## Undergraduate Research and Creativity, 2025, Fall Showcase

***Concurrent Oral presentations (please check details of presentations in both rooms):***

**Carver Science Building, Room 215, Jordon lecture hall (12:45 pm-2:00 pm)**

1. **Rachel Garcia.** "Student Loan Debt and its effect on the Job Market." Simpson College, assisted by SYLFF Research Grant

   This paper examines how student loan debt impacts the way individuals weigh trade-offs between risk (layoff risk, earnings uncertainty) and expected pay on the job market. I test this relationship directly using a hypothetical choice survey experiment on recent 4-year college graduates in the U.S., comparing participants' risk preferences over jobs at baseline with their preferences after a randomized, hypothetical debt shock. I find that an increase in student loan debt has little effect on average on the way participants evaluate this trade-off, but that this masks heterogeneous responses across participants. Some participants choose less risky but lower-paying jobs in response to a higher debt level, prioritizing stability to minimize the likelihood of missed monthly payments and default. Other participants choose higher-risk, higher-paying jobs in response to the debt shock, citing the need to manage financial obligations and pay down debt under a larger debt burden. The debt shock also significantly reduces reported likelihoods of making life choices that involve risk, such as purchasing a home and investing. Response patterns for both job choices and life choices are related to actual borrower status and awareness of repayment plan options, suggesting that experience and/or familiarity with the student loan repayment system and its insurance properties may help explain mixed responses to student debt in early-career job choice.

2. **Kalen Stefanick.** "Transhistorical Narratives: Scientific Discovery Beyond the Bounds of Identity." Society of Physics Students, Washington D.C.

   Transgender and nonbinary physicists have always existed, but their stories are notably absent from many textbooks and archives. Even when their voices are present, it seems that the primary focus is on their gender identity; their scientific contributions are often minimized, if discussed at all. In a world that is increasingly becoming more polarized on transgender topics, it is more important than ever to talk about their relative absence from the history of physics and fill in these gaps in the record. By illuminating these histories, physicists will be better equipped to work with their trans and nonbinary colleagues and tackle the issues of transphobia and lack of gender diversity in the workplace. In this presentation, I will discuss my work editing the Wikipedia articles of notable trans and nonbinary physicists, as well as creating a style guide with best practices for researchers studying these scientists. Then I will feature the x-ray diagnostic tuberculosis research and public health advocacy of Alan Hart, a pioneer in medical physics whose story has previously only been highlighted by gender studies researchers due to his trans identity. Finally, I will discuss the importance of ongoing work documenting trans physicists in the

present day via oral histories. Transgender and nonbinary physicists have done more than just defy gender norms—they have enriched their field with the diversity of their ideas and scientific discoveries.

3. **Ava Carnes.** "Beyond Blame: Rethinking Mental Health, Responsibility, and Growth in Our Communities." Simpson College

   Our research is an attempt to reframe adolescent mental illness through a phenomenological lens as a crisis of self-knowledge rather than merely a clinical condition. When mental illness compromises memory, perception, and agency, adolescents face a fundamental tension. They are expected to demonstrate rational decision-making and stable self-awareness while experiencing conditions that fragment these very capacities. We argue that institutional responses often impose epistemic injustice by dismissing or oversimplifying adolescents' lived experiences. Addressing adolescent mental health effectively requires interdisciplinary, humanities-centered approaches that recognize the interconnection between individual psychological development and broader social structures.

4. **Kai Starr.** "3D Printed Trap and Device Viability for Entomological Research." Simpson College Ecological Research Program

   Entomological research utilizes numerous different trapping devices and techniques in the collection of insect specimens. These traps used vary significantly in size, shape, design, durability and cost, all factors which may influence research efficacy and efficiency. Insect traps often are made by using repurposed products, such as plastic cups and bowls, whose design may vary between different manufacturers, and may change unexpectedly. We evaluated the use of 3D printing technology for custom-built insect trap creation to provide researchers with greater control over trap design. 3D printers are steadily becoming more widely available at colleges and universities, making it easy for others to produce similar traps. We tested a multipurpose 3D printed trap in the field with multiple different deployment methods. We analyzed abundance for each method and compared the cost and durability of these 3D printed traps to commonly-used equivalent traps.

**Carver Science Building, Room 205 (12:45 pm-2:00 pm)**

1. **David Lochner.** "Modeling Chronic Wasting Disease in Iowa Deer Populations." Simpson College, Bryan summer research program

   Chronic Wasting Disease (CWD) is a fatal neurological disease, arising from a misfolded prion that affects cervids, such as whitetail deer. This disease poses a significant threat to ecosystems in cervid populations in North America, hunting economies, and ecological balances. Because the whitetail deer population in Iowa is indispensable for the ecological and fiscal health of the state, mathematical modeling is essential to predict the future spread of the disease and draft policy suggestions of the Department of Natural Resources (DNR) to reduce its spread. This research presents an agent-based model (ABM) to forecast the spread of CWD in Iowa. An ABM is a computational approach in which each

individual entity, in this case of deer, holds their own behaviors, conditions, characteristics, and calculations according to the defined rules of the model. Using the ABM computation, this project will evaluate the many factors that influence the spread of CWD, including direct and environmental transition pathways. Validating the model through a performance evaluation using a pre-existing dataset, we will develop a predictive framework to simulate the future spread of the disease. By adjusting model variables including hunting strategies and environmental factors, we can predict their influence on the spread of the disease over the next 50 years.

2. **Alexis Ulrich.** Effect of local floral density on bowl trap collection of pollinators in central Iowa. Simpson College Ecological Research Program

   Accurate monitoring of pollinator populations is essential for understanding pollinator health and ecosystem function; yet widely used methods such as bowl (pan) trapping are increasingly scrutinized for their methodological limitations. Previous research indicates that bowl trap captures may be inversely related to floral abundance, potentially due to pollinators favoring natural floral resources over artificial ones, but findings remain inconclusive and methodologically inconsistent. This study seeks to evaluate how floral density influences the effectiveness of bowl traps in sampling pollinator abundance and diversity across varied habitats in Central Iowa. We integrated standardized floral density measurements and supplemental netting to address both taxonomic bias and environmental context. Our results will inform best practices for pollinator monitoring and contribute to the development of more accurate, ecologically meaningful sampling protocols.

3. **Maya Jolliffe and Drew Engler.** "Arthropod Biodiversity at a Fallow Farm in Marion County, Iowa." Simpson College Ecological Research Program

   We collected ecological data from a multitude of biologically varying locations on a fallow farm in the summer of 2025. Our goal is to find species and population trends and how they change over time annually. This part of our research is the start of this experiment. Overall, we found different trends of biological diversity in the separate locations we observed on the same fallow farm.

4. Econ 385 Econometrics, Simpson College

5. Econ 385 Econometrics, Simpson College

## Poster presentations:

### Carver Science Building atrium

1. **Noah King.** "Transfer Printing of Responsive Micro-Hydrogel arrays onto a Soft Surface." University of Nebraska-Lincoln

   Hydrogels are stimuli responsive and can act as actuators or afford color change based on external stimuli. Micromolding enables the ability to place controlled arrays of hydrogels (micro-hydrogels) on a soft surface, allowing actuation or color changing properties of the surface. Current micromolding techniques are limited to one hydrogel type, limiting to one control vector. Transfer printing of micro-hydrogel arrays allows more control vectors leading to a more precise and responsive surface.

2. **Audrey Gordon.** Analysis of Benzothiophene-Derived Inhibitors of Zika Virus RNA Polymerase. University of Nebraska Lincoln

   Zika virus (ZIKV) is a mosquito-borne flavivirus responsible for significant global health challenges, including neurological disorders such as microcephaly. The viral RNA-dependent RNA polymerase (RdRp) is essential for replication and represents a key target for antiviral drug development. In this study, we analyzed the inhibitory potential of a benzothiophene-derived compound, OFB3-10, against ZIKV RdRp. Vero 6 cells were infected with ZIKV and treated with various concentrations of OFB3-10. Viral titers were determined by using plaque assays to evaluate antiviral activity. The results demonstrated that OFB3-10 effectively inhibited ZIKV replication with an $EC_{50}$ value of 6.9 μM, indicating antiviral activity. These findings suggest that OFB3-10 interacts with the RNA polymerase active site, reducing viral replication efficiency. Future work could include cytotoxicity (MTT) assays to assess compound safety and testing the compound on other flaviviruses to see if it would have a similar effect on their replication trends.

3. **Brennan Voss.** Constraints of pH Fluctuation and Potassium Stress on Acetate Utilization for Plant Cell Culture. University of California, Riverside

   Plant cell cultures rely on sucrose as a carbon source, limiting sustainable and economic production of plant-derived compounds. Artificial photosynthesis-derived acetate is an alternative; however, plants cannot sustainably grow on potassium-buffered acetate alone, and concentrations above 2 mM negatively affect cell growth. Here, we explore factors associated with acetate feeding and their effects on cell growth and viability.

4. **Ethan Drake, Eli Fox, and Jack Howard.** Can neurocognitive test scores predict ACL injury risk? A transition from MATLAB to Python and a regression analysis. Bryan Summer Research Program, Simpson College

5. **Payton Seo.** Co-crystallization as a Tool to Enhance the Solid-State Behavior of Famotidine Department of Chemistry, University of Missouri-Columbia

   Famotidine (FMT), a drug used to decrease stomach acid production, has low permeability and aqueous solubility, resulting in poor bioavailability. Cocrystallization, the process of combining at least two molecules to generate a unique solid phase, has been found to have significant application in pharmaceutics as a way to modify the physicochemical properties of drugs. FMT was cocrystallized with nicotinic acid and acetic acid using liquid-assisted ball mill grinding and slow evaporation methods to overcome solubility issues. This resulted in two unique salt forms. Distinct phases were confirmed by powder X-ray diffraction and thermal analysis. FMT was shown to interact with the carboxylic acid moieties present in both coformers through strong, charge-assisted hydrogen bonds via single crystal X-ray diffraction analysis. The solubility properties of FMT and the salts will be discussed.