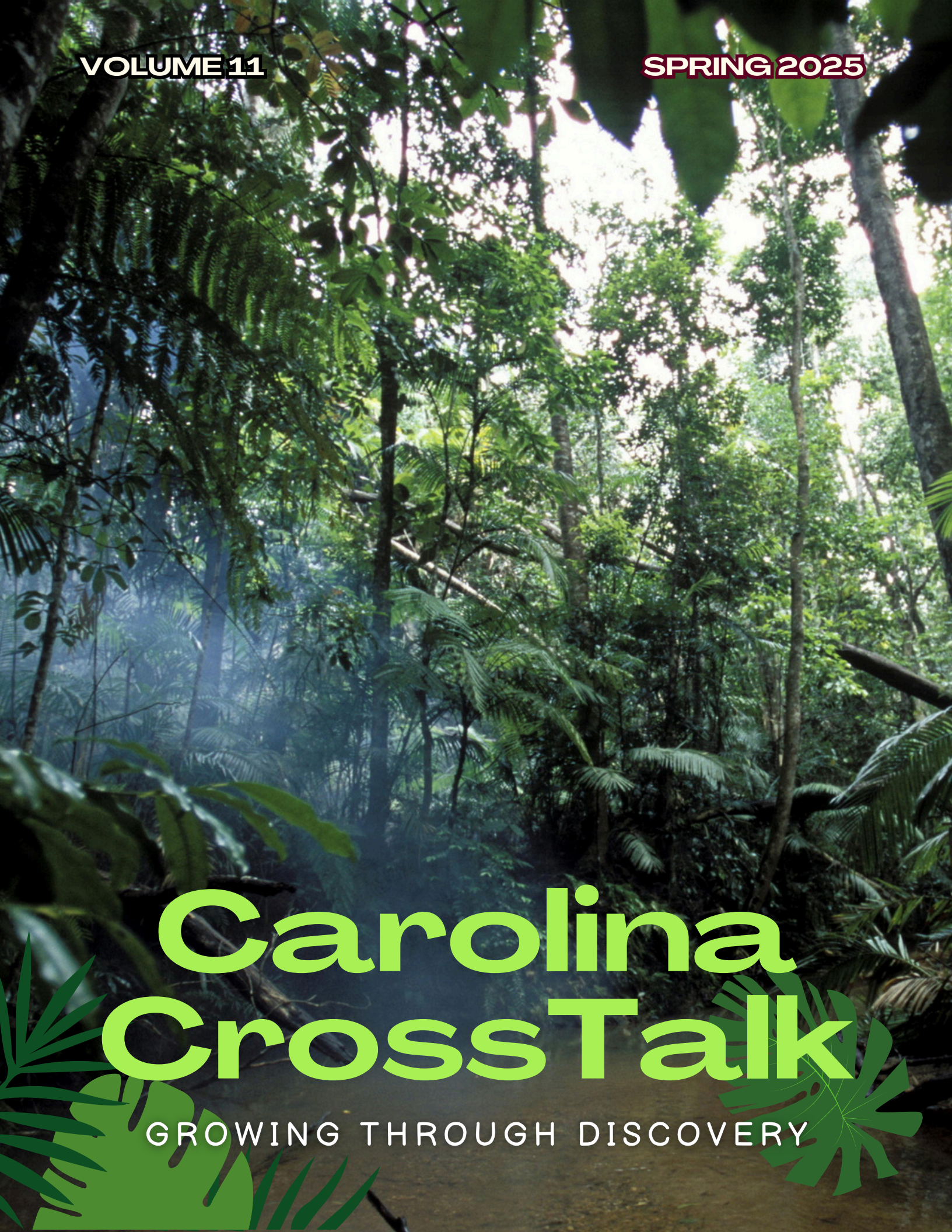
VOLUME 11

SPRING 2025



Carolina CrossTalk

GROWING THROUGH DISCOVERY

EDITOR IN CHIEF
SRIYA PALLAPOTHU

SENIOR EDITOR
AMBER HOLOWIECKI

SENIOR DESIGNER
ANNA CULLY

ASSOCIATE WRITERS
RACHEL KISER
AUDREY LOUDEN
HALEY MCKELVEY
RACHEL JOEL
AARON MCLEOD

ASSOCIATE EDITORS
IANGEL TOLAKA
RACHEL KISER
NYAH BORJA
ANGELINA JOBY CHACKO

GRAPHIC DESIGNERS
LIZ CLAUS
ANUVARSHINI RAJAJI SIVARANJANI

PHOTOGRAPHER
NYAH BORJA

COVER DESIGN BY ANNA CULLY
PHOTO FROM CANVA FREE IMAGES

BACKGROUND IMAGES FROM
CANVA.COM

TABLE OF CONTENTS

Letter from the Editor

Dear Carolina CrossTalk readers,

Growth doesn't always begin with a plan. It can start with a question, a spark of curiosity, or even an unexpected detour. This semester's theme, "Growing Through Discovery", celebrates the surprising paths research can take us on.

In this issue of Carolina CrossTalk, you'll meet researchers who are growing through discovery in every sense. From investigating the effects of medical devices and creating novel educational curricula, to studying marine organisms and infectious bacteria, their work represents a wide range of disciplines and personal journeys. Some are following long-held passions, while others are diving into new interests they never imagined would become so meaningful. Through trial and error, teamwork, and perseverance, research becomes not just a method of finding answers but a transformative experience in itself. Sometimes, the most impactful discoveries aren't just about what we find but who we grow into along the way.

Happy Reading,

Sriya Pallapothu

Editor-in-Chief

THE CRAB-ABILITY TO FIND VISUAL DIFFERENCES

Featuring *Maryia Sikirzhytskaya*, Biological Sciences & German Language, Literature, and Culture double major, Class of 2025

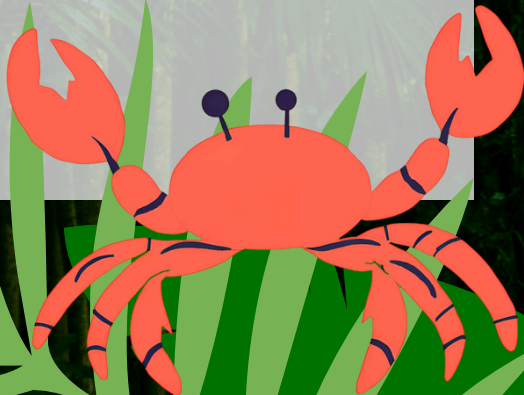
Written by
Haley McKelvey,
Associate Writer

Edited by
Nyah Borja,
Associate Editor

Designed by
Sriya Pallapothu,
Editor-in-Chief

As a senior Biology and German double major, Maryia Sikirzhytskaya first found a passion for research in her biology courses. She was immediately hooked when her professor, Dr. Speiser, discussed his research in her *Sensory Biology* (BIOL 599) and *Comparative Physiology* (BIOL 543) courses. Motivated, she emailed Dr. Speiser to seek out what opportunities his lab could offer. To her surprise, a spot to volunteer in the lab was available. With her foot in the door, Sikirzhytskaya was elated to work in a lab within her scope of interest.

Growing up near beaches in New York and South Carolina, Sikirzhytskaya was deeply curious about how life in the sea functions, and the Speiser lab was the perfect place for her to explore these questions. Dr. Daniel Speiser runs the Speiser Lab and specializes in the evolutionary physiology of marine invertebrates. During her first semester of volunteering in the lab, Sikirzhytskaya learned basic lab procedures. These included how to sedate the crabs to glue sensors on them, remove the sensors and accurately interpret the crabs' cardiac responses, and design an experiment. After a semester, Sikirzhytskaya applied for the Magellan Grant for the Spring 2025 semester, which required her to develop a research question and project proposal.
She combed



through existing literature to look for a "gap" in understanding that she could contribute to. After becoming proficient in basic lab procedures, Sikirzhytskaya felt comfortable conducting an independent experiment and began designing her project. The topic? How *Panopeus herbstii*, a type of Atlantic mud crab, picks up on chromatic contrast.

Everyone sees the world differently due to a variance in visual abilities, and animals differ in their abilities to distinguish colors. Though most humans can differentiate between reds and greens, many animals cannot. Underwater elements affect marine animals' visual capabilities, and Sikirzhytskaya was explicitly interested in whether *P. herbstii* can perceive color. Sikirzhytskaya chose to specifically study this species because, as both a predator and prey, *P. herbstii* plays an integral role in its ecosystem, and Sikirzhytskaya was eager to investigate how the crabs' sensory cues can influence this ability. Currently, there is very little neuroethology research on *P. herbstii* as compared to other more popular crabs to research, such as fiddler crabs. This means that Sikirzhytskaya's research can significantly contribute to developing a greater understanding of *P. herbstii*. Additionally, she already had prior experience working with these crabs and knew they could successfully withstand the sensor gluing process for the heart monitors she utilized in her study.

Sikirzhytskaya hoped to answer several questions with her research. Do P. herbstii have color vision? If they do, why do they have color vision? What is the potential relationship between their color vision and physiological responses? To investigate this, Sikirzhytskaya presented visual stimuli to the crabs on a monitor, which she liked to call "Crab TV." Located above the crabs' enclosure, Crab TV depicted a variety of looming stimuli. The experimental procedure called for presenting the crabs with visual stimuli in a randomized order.

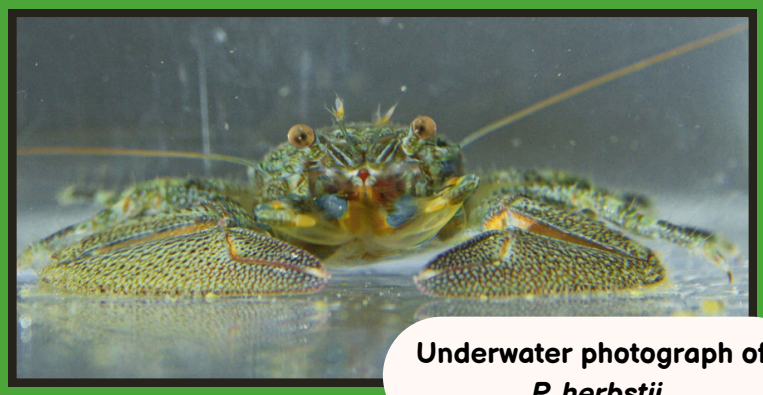
Headshot of Maryia Sikirzhytskaya

All photos provided by Maryia Sikirzhytskaya

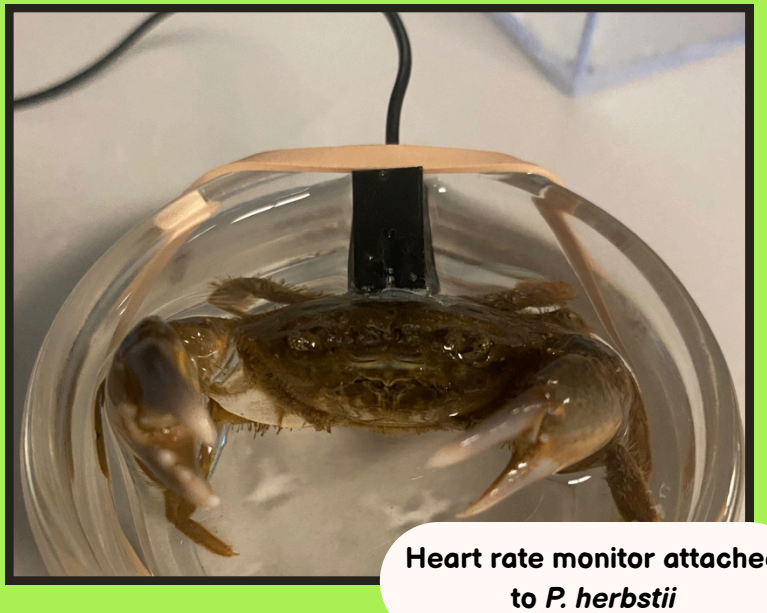
For the treatment groups, a green circle centered on a blue background was shown and a blue circle on a green background. The positive control group was a black circle on a white background and a white circle on a black background. The negative control group was a blue circle on a blue background and a green circle on a green background.

This procedure examined whether there was a correlation between looming threats (the visual stimuli) and the crabs' cardiac and behavioral responses. Heart rate monitors were connected to the crabs to observe their physiological reactions to the stimuli. "Crabs, like many organisms, have a variety of ways that they can respond to threatening stimuli," Sikirzhytskaya said. "One of those responses is freezing up, which - while useful for the crab - is not useful for researchers trying to determine whether the crab is responding or not." Her goal was to provide an objective measure of responsiveness via heart rate monitors, regardless of whether the crab was moving. Preliminary results indicated that the heart rates flatline when the crabs are scared. Sikirzhytskaya hypothesizes that the crabs are "playing dead" to avoid becoming prey, which could have been evolutionarily beneficial.

Ultimately, Sikirzhytskaya's work on this project allowed her to learn more about Atlantic mud crabs and herself as a researcher. One of her biggest takeaways from this experience was the importance of confidence — believing in her abilities both inside and outside of the lab and trusting what she had been taught. Although the project came with challenges, the reward of seeing the results from her first independent project made every obstacle worthwhile.



Underwater photograph of *P. herbstii*



Heart rate monitor attached to *P. herbstii*

Maryia running the experiment. There are 3 main sections on the computer screen: live cardiac data from the crab (top left), video footage of the crab that is monitored for behavioral responses and to make sure the crab does not escape (bottom left), and the stimuli currently being shown to the crab (right). The crab is not visible in the image, but it is located under the setup with the black blanket.

Exploring the Uncharted Territory of the Urinary Microbiome:

Insights From Bioinformatics

Written by Elena Renshaw
Edited by Rachel Kiser, Associate Editor
Designed by Anna Cully, Senior Graphic Designer
Featuring Elena Renshaw, Biological Sciences major, Class of 2025

The urinary microbiome, a complex ecosystem formed by various microorganisms that inhabit the human urinary tract, is an underexplored yet critical component of maintaining health. Part of this under exploration can be attributed to historical gender bias in research, as early medical studies were male-focused even though women are more affected by urinary symptoms; in fact, premenopausal women are between 20 and 40 times more likely to have a urinary tract infection in their lifetime than men of the same age (Deltourbe et al. 2022). A decade ago, it was widely accepted that the urinary tract was sterile. However, current research documents the presence of a highly dynamic resident microbial community, known as the microbiota, in the urinary tract. Research has shown this microbiota can contribute to susceptibility to urinary tract infections, kidney stones, and even bladder cancer, making the study of the urinary microbiota a critical and increasingly popular field.

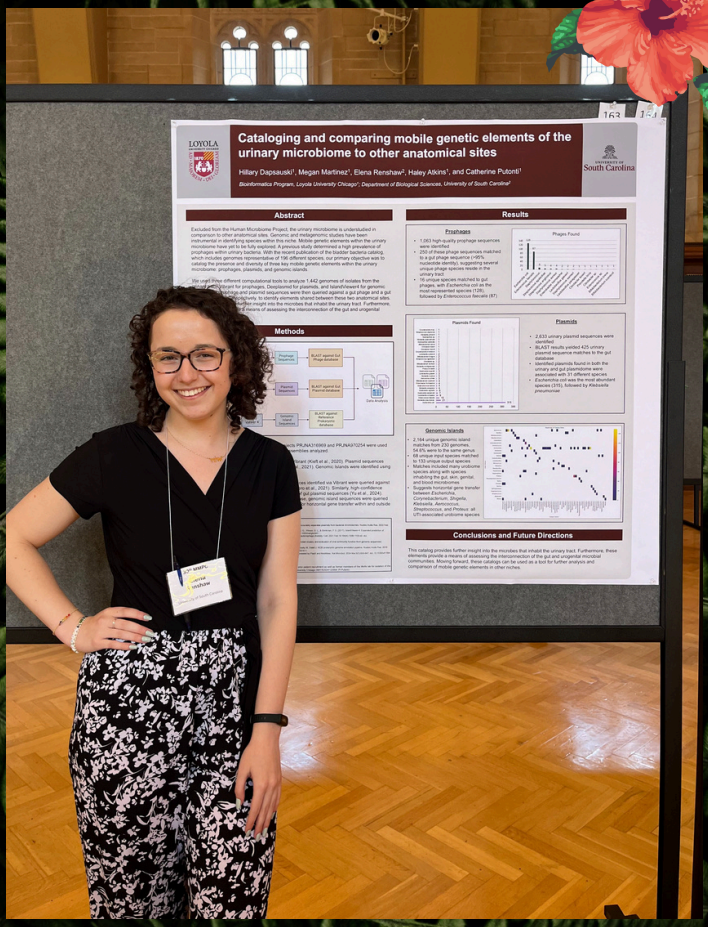
I knew early in my research career that I was ultimately interested in conducting research that has implications for human health. However, directly researching humans poses a myriad of ethical concerns due to strict guidelines; thus, it is much easier to research other organisms. Before starting my urinary microbiome research, I worked for two years in Dr. Jeff Dudycha's lab, where I studied life history, morphology, and gene expression in water fleas. Additionally, I also participated in two other summer research experiences. However, despite my extensive research background, I knew I needed additional research experience because I wanted to apply for Ph.D. programs. I considered applying for summer research internships, but I also wanted to be close to home because I had been away the previous summer. However, there did not seem to be many options for summer research where I was. This led me to wonder whether it was possible to do meaningful research outside of a laboratory setting. I had started taking classes for my Statistics minor the prior semester, so I considered applying for some remote biostatistics programs. While looking through the USC Office of Undergraduate Research's newsletter, I came across the Loyola Adventures in Urobiome Data program, which was exactly what I was looking for. While I had not considered the urinary microbiome in particular, I was interested in microbiomes, human health, and bioinformatics, and this program was all of those. It was a remote summer research program conducted through Loyola University Chicago, where students work on bioinformatics and biostatistics projects focusing on the urinary microbiome.

Being a part of this program was not only an incredible learning experience but also a

personal success. My group was tasked with examining mobile genetic elements of the urinary microbiome, and the entire project was coded through UNIX and Python. I had taken one introductory Python course, which I quickly realized was not enough to understand the complicated workflow of the project. It was difficult to cope with feeling underprepared and incapable, especially since many other students in the program came from bioinformatics backgrounds. However, with the help of my two group members, a graduate student, my research mentor, and online coding resources, I gradually became more comfortable and confident with coding.

My portion of the project was annotating and examining genomic islands (GIs), or regions of the bacterial genome likely to be of horizontal origin. Vertical gene transfer describes the classical pattern of inheritance where genes are passed from parent to offspring, while horizontal gene transfer (HGT) is common in bacteria and allows genetic information to be passed between unrelated organisms. HGT, and thus GIs, can occur through a variety of methods, including viral genome integration (transduction), bacterial mating (conjugation), or environmental DNA uptake (transmission). GIs are important because they encode important fitness-improving genes such as resistance, metabolism, virulence, and symbiosis. Particularly, understanding the role of HGT in transmitting antimicrobial resistance and virulence genes may provide insight into understanding and controlling urinary infections and conditions.

For my project, I used genome assemblies of bacteria that represent the bacterial diversity of the human urinary tract. I spent several weeks modifying Python code to send these genome assemblies into the annotation software. Because the urinary microbiota is understudied and limited full reference genomes exist, the annotation software was not properly equipped to deal with the level of diversity the bacterial genome assemblies displayed. The software I used combined four methods to predict GI segments, one of which utilized comparative genomics by aligning the inputted genome assembly to a reference genome. After running the software, only about a third of the 1,400 genome assemblies I entered were annotated successfully. Additionally, the species represented were quite limited, which was not ideal as the aim of the project was investigating



Elena presenting her group's research poster "Cataloging and comparing mobile genetic elements of the urinary microbiome to other anatomical sites" at the **Midwest Microbial Pathogenesis Conference** at Indiana University.
(photo provided by **Elena Renshaw**)

if any specific GIs were shared across species. Regardless, I ran a nucleotide similarity estimator program to see what species these annotated GIs matched and presented my results at the end of the program.

Coincidentally, only a few weeks after I started the summer program, a new GI annotation tool based on machine learning was released. Machine learning is a form of artificial intelligence that uses existing data to make predictions about newly provided data, and my research mentor and I hypothesized this model could be more robust for handling novel species. This software was already integrated into Python, so running the code was easier than the earlier tool. However, this tool had a different problem: it appeared to have an incredibly high false positive rate, meaning it seemed to annotate anything it did not recognize in its training sets as a genomic island. This was disappointing as I had hoped this tool would function smoothly, so I could begin to examine the GIs for functionality, origin, and association with factors such as symptom status. On the other hand, this opened up a new avenue for exploration. While I was planning the majority of my thesis to be on urinary microbiome evolution, it now made sense to compare the tools and examine how these alternative techniques perform on novel species.

Through this research experience, I have learned both about myself and my interests as well as bioinformatics. My previous work at the Dudycha lab had been exclusively hands-on experimentation, also known as wet lab work. This project was entirely computational, or dry lab, which is a stark contrast as it uses computer analysis and modeling to do research. I have found that exclusively conducting dry lab work has made me feel somewhat separated from the science, as the bulk of what I do is more data analysis and coding than biology. On the other hand, I enjoy the challenge of analytical thinking in coding, as a lot of wet lab work can feel routine after repeating the same techniques. Computational work does have a more challenging learning curve than the wet lab research I have done; however, it is also more accessible, as you can learn and practice the basics online versus requiring laboratory space and equipment. Either way, it takes persistence and dedication to learn, but it is incredibly rewarding.

From this experience, I realized I would like to conduct both experimental and computational research moving forward, which is why I will be working in a lab doing both for my Ph.D. Ultimately, having broad experiences in multiple subfields of biology allowed me to find my ideal research niche.

References:

Deltourbe, L., Lacerda Mariano, L., Hreha, T. N., Hunstad, D. A., & Ingersoll, M. A. (2022). The impact of biological sex on diseases of the urinary tract. *Mucosal Immunology*, *15*(5), 857–866. https://doi.org/10.1038/s41385-022-00549-0

Interested in Joining the Team?

Fill out our application!

We are looking for:

Writers
Editors
Designers
Photographers
Anyone who's interested!

Perks of Joining

- be published in a peer reviewed magazine
- writers & designers have lots of creative freedom
- looks great on resumes!

carolinacrosstalk@gmail.com

Check out our previous issues!
bit.ly/carolinacrosstalk

The Road to Recovery:

How Exercise Transforms the Lives of Cancer Survivors

Written by Audrey Louden, Associate Writer
Edited by Amber Holowiecki, Senior Editor
Designed by Liz Claus, Graphic Designer
Featuring Nicholas Volpe, Biological Sciences major, Class of 2026

Every year, around two million people in the United States are diagnosed with cancer (National Institute of Health, 2024). Unfortunately, these diagnoses are as painful to receive as they are prevalent. This was one of the first things that Nicholas Volpe, a junior biology major on the pre-medical track, mentioned when discussing his research in an exercise oncology lab through the Arnold School of Public Health. Volpe, an avid sports fan, has always been passionate about exercise, and it is one of the many interests he credits with getting started in his research. Twice a week, Volpe can be found at the Apex Physical Therapy center, where he works with participants who have undergone cancer treatment — typically radiation or chemotherapy — and guides them through exercises designed to help them regain strength and an active lifestyle.

Volpe works with the same participants over a period of eight to ten weeks, monitoring their progress from one week to the next. At the beginning of each session, participants typically start with a quick five-minute warm-up on the exercise bike, followed by around five different exercises that can be tailored to the hamstrings, quads, shoulders, chest, or back, depending on the needs of each participant. No two participants are exactly alike, so workouts must be customized for each

Prisma Health Apex Athletic Performance Center

The Prisma Health Apex Athletic Performance Center in Lexington, SC, is a hub for the lab's exercise oncology research. Cancer patients participate in tailored exercise programs that aid in their recovery, improve strength, and support overall health both during and after treatment.
(photo provided by **Nicholas Volpe**)

individual, which is one of Volpe's favorite aspects of his research.

"What's interesting for us is that for eight weeks you could train a 60 year-old man who had colorectal cancer, but the next semester, you could train an 80 year-old woman who had breast cancer," said Volpe. "Being able to adapt and kind of learn from the different situations that I'm presented with has been a big help," Volpe added, referring to how his research is helping him prepare to work with people in healthcare. Due to the largely interpersonal nature of his research, being able to connect with a diverse group of people is essential for success.

Volpe cites his aspirations of becoming a doctor and appreciation for genuine connections with participants as his motivations for getting involved in research. "I was particularly drawn to this research project just because of the fact that it was less white coat in a lab pipetting . . . I wanted to get a more personal sense out of research, and I feel that's very helpful for the future career that I hope to pursue," Volpe said. Those personal relationships are also a large part of what makes his work so rewarding, especially since he's able to help people who may be undergoing a difficult time in their lives. This research experience has enhanced Volpe's outlook on the field of healthcare, cancer, and his own future plans to be a medical provider. His relationship with participants has been integral to both his time in research and at USC, and the progress participants make from week one to week ten is why he continues with

Headshot of **Nick Volpe**. Photo taken by **Nyah Borja**, Carolina CrossTalk photographer

his research each semester. So far, many of the participants have made significant progress, which can be easily tracked by using a metric of exercise volume. This metric is calculated from the amount of weight lifted, number of repetitions, and number of sets used in each workout. For example, one participant Volpe worked with gradually increased the intensity of his workouts over 10 weeks, bringing his exercise volume score from 1500 to an impressive 5100. The large score improvement highlights just how effective the exercises can be, supporting the idea that personalized workouts can have significant effects on cancer survivors' physical capabilities.

Volpe's ultimate goal is for participants to continue reaping the benefits of their workouts long after their eight to ten week sessions come to an end. He hopes that participants will continue to exercise on their own, something he encourages with follow-up phone calls even after the program is finished. For cancer survivors recovering from this devastating illness, Volpe's research shines light on how the power of regular exercise builds not only muscle but also confidence. He hopes his research will continue to help individuals reclaim their lifestyles from cancer, one workout at a time.

The layout of the gym at Prisma Health Apex Athletic Performance Center provides a versatile and supportive environment for cancer patients. From cardio machines to strength training equipment, the space is designed to accommodate a range of exercises tailored to each participant's individual needs and goals.
(photo provided by **Nicholas Volpe**)

References:

National Institute of Health. (2024). Common cancer sites - cancer stat facts. National Cancer Institute. https://seer.cancer.gov/statfacts/html/common.html

Elucidating Auditory Processing in Cochlear Implant Listeners Using fNIRS

Written by Rachel Kiser, Associate Writer
Edited by Sriya Pallapothu, Editor-in-Chief
Designed by Anna Cully, Senior Graphic Designer
Featuring Reed Farrar, Neuroscience major & Entrepreneurship minor, Class of 2025

Everyone has seen a similar video: a toddler, born with neurological hearing loss, has their cochlear implant turned on and can finally hear their mother's voice. It's emotional for everyone in the room and for those scrolling through tear-jerking videos on Instagram. The toddlers in those videos are just one of many individuals receiving cochlear implants across the world; as of 2022, over 1 million devices have been implanted globally to improve the ability to hear speech, environmental sounds, and music (Zeng, 2022). Cochlear implants are the most successful neuroprosthesis in the world, yet there is still variation in how cochlear implant users interpret sound and understand speech, especially in the presence of background noise where auditory performance is significantly reduced (Zeng, 2022).

Reed Farrar, a junior neuroscience major, is on the cutting edge of improving this critical technology for those with neurological hearing conditions. His work in Dr. Meisam Arjmandi's lab focuses on the neural basis for how cochlear implant users interpret sound, honing in on the specific brain structures that contribute to how we hear. "Once we can understand those contributions," Farrar said, "we can understand how to provide the best possible speech perception for cochlear implant listeners."

As a freshman, Farrar had no plans to conduct any research. After applying to several labs and being rejected, told he should apply again later, or ghosted, he was ready to move to a more service-based extracurricular. However, in the spring of 2023, he stumbled upon a new lab, led by recently hired professor Dr. Meisam Arjmandi, that was being advertised in the South Carolina Honors College newsletter. The application required an interview, a daunting process for any researcher looking to break into a field. However, Dr. Arjmandi was just looking for inquisitive minds. "He liked that I was curious and wanted to learn about the process and how cochlear implants work," said Farrar. "I knew the day of that I was a part of this lab."

Now, Farrar is leading his own project on the use of neuroimaging, specifically Functional Near-Infrared Spectroscopy (fNIRS), for understanding how cochlear implant listeners process sound inputs at the neural level. fNIRS is a recently developed method of examining surface-level cortical brain function by using near-infrared light to measure fluctuating hemoglobin levels in response to processing sounds. Increased blood flow to neurally active cortical regions leads to a spike in hemoglobin, which fNIRS maps onto the brain.

Farrar's current project studies non-cochlear implant users (e.g. those with normal hearing) and creates a simulation that generates auditory stimuli like what a cochlear implant user may hear, a process called vocoding. These simulations create stimuli with varying levels of degradation, making speech sound noisy or robotic. The level of degradation is varied to simulate the range of performance observed in actual cochlear implant users. Using the new fNIRS technology, Farrar and his team can see which brain regions are activated when participants correctly guess the speech over the background noise and those that activate when participants cannot hear the speech through the noise.

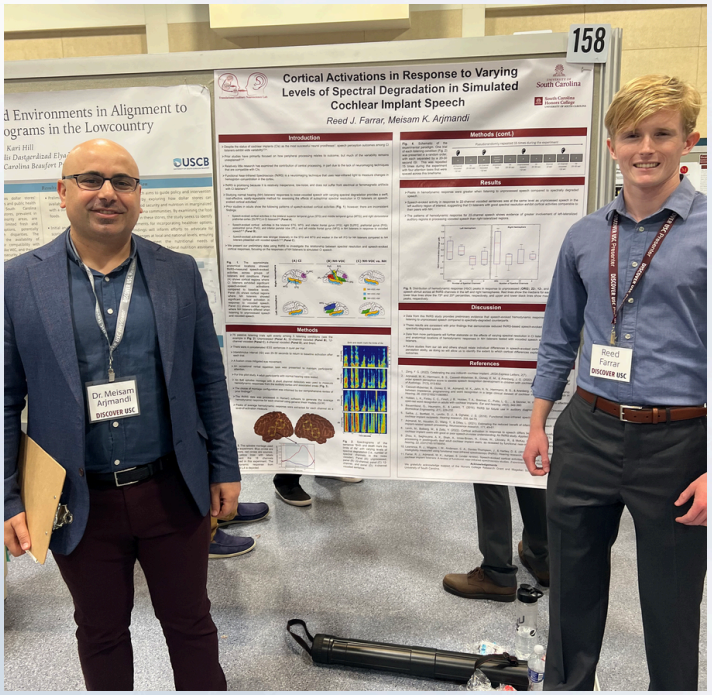
Bottom Left:
***Reed Farrar** using the Homer3 software to analyze fNIRS data from a recent experiment in the sound booth, the soundproof room where experiments are conducted. On his left is the fNIRS equipment, including the cap which is currently placed on a mannequin head.*

Farrar's study stands out in the field of neuroimaging because of his choice of auditory stimuli. Typically, the speech used as auditory stimuli is composed of sentences, but Farrar is utilizing vowel fragments instead, which is largely unexplored by fNIRS. "Most of the time people use sentences [as auditory stimuli] because it gives you more time to have the right hemodynamic responses," he says. Because of the novelty of both the length of the auditory stimuli used and the technology of fNIRS, Farrar has the unique opportunity as an undergraduate to develop new research methods for his lab and field. Designing the methodology of a specific study is one of Farrar's favorite parts of the process: "That's where I'm making the plan. That's the fun of it."

Farrar has been successful in his project planning, publishing two literature reviews in the span of two years with Dr. Arjmandi; he is

the first author of one of these reviews, titled *Speech-evoked cortical activities and speech recognition in adult cochlear implant listeners: A review of functional near-infrared spectroscopy studies*. He is also a recipient of both the Honors Research Grant (2023) and the Magellan Scholar Grant (2024), which were used to support his work and presentations at DiscoverUSC.

The unique experiences of being able to observe both the research process and real-world applications of the study have motivated Farrar to continue conducting research throughout his future career as a physician and auditory neuroscientist. Arguably, the most rewarding part of his work is being able to see the direct impact on patients: "It's very common as I'm walking into the lab that I see a young child with a cochlear implant running through the hallway, excited to meet with professionals who improve their hearing," he explains. "It [the study] is directly tied to real people who have real struggles and real lives."



***Reed** at DiscoverUSC 2024 presenting preliminary findings that used fNIRS to investigate the relationship between spectral resolution and speech-evoked cortical activity.*
(all photos provided by Reed Farrar)

References:

Zeng, FG (2022): Celebrating the one millionth cochlear implant. JASA Express Lett. Jul;2(7):077201. doi: 10.1121/10.0012825.

Interested in Being Published?

Want to Share Your Research With a Larger Audience?

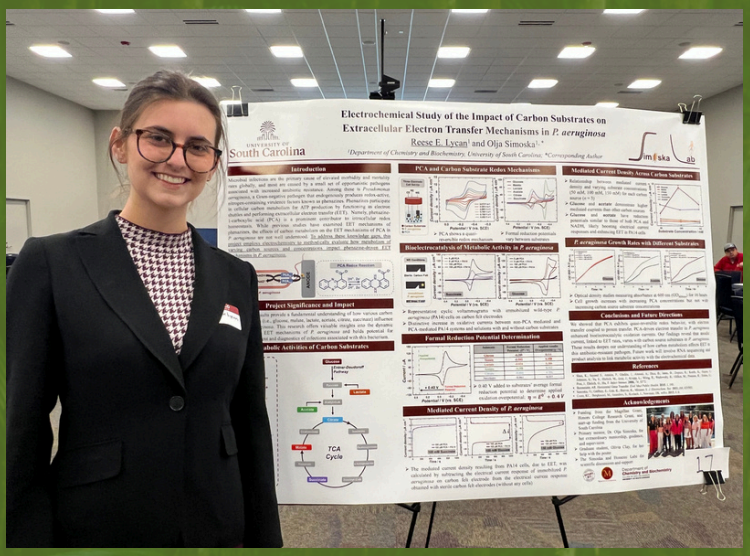
Scan the QR code to submit your research to be featured in our peer reviewed magazine!

Biofilms and Biochemistry: Studying Bacterial Growth to Prevent Infections

Written by Rachel Joel, Associate Writer
Edited by Iangel Tolaka, Associate Editor
Designed by Anuvarshini Rajaji Sivaranjani, Graphic Designer
Featuring Reese Lycan, Biochemistry/Molecular Biology major & Health Promotion, Education, and Behavior minor, Class of 2025

Bacteria can be found in our food, body, surroundings, and all around us. These bacteria are often harmless and sometimes even beneficial. However, this is not always the case, as seen with *Pseudomonas aeruginosa.* This bacterium is a deadly threat to patients with cystic fibrosis, a life-threatening genetic condition in which mucus builds up in the lungs. *P. aeruginosa* is a bacterium known to form biofilms — sticky and highly dense communities of microbes — that build up on the inside of the lungs, and this particular bacterium is a major cause of hospital-acquired infections. Unfortunately, *P. aeruginosa* is also very resistant to antibiotics, making it a major threat to immunocompromised patients and those suffering from cystic fibrosis.

Reese Lycan, a University of South Carolina senior majoring in Biochemistry/Molecular Biology, is attempting to tackle this problem by investigating how *P. aeruginosa* aggregates into biofilms and grows. She hopes that this research, conducted under the mentorship of Dr. Olja Simoska, will help develop medicines that can reduce this bacterium's high infection rates. Her research investigates how *P. aeruginosa* interacts with different carbon sources, like glucose and malic acid, and communicates with other bacteria as part of the process that helps it form biofilms, a cause of its antibiotic resistance. Lycan aims to bridge the gap in existing literature regarding *P. aeruginosa* and its relation to different carbon sources by applying the electrochemical techniques utilized in Dr. Simoska's electroanalytical chemistry lab.



Reese presenting a poster at the Analytical Chemistry Society Undergraduate Research Symposium (2025). (photo provided by Reese Lycan)

Lycan admits that much of her research is very new. "[There have been] a lot of studies on how this bacterium grows but not necessarily how it transfers electrons, which is one of the mechanisms used to form the biofilms," she said.

Embarking on the study of this newer topic can be somewhat frustrating due to the lack of articles available that she can reference. However, Lycan enjoys the challenge and admits that it is rather "exciting to be fishing the boundaries in that way."

Before this project, Lycan didn't have much exposure to research besides experience with writing a literature review. However, she quickly discovered that research requires copious problem-solving and critical thinking skills. For example, to ensure efficient progress on her project, she needed to plan ahead, keep track of the work she had done each day, and block out time to finish everything accordingly. Most of all, instead of panicking when results or procedures didn't turn out as planned, she learned it was important to be adaptable and open to changes in the project.

As a result of this project, Lycan has grown to enjoy many aspects of research. She believes that focusing on one research topic can foster tremendous growth and expresses that she "enjoyed digging into this subject in the same lab for two years." Lycan presented the results of her project at the 2025 American Chemistry Society's Undergraduate Research Symposium and at DiscoverUSC 2025. In future studies, she would like to explore how different strains of *P. aeruginosa* utilize carbon and interact with other bacteria in their environment. As she looks ahead, Lycan remains eager to keep asking questions and pushing the boundaries of what she knows. "There's always something in research that can challenge you," she said — and for Lycan, that's exactly the point.

Advocacy Through Research:

What Developing a Portuguese Curriculum Meant to Me

Written by Paige Swanson
Edited by Sriya Pallapothu, Editor-in-Chief
Designed by Liz Claus, Graphic Designer
Featuring Paige Swanson, Criminal Justice major & Portuguese minor, Class of 2026

There was one major question I was confronted with when I considered getting involved in undergraduate research. Before finding an advisor, developing a topic, writing the research question, and subsequently editing it ten to twenty times, I had to ask myself, "What does research mean to me?" I thought about the real-world applications of research and how many sectors it is valuable in: not only in the sciences, but also in criminology, international studies, marketing, education, and linguistics. Research builds the foundation for fields that impact people's everyday lives. Understanding the wide scope of different research applications to policy, educational programming, and social justice became just as important to me as the research component itself. It was in this realization that I found the answer to the all-important question — to me, research is the first step in advocacy, equity, and communal change. I wanted my project to be a starting point for something that could help people in the Columbia community. After I understood that, it became easy to explore different topics and learn more about how my academic focuses fit into advocacy through research.

To understand my passion for this research project, it is important to learn more about my interests and backstory. My name is Paige, and I'm from South Carolina. As a student in the Honors College, I am studying criminal justice with a minor in Brazilian Portuguese. Typically, when I tell people this combination of degrees, they tilt their head inquisitively and ask, "Why Portuguese?", to which I always reply, "It's a long story." In short, I started undergrad in the IBEA International Business cohort because I wanted to travel, and this particular program would allow me to travel for three of the eight semesters of my undergraduate career. A requirement of the program was minoring in a language, and the choices were German, French, or Brazilian Portuguese. Having taken Spanish throughout high school, I honestly thought Portuguese would be a simple transition (I realized that I

wrong about two days into my first class but have caught on since). Even though I was wrong in that regard, I stuck with it. When I changed majors from business to criminal justice, I decided to keep the Portuguese minor. Although it is considered an odd combination, I have always enjoyed learning languages because they connect people together, and one of my personal goals is to become bilingual. Flash forward to today, I have gained so much more from my Portuguese minor than I ever expected; I have learned about culture, social inequalities, and the power language has to unite people. I met some of my best friends in my Portuguese classes, and I genuinely enjoy bonding through speaking activities and that well-known sense of collective fear of being randomly called on in class. I developed a new understanding of how language education can impact students not only academically but also personally. From the beginning, I knew it was important to integrate educational equity standards and language learning, but it wasn't until later in my undergraduate career that I learned how it could apply to a relevant issue facing the Columbia community.

Strangely enough, it was a criminal justice class that helped fill the gap to create a solid and meaningful research question. I recently took a class called *Adolescent Mentoring* in which I volunteered at a local alternative school. This is a type of school where students who need additional resources or students with behavioral difficulties who were expelled from their original school are transferred. I supported students in becoming self-sufficient and worked with them to navigate the systemic barriers they face in their communities. From the training sessions and my own experiences at the school, I realized that the populations facing the most barriers in South Carolina also struggled the most in school. Reading and math literacy, the foundations of public education, seemed to be especially difficult. It was clear that aversion to schoolwork was often the result of simply not understanding, and I knew this was a problem that needed to be addressed in a unique way — one different from what policymakers had attempted in the past. When I considered solutions to improve literacy development in South Carolina's most vulnerable schools, I thought of the attention to detail that is required when studying another language. This sparked my interest. Was there really a way that I could use the Portuguese language to promote literacy in other subjects, like English language arts and mathematics? Could I tie my interests in Portuguese, criminal justice, and advocacy together? It was these very questions that inspired me to research bilingual education programs. Finally, when someone asks, "Why Portuguese?", I have an answer. Now, I can explain my research project, which connects language learning to a variety of other fields, including criminal justice and education advocacy work.

That short synopsis of my educational career at USC may have provided some idea of what my research is about, but I would like to dive a little deeper. In a typical humanities research fashion, the name of my project is a mouthful: *"Developing a bilingual education program for middle schools in Richland School District 01: Promoting literacy through culturally relevant pedagogy"*. That may clear things up a bit, but even that is a lot to take in. To break it down further, the project was developed to

create a middle-school level Portuguese language and culture curriculum that could be used in Richland 01 schools, which historically have extremely low literacy rates. The purpose of this program is twofold: first, it seeks to help students who face barriers in the education system improve their literacy in English and math by learning another language — specifically, Portuguese.

This may seem counterintuitive, but previous studies have found that learning in a different language forces students to engage more with the content, and in student populations facing barriers, learning these tools can be essential to literacy improvement. Secondly, the program was also created to unite students of different backgrounds and provide a space for classroom discourse about the struggles they may face at home and in their communities. By using Brazilian culture and the Portuguese language as an outlet and comparison point, predominantly minority students in Richland 01 would have a space to be open about their viewpoints, culture, and lives. This is where "culturally relevant pedagogy" comes into play, as the goal was to use students' own experiences, culture, and beliefs to teach them. By replacing Eurocentric material with more relevant stories and language patterns in the classroom, students will be able to relate to each other and the content more effectively, which also helps promote literacy development.

The goal of the project was to create a more inclusive environment for students in public schools while also solving the literacy problem in Richland 01. Easy, right? Turns out, it was not so easy. Thanks to the Honors College Research Grant, I was able to fund my work and study the topic for over six months. I used that time to work on thematic coding, write an extensive research paper, and most importantly, develop a curriculum that — if the school district gets the resources to implement it — can be easily put in place by an instructor. It provides a week-by-week breakdown of activities and a sample weekly lesson plan that works towards improved literacy and classroom inclusion. With the groundwork completed, the last step in the project will be making the program a reality.

I am extraordinarily grateful for the insight this project has given me. It began as a way for me to dive deeper into language studies and understand how the local community could benefit from more language programs. It ended with me gaining a greater understanding of the inequities of the public school system and the unique experiences of minority students. I urge other student researchers to pursue projects that will similarly benefit the greater Columbia area. Moving forward, it is important we all do our part to understand and improve the experiences of local disadvantaged populations and use our available resources to advocate for our community.

Photo of Paige Swanson (all photos provided by Paige Swanson)

Carolina CrossTalk © 2025