week into the project.

ID Number: 5

Academic College: Science

Research project title: Satellite Mission Operations for UtProSat-1 at Low Earth Orbit

Description of project: Using the Virginia Tech Ground Station, VT students will be allocated to establish communication stations for operating uplink and downlink commands with the satellite Utprosat-1 in Low Earth Orbit. Depending on orbital parameters and the day of the week, these events occur ad hoc, twice or three times a day, for about a 10-minute duration window. Working in situ at the Mission Ops Center (on campus) with a group of 5 to 10 students and the Space@VT Technical Team, the goal is to establish mission operations with the satellite by sending uplink commands and downloading scientific data from its experiments.

Research goals: Each student is expected to learn at least three out of the following skillset or knowledge bases: (1) What is Low Earth Orbit, and how does satellite orbit work in this environment. (2) How do orbital parameters affect satellite communications. (3) How to predict when the satellite communication window will happen. (4) How to use GNSS data from the satellite to generate TLL data. (5) How to send uplink commands and download data from the satellite using COSMOS/OpenC3 Software. (6) What are the Virginia Tech Ground Station (i.e., Prices Fork Tracking Station) network design characteristics that enable communications with a moving spacecraft at Low Earth Orbit.

Mentoring style: Mentoring for the student will be at a minimum of: (1) debrief 1-hour call (direct mentoring) to discuss the successes and failures for the past week of satellite communications, research and learning process, research report engagement, and to cover any other office hours topic needs. (2) Mission-debrief of 45 minutes after every communication window with the mission operations director and operations team for the UtProSat-1 mission to discuss the successes and failures, and potential actions for subsequent engagements.

E**xperience or skills needed:** No particular skill is needed. As long as the student is engaged and participative enough with the project's objectives, we will make sure he learns as much as he would like to learn.

Restrictions or time constraints for this project: No restrictions. The student will need to participate in at least in 20 mission operations events (ad-hoc) and mission debrief sessions.

ID Number: 6

Academic College: Science

Research project title: Mapping water quality across the Stroubles Creek network

Description of project: The student will collaborate with the Hotchkiss Lab to compile and analyze data collected across the Stroubles Creek network in Blacksburg, VA over the past ~10 years while supporting ongoing water quality data collection. We will use past and new data to find hotspots of nutrient pollution inputs as well as pollutant removal hotspots within the stream network. If of interest, the student may also conduct experiments to measure microbial activity in different pollutant input/removal hotspots to better understand the role of stream biology in changing downstream water quality.

Research goals: The student will learn to collect water quality samples from streams; support labwork and lab experiments; analyze data using the R computing environment; develop an understanding of water quality issues and how they connect with biology, ecosystem health, and human health; and build knowledge about the scientific research process.

Mentoring style: I view mentorship as an iterative and collaborative relationship with an early career scientist. While I have a general project idea in mind, I will work with the student to revise research goals in ways that best suit their interests, skillsets, and professional goals. When students leave my lab after conducting undergraduate research, I want them to have an appreciation for the process of research, the role of curiosity and failure in research, how to communicate science to non-scientists, and whatever discipline-specific knowledge is relevant for the success of their project. We set goals and expectations and discuss communication preferences at the start of our collaboration, check in frequently, and revise research objectives as needed throughout the project.

E**xperience or skills needed:** No experience necessary; just curiosity and willingness to learn.

Restrictions or time constraints for this project: None outside of standard working hours.

ID Number: 7

Academic College: Science

Research project title: Validation of an Implicit Learning Task using Eye Tracking

Description of project: This project was funded by ISCE and data collection is almost completed. The goal of the project is to validate a classical implicit learning task using a new set of child-friendly stimuli. Eye tracking parameters were additionally collected.

Research goals: The first ting would be to analyze reaction times; for this, I already have an R code that woud just need to be adapted to the new data. I would be happy to guide a student through this, which would give them a chance to gain some experience with coding and statistics. The second step would be to explore the eye tracking parameters - if time permits.

Mentoring style: Based on my experience mentoring three undergrad students throughout the past academic year, I am confident that the student working with me on this would gain new technical skills as well as overall mentoring regarding their studies and career prospects. I love mentoring and have so far received very positive feedback from the students that I have worked with.

E**xperience or skills needed:** They should be willing to learn basic coding and statistics. I know from my own experience as well that this can be intimidating at first, so being willing to push through the initial frustration is pretty much all they need to get started.

Restrictions or time constraints for this project: No restrictions; I prefer giving my students some flexibility, with a check-in meeting once a week.

ID Number: 8

Academic College: Science

Research project title: Development of arbitrarily patterned patchy particles

Description of project: In this bio-inspired project, the goal is to develop a new type of patchy particle, that is a particle where the surface is covered with patches that have different chemical and/or physical properties compared to the rest of the surface. The particles are intended to work as building blocks for self-assembly, that is the process where smaller components assemble into larger ordered structures, just like how proteins and other biomolecules self-assemble into anything from viral capsids to organelles, to cell membranes, to blood vessels.

Research goals: The student will assist in carrying out experiments on patchy particle fabrication and/or on developing the physical chemistry of patch creation. The student will learn how to design an experiment and collect data, and will learn technical skills in colloidal physics and optics.

Mentoring style: The student will work closely with the graduate student responsible for the project and participate in group meetings as well as regular individual meetings with me. As the student would be a freshman, the main goal of the mentoring would be to give the student a good experience of what it is like to work in a research lab to help them decide if they are interested in pursuing more research work in college or as a career.

E**xperience or skills needed:** The ideal student for this project enjoys practical hands-on work, and is conscientious and detail oriented.

Restrictions or time constraints for this project: No restriction other than that the student needs to be prepared to work in the lab each week during the semester.

ID Number: 9

Academic College: Science

Research project title: Using Collaborative and Proactive Solutions to Support Parents and their Autistic Children with Disruptive Behaviors

Description of project: School-aged autistic children may demonstrate increased disruptive behaviors, such as aggression and oppositional behaviors, but the reasons and effective supports are not clearly understood. Collaborative and Proactive Solutions is a promising approach to lessen disruptive behaviors by working with families to cooperatively identify and solve problems that underlie the behaviors, but has not yet been tested with autistic children. This project will test CPS to support parents and their autistic children, and examine potential mediators of the intervention..

Research goals: The student will assist with IRB submission, recruitment, screening, and data entry. They will learn how treatment outcome research projects are set up and conducted.

Mentoring style: I use a lab-based mentorship model. I have regular lab meetings as well as individual meetings with my graduate students to review all projects and answer questions. For this project, the undergraduate fellow will be assigned to a specific graduate student for direct supervision with weekly meetings, and I will provide the oversight. We will also offer professional development guidance.

E**xperience or skills needed:** The student should be responsible, detail-oriented, and have a desire for research training. They should be able to work with a team as well as independently, as needed. They should have some familiarity with using computers for word processing and data entry. Finally, they should be interested in pursuing graduate studies or a professional career in psychology or a related field. A strong academic record in high school is a strength. We welcome autistic students and provide a neuro-affirming lab atmosphere.

Restrictions or time constraints for this project: No specific restrictions.

ID Number: 13

Academic College: Science

Research project title: Exploring Episodic Memory in Younger and Older Adults: How Context Shapes What We Remember

Description of project: How do study and test conditions shape what older adults remember? This project explores how context variability, or studying something in a variety of ways, impacts memory performance in both older and younger adults. You will help prepare study materials, administer cognitive testing sessions, and learn how psychologists design experimental tasks. No prior experience is needed: just curiosity about how the mind works and an interest in aging or memory research. This is a great opportunity to gain hands-on experience with behavioral research and explore how memory changes across the lifespan.

Research goals: The student will gain foundational experience in memory research, focusing on the mechanisms that influence memory and aging. They will assist with study material preparation, participant scheduling, administering cognitive tasks, and organizing participant data. They will also be introduced to tools researchers use to design and interpret memory experiments. If interested, students may explore data visualization or basic analysis techniques. The project emphasizes skill-building and scientific curiosity.

Mentoring style: I aim to foster a welcoming and supportive environment where students can ask questions freely, build confidence, and grow their scientific curiosity. I adapt my mentorship style to the student's goals and interests. We'll begin with an orientation to lab processes and background concepts in memory and aging. I will meet regularly with the student to provide step-by-step guidance and to discuss progress, challenges, and goals. The student will be trained in data collection through a scaffolded process: observation, practice, supervised administration, and then independent work. I view mentorship as a collaborative and empowering experience that helps students see themselves as future researchers or scholars.

E**xperience or skills needed:** No prior research experience is needed. The ideal student is reliable, curious, and open to learning new things. Attention to detail and good communication skills are helpful. Basic comfort with using a computer (e.g., typing, navigating files) is a plus, but all specific training will be provided. Time management and people skills will be useful when scheduling and working directly with participants from the community.

Restrictions or time constraints for this project: Data collection and training are very flexible. We can create a schedule that fits the student's classes and commitments. Tasks

can occur during or outside of regular business hours. Most work, especially data collection, can be completed in short blocks (1-2 hours) once or twice a week. Students can schedule participants based on their own availability.

ID Number: 16

Academic College: Science

Research project title: Development of spns2 inhibitors for the treatment of kidney disease

Description of project: Spns2 is a transporter of S1P, which is an endogenous molecule that is implicated in acute kidney disease. S1P is synthesized within a cell and needs to be exported extracellularly to elicit a signal by binding to cell surface receptors. Binding of S1P to receptors leads, in some cases, to diseases such as acute kidney injury, multiple sclerosis, and ulcerative colitis. Thus, blocking S1P transport could be a possible therapy for kidney diseases.

Research goals: The student will synthesize inhibitors of Spns2 and learn the consequence of blocking S1P transport in vitro and in mice.

Mentoring style: The student will be mentored by a senior graduate student and I typically meet with them twice a week (and impromptu daily).

E**xperience or skills needed:** The student should be motivated to work and learn new skills in organic chemistry.

Restrictions or time constraints for this project: The student should have 2-3 hour blocks in their schedule dedicated to working in the lab .

ID Number: 24

Academic College: Science

Research project title: Simple Statistical Test to Detect Heterogeneity in Meta-Regressions

Description of project: Our objective is to develop a statistical test for detecting location-level and time-level heterogeneity in meta-regression datasets. This test will help researchers identify when specific types of modeling techniques are needed to account for underlying differences across space and time in pooled data. The project involves empirical and simulation based analysis.

Research goals: The research goals for the student are to assist in the design process and validation of simulation-based tests for detecting heterogeneity in meta-regression data. This includes helping code and run simulation studies, analyzing the results, and assisting in preparing visuals and reports. Students can expect to learn the fundamentals of meta-regression analysis, statistical simulation methods, and how to use software such as R or Python to conduct applied research. They will also gain experience reading academic papers, discussing methodological decisions, and understanding how empirical research is conducted in economics and statistics.

Mentoring style: My advisee Jonathan Gendron will serve as the student's primary mentor and will coordinate closely with me as needed. Jonathan is highly qualified, with over two years of experience supervising teams of undergraduate research assistants. I have observed him take full responsibility for student development; he meets with students weekly and ensures they are supported both technically and academically. In addition, Jonathan has mentored students through his teaching and his role in my research lab. For this project, we view mentorship as a collaborative and inclusive process focused on skill-building, intellectual growth, and meaningful contribution to an active research agenda.

E**xperience or skills needed:** While no prior research experience is required, students with some exposure to data analysis, statistics, or programming (such as R or Python) may find the work more accessible. A willingness to learn and curiosity about data and research are the most important traits for success in this project.

Restrictions or time constraints for this project: No. We will work with the student to establish a regular meeting schedule that fits within standard business hours and accommodates both the students' and mentors' availability.

ID Number: 28

Academic College: Science

Research project title: Tests of Dark Matter with Terrestrial Experiments

Description of project: We will examine the ability of current experiments to test theories of Dark Matter. In particular, we'll examine the ability of dark matter direction experiments to constrain dark matter properties. We will also examine complementary searches from dark matter accumulation in the Earth and Sun.

Research goals: Students will learn some of the basics of particle physics and coding. A specific goal will be to determine novel utility of current experiments to probe new scenarios for dark matter.

Mentoring style: The most important first step is to ensure that the student understands the physical laws and principles which underpin the research project. Next, is to ensure that the student understands how to begin implementing those physical laws into a computer code. Once we have an up and running code, we can perform self-consistency checks to ensure it's working properly. Finally we can use it to probe new physics questions which form the basis of cutting-edge research.

E**xperience or skills needed:** Having some coding experience would be helpful, but using something like Mathematica is fairly intuitive and I'm happy to assist the student.

Restrictions or time constraints for this project: No, the research times are very flexible.

ID Number: 38

Academic College: Science

Research project title: Understanding Thoughts and Feelings

Description of project: Have you ever thought about the way you understand what is going on in someone else's mind or your own? The ability to infer what people are thinking and feeling is important for our social relationships and mental health. Yet, despite its significance, we don't understand what elements make up this skill or how it can affect our well-being. In this project, you will assist with collecting and processing data that will help us better understand how thinking about thoughts and feelings is related to mental illness.

Research goals: In this project, students will learn how to work with research participants and gain an understanding of the research process. Additionally, students will learn how to assess and score participants' responses to multiple tasks.

Mentoring style: Plans for mentoring will include weekly meetings with full time research staff, availability to answer questions via Slack, bi-weekly lab meetings with full teams, and additional meetings when needed. More frequent meetings will occur as the student in trained on study and lab procedures.

E**xperience or skills needed:** Students should demonstrate an ability to work with others in a manner that is both approachable and professional. Additionally, students should demonstrate strong critical thinking skills and attention to detail.

Restrictions or time constraints for this project: To help run participants, students will need to be available for a four-hour period at least once a week.

ID Number: 39

Academic College: Science

Research project title: Context Variability During Memory Encoding: Insights from Event-Related Potentials (ERPs)

Description of project: Electrical activity on the scalp (electroencephalography/EEG), time-locked to cognitive events like the appearance of a word (event-related potentials/ERPs), reveals millisecond-by-millisecond changes in neurocognitive processing. We will measure EEG while human participants study words for a later memory test and then sort the ERP data according to future memory performance. The P300 ERP component is known to reflect attention to a stimulus. We will assess P300 variation across repetitions of a study word when the context of that word does or does not change. We will determine whether variations in P300 amplitude predict later memory retrieval.

Research goals: The goal for the student is to learn more about cognitive psychology and cognitive neuroscience experimental design, human subjects research in general, and EEG techniques in particular. We anticipate that they will be involved in initial set-up of the experiment procedures and then be trained in and assist with data collection. Finally, we plan to train them to analyze both behavioral data and EEG data.

Mentoring style: For this project, the student would work closely with a graduate student in the lab and the lab director. The student would attend weekly lab meetings to learn about related projects in the lab, receive training in experiment design, and gain knowledge of the research literature in the cognitive neuroscience of memory. They would also meet weekly with the graduate student leading the project for hands-on training. The lab director will join these meetings as needed, especially while the project is getting started. We view mentorship as a process of building trust between the members of the lab that their ideas are valued and their work makes important contributions. The mentor is responsible for providing training and creating a positive environment. The mentee is responsible for doing their best to follow the guidance provided and asking for help whenever it is needed.

E**xperience or skills needed:** This project does not require any prior experience. Training will be provided for all tasks, which include: using Windows computers, basic spreadsheets (e.g. Excel), and interacting with volunteer participants. Students who are interested in the area of research, willing to learn, and dedicated to completing the required lab hours for this program will be successful.

Restrictions or time constraints for this project: This project will be conducted on campus (Williams Hall). The specific work schedule can be determined based on mutual

convenience. Our lab activities usually take place during regular business hours. Lab meetings are typically held on Friday afternoons.

ID Number: 43

Academic College: Science

Research project title: Utilizing Predictive Powers of Machine Learning to Improve Life-Detection Efforts in Mars-Analog Environments

Description of project: This project seeks to leverage predictive capabilities of machine learning to make minor improvements to current life-detection strategies in Mars-Analog environments. To do so, the student will create a classification and a regression model to predict organic carbon abundance from Mars-analog hypersaline lake mineralogy data using the python programming language.

Research goals: My specific research goal for the student is to equip them with transferrable skills in data science techniques applied to earth and planetary science problems. The students can expect to learn the fundamentals of supervised machine learning and computer programming in the python language. Additionally, the student will be introduced to earth science, specifically astrobiology, concepts.

Mentoring style: My mentorship philosophy is based around student-oriented mentoring. Student-oriented mentoring allows the student to engage in their own curiosities and passions, ultimately, building knowledge pillars for them. This approach promotes a purposeful learning experience for the student and me. Using this approach, I apply methods associated with learner-oriented teaching such as active learning, cooperative learning, and inductive teaching and learning. I believe it is my responsibility to understand who my students are and identify their individual knowledge gaps so that I can both challenge students who are passionate and have a clear grasp on concepts while simultaneously helping struggling students succeed.

E**xperience or skills needed:** I've designed this project in such a way that there are no required experience or skills for the student. The student will learn all necessary skills throughout the project.

Restrictions or time constraints for this project: There are no restrictions or time constraints for this project

ID Number: 45

Academic College: Science

Research project title: Antibiotic diffusion rate studies

Description of project:

Research goals: The research goals for this project is to test the hypothesis that polarity and charge density correlate with diffusion rates in antibiotic assays. Students will focus on techniques to dilute and prepare antibiotic solutions, prepare bacteria for assays, and graph and analyze results.

Mentoring style: My plans for mentorship are to meet regularly with the student and assisting graduate student to talk about this project and also philosophy and opportunities in research in general. I view mentorship as an important aspect of science. It provides a safe space for students to learn both how research is done and why, both project specifically and overall.

E**xperience or skills needed:** No particular skills are needed as the dilutions, microbiology, and graphing are straightforward and can be quickly taught.

Restrictions or time constraints for this project: Because of the nature of setting the assays and then analyzing them, time on two sequential days is ideal. A gap of a day may be acceptable as we should be able to preserve results by refrigerating tests for the student.

ID Number: 48

Academic College: Science

Research project title: How does temperature effect ticks that spread infectious diseses?

Description of project: This project will explore how temperature impacts traits of ticks, and what this means for the spread of tick-borne pathogens. We will focus on Lone Star and Black Legged ticks that spread a variety of pathogens in the US, using published data and simple mathematical and statistical models.

Research goals: The student will learn about vector-borne diseases, esp in ticks; learn how to read literature; how to organize data; ways to fit simple models to data in R; and how to compare and contrast predictions from models.

Mentoring style: I like to do triad mentoring so that students have multiple mentors to work with. Thus the student will work with me and a grad student, have at least one weekly meeting with each of us. Mentoring should support exploration -- students must be allowed to try things on their own first, but then have good access to mentors who can help trouble shoot.

E**xperience or skills needed:** ideally a student would have at least taken mathematics through calculus, and feel comfortable learning new computing skills, and be open to learning to program.

Restrictions or time constraints for this project: No. This is a computational project, and students have a lot of flexibility in when they work on it.

ID Number: 50

Academic College: Science

Research project title: Exploring Encoding Strategies and Memory in Aging Adults

Description of project: This project examines how study strategies influence memory in older adults. Experiment participants will answer questions about a series of words and later be tested on their memory for those words. Our prior studies indicate that younger adults' memory improves after they answer varied questions about each word but that older adults' memory is equivalent for varied as compared to consistent questions. We will be continuing this line of research in order to understand why that pattern occurs. Findings will contribute to our understanding of healthy cognitive aging and memory processes.

Research goals: Students will gain hands-on experience with cognitive psychology research. They will learn how to schedule participants, administer neuropsychological evaluations, and collect behavioral data. They will also practice entering and organizing data, assisting with preliminary analyses, and discussing how the results relate to theories of aging and memory. The project will introduce students to the scientific process from data collection to interpretation, giving them insight into both experimental methods and the broader goals of cognitive neuroscience research.

Mentoring style: For this project, the student would work closely with a graduate student in the lab and the lab director. The student would attend weekly lab meetings to learn about related projects in the lab, receive training in experiment design, and gain knowledge of the research literature in the cognitive neuroscience of memory. They would also meet regularly with the graduate student leading the project to discuss progress, answer questions, and connect their tasks to the broader research goals. The lab director will join these meetings as needed, especially while the project is getting started. We view mentorship as a collaborative process that supports both research and professional development. We would provide structured training at the start (e.g., task administration, lab procedures), then gradually encourage independence as the student gains confidence. Mentorship in this project means not only learning technical skills but also developing critical thinking, communication, and teamwork, while exploring how research fits into the student's academic and career interests.

E**xperience or skills needed:** No prior research experience is required. Curiosity about memory and aging, reliability in showing up for scheduled sessions, and attention to detail during data collection are the most important qualities. Strong communication skills and willingness to learn new procedures will help students succeed in the project. Basic familiarity with computers is helpful but not required.

Restrictions or time constraints for this project: One-on-one meetings, training, and data collection are flexible. The student should anticipate needing 1.5 hour blocks of availability to assist with participant sessions, but the session itself can be scheduled based on the student's availability. Time spent on data entry is flexible. There will be a one hour weekly lab meeting which is typically held on Friday afternoons.

ID Number: 55

Academic College: Science

Research project title: Flocculation-Based Removal of Microplastics Mixtures from Various Water Sources

Description of project: Microplastics (MPs) in water and wastewater systems pose a threat to the ecosystem and human health. We are examining the use of food-grade hydrophobic polymers (FGHP) to enhance the removal of MPs from contaminated water. Our comparative case study will evaluate the removal efficiency of MPs, including Polyethylene (PE), Polyurethane (PU), and Polyamide (PA), with different morphologies, such as fiber and film, from nanopore water, seawater, tap water, pond water, and biologically treated municipal wastewater. The selected students will gain experience with infrared microscopy (FTIRμ) and inductively coupled plasma mass spectrometry (ICP-MS).

Research goals: • Learn how to conduct lab-scale microplastic flocculation experiments. • Gain hands-on laboratory experience by learning how to collect and prepare samples, as well as measuring, analyzing, and interpreting data. • Read relevant scientific literature and gain experience presenting research findings.

Mentoring style: I view mentorship as a means of helping students develop into independent researchers. For this project, I will begin by teaching preparing microplastics, conducting flocculation experiments, and utilizing analytical tools such as FTIR microscope. We will meet weekly to check on set goals, conduct experiments, and solve any problems.

E**xperience or skills needed:** No prior research experience is required. We are looking for motivated students who are curious, willing to learn, and able to follow instructions carefully. An interest in environmental science, nanoscience, or laboratory work is helpful, but not necessary. Enthusiasm, reliability, and a positive attitude are the most important qualities for success in this project.

Restrictions or time constraints for this project: Research will happen during regular business hours (Monday to Friday, 8 AM to 5 PM). The exact schedule will be flexible and agreed upon based on everyone's availability.

ID Number: 56

Academic College: Science

Research project title: A Case Study Evaluating Microplastics in the Ponds of Virginia Tech Campus

Description of project: Microplastics (MPs) pollution in freshwater systems remains understudied. This study addresses the gap by providing baseline data on MPs in the ponds of the Virginia Tech campus, which may serve as localized sources and carriers of contaminants. The current understanding of MP contamination in these surface waters is limited. We aim to identify and quantify MPs concentrations in campus ponds while simultaneously analyzing associated chemotypes. The selected students will gain experience with sampling MPs using a 53 µm mesh Wisconsin net, and characterize the MPs using infrared microscopy Fourier Transform Infrared Microscopy (FTIRµ) to assess the average concentrations and dominant polymer types across the ponds.

Research goals: • Learn how to collect freshwater samples from ponds and prepare them for analysis. • Gain hands-on laboratory experience by learning how to collect and prepare samples, as well as measuring, analyzing, and interpreting data. • Read relevant scientific literature and gain experience presenting research findings

Mentoring style: I view mentorship as a means of helping students develop into independent researchers. For this project, I will begin by teaching sampling microplastics, sample preparation, and utilizing analytical tools such as FTIR microscope. We will meet weekly to check on set goals, conduct experiments, and solve any problems.

E**xperience or skills needed:** No prior research experience is required. We are looking for motivated students who are curious, willing to learn, and able to follow instructions carefully. An interest in environmental science, nanoscience, or laboratory work is helpful, but not necessary. Enthusiasm, reliability, and a positive attitude are the most important qualities for success in this project.

Restrictions or time constraints for this project: Research will happen during regular business hours (Monday to Friday, 8 AM to 5 PM). The exact schedule will be flexible and agreed upon based on everyone's availability.

ID Number: 57

Academic College: Science

Research project title: Evaluating FTIRμ Reliability for Environmentally Exposed and Processed Microplastics

Description of project: Larger studies have employed Fourier Transform Infrared Microscopy (FTIRμ) for the identification of microplastics (MP); however, the reliability of spectra after environmental exposure and sample processing remains uncertain. We are examining whether MPs preserve their characteristic FTIRμ spectra following incubation in a natural pond and sediment for 1-2 weeks, to simulate biofouling and sediment interactions. Pristine polymers (Nylon, Polypropylene, Polystyrene, PVC) will serve as controls. After exposure, samples will be processed by drying at 40°C, refrigeration, and treated with 10% hydrogen peroxide to remove organic matter. The selected students will gain hands-on experience with FTIRμ to collect multiple spectra for each treatment, assessing consistency and accuracy in characterizing environmentally aged MPs

Research goals: • Learn how to expose microplastics with environmental and chemical treatments. • Collect pond and sediment samples and prepare them for analysis. • Gain hands-on laboratory experience by learning how to give various treatments, prepare samples, and measure, analyze, and interpret data. • Read relevant scientific literature and gain experience presenting research findings.

Mentoring style: I view mentorship as a means of helping students develop into independent researchers. For this project, I will begin by teaching environmental exposure, sample preparation, and μFTIR analysis. We will meet weekly to check on set goals, conduct experiments, and solve any problems.

E**xperience or skills needed:** No prior research experience is required. We are looking for motivated students who are curious, willing to learn, and able to follow instructions carefully. An interest in environmental science, nanoscience, or laboratory work is helpful, but not necessary. Enthusiasm, reliability, and a positive attitude are the most important qualities for success in this project.

Restrictions or time constraints for this project: Research will happen during regular business hours (Monday to Friday, 8 AM to 5 PM). The exact schedule will be flexible and agreed upon based on everyone's availability.

ID Number: 58

Academic College: Science

Research project title: Climate change impacts on local medicinal plants

Description of project: Many local plants are used to treat medical issues or as food. The use of these plants form important traditions in local cultures and serve as valuable parts of the diet or medicine cabinet for many in Appalachia. Climate change could impact some of these species however; with bloom times or survival threatened. We will use citizen science and museum observations to determine if or how these plants are being impacted. We can then share these discoveries with local herbalists or foragers so they can prepare and adjust to changes in the abundance of these wildflowers.

Research goals: The student will start with reading papers on phenology, or the science of the timing of life events, for local wildflowers. They will also learn data collection procedures from a senior student working on the project. Then they will begin generating data themselves by looking at photographs of plants in the wild or in museum collections and determining what blooming stage the plant is in.

Mentoring style: We will gradually cover background knowledge and protocols with the student, checking in weekly to gauge comprehension, discuss questions or issues, etc. We'll move into data collection after that. The goal is to have the student understand the project and methods so that they can act independently but not to abandon the student. We want to make sure the student is progressing ok with the project and with adjusting to VT and help them as issues arise. The weekly group lab meeting will focus more on building general career skills and getting to know your labmates. My goal for mentorship is to have the student learn the science and become an active participant while feeling they are getting the support they need to do that successfully and confidently. I also want them to have the chance to feel like the lab is a family away from home.

E**xperience or skills needed:** A general interest in biology is fine! Enthusiasm for plants and/or ecology would be great!

Restrictions or time constraints for this project: It would be good for the student to be able to join meetings on Wednesday 12:30-1:30pm and Friday 1:30-2:30. Other times might be available if the Wednesday meeting isn't possible to attend.

ID Number: 32

Academic College: Vet Med

Research project title: Cancer Sucks: Evaluating Novel Therapeutic Approaches to Find a Cure

Description of project: I am an immunologist and my research team studies ways to harness the body's immune system to fight cancer. This project will complement on-going studies in my laboratory testing different therapeutic approaches in an attempt to find a successful cure to some of the most aggressive forms of the disease. The student will learn and utilize a diverse range of laboratory techniques including basic cancer procedures, tissue culture techniques, immunological assays, biochemical assays, and methods to assess gene expression.

Research goals: The student will learn to follow standard laboratory protocols and instructions with minimum supervision, participate in weekly laboratory meetings and journal clubs, and learn cutting-edge approaches being developed to understand and combat cancer.

Mentoring style: The student will work directly with a graduate student to assist with on-going research studies. In addition, the student will meet weekly with Dr. Allen to discuss research goals and progress. This will be in addition to weekly laboratory meetings and daily interactions to discuss short-term deliverables. Mentorship in my laboratory is a team effort with everyone contributing to the development of their peers.

E**xperience or skills needed:** The student will learn basic tissue culture techniques using human and mouse cell lines, immunological assays, biochemical assays, and methods to assess gene expression.

Restrictions or time constraints for this project: None

ID Number: 40

Academic College: Vet Med

Research project title: The role of titan cells in the human fungal pathogen Cryptococcus neoformans

Description of project: Cryptococcus neoformans causes deadly meningitis in severely immunocompromised individuals. When causing disease, a subset of Cryptococcus cells enlarges to generate Titan cells that dwarf the immune cells that would normally contain and kill the pathogen. In this project we will explore genes important for Titan cell production and how they influence Titan cell formation.

Research goals: The student will learn basic microbiology, cell biology, and genetics techniques that are widely applicable across disciplines. In addition, the student will learn about host-pathogen interactions and explore models of human disease.

Mentoring style: The student will work closely with a lab member to learn both techniques and develop a conceptual understanding of the project. The student will perform their own experiments under the guidance and supervision of a more senior lab member (postdoc) with the goal of developing confidence and independence.

E**xperience or skills needed:** Students should anticipate majoring in a biological science. No other skills are required.

Restrictions or time constraints for this project: No, we will work around the student's schedule. Note:student cannot be severely immune - compromised.