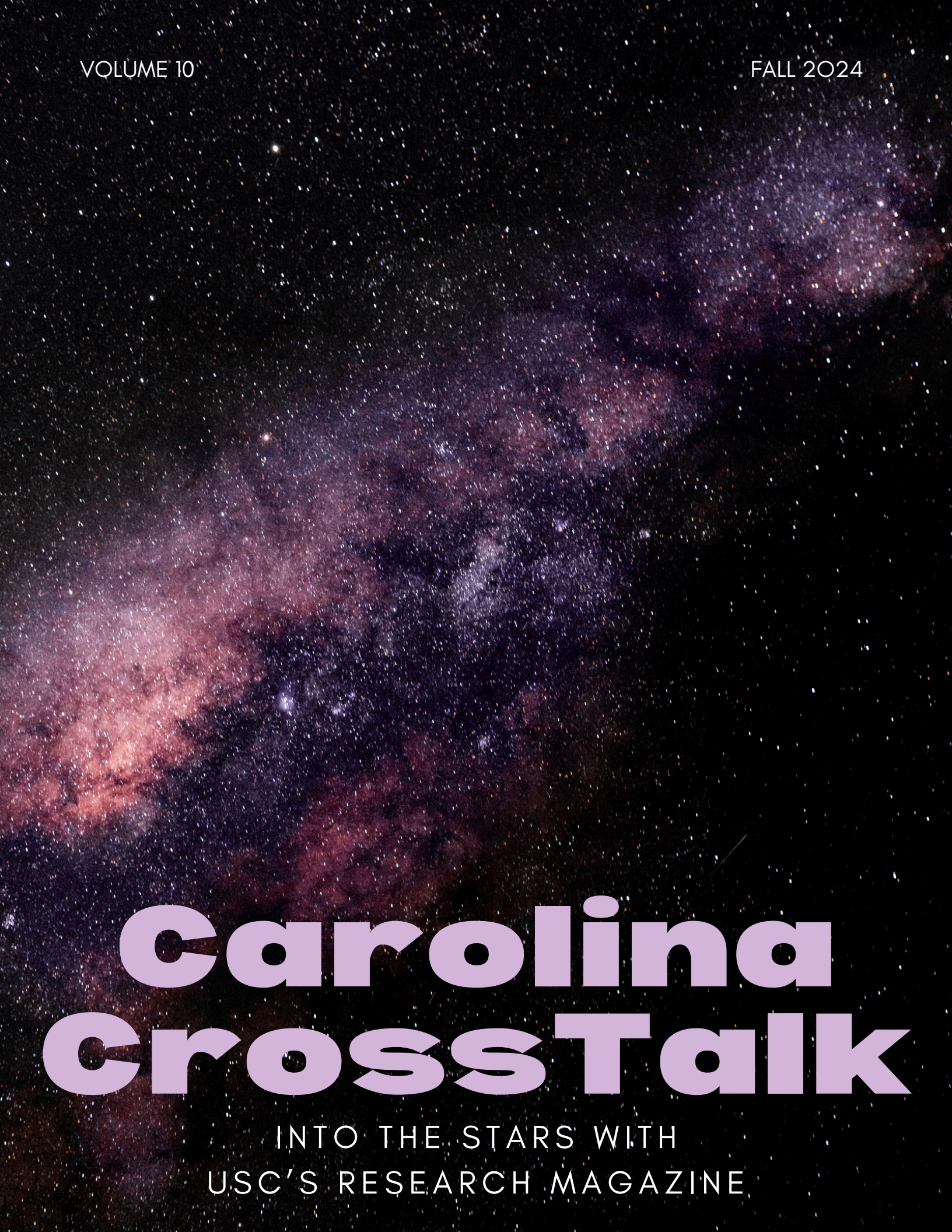

VOLUME 10

FALL 2024

Carolina CrossTalk

INTO THE STARS WITH
USC'S RESEARCH MAGAZINE

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Letter from the Editor

Dear Carolina CrossTalk readers,

Reaching for the stars requires embracing the unknown and daring to dream big. Though daunting, embracing uncertainty can lead to the discovery of novel ideas and yield further questions to investigate. This issue's theme of "Into the Stars" invites us to think of research as an exploration. Just like how astronauts venture into the vast expanse of space, researchers embark on a journey into the unknown to uncover something new and change the world.

This issue of Carolina CrossTalk features researchers who have been thinking outside of the box and exploring new ideas, whether that's by being brave enough to find a research lab that resonates with their passions, working on novel treatments for diseases, evaluating public policy, breaking down barriers in research, or exploring early indications of autism. These stories highlight the bravery required to pursue one's passions, overcome obstacles, and make an impact. We hope this issue encourages you to ask questions, dream big, and see how your research journey can take you to new places. Get ready to learn about some of our amazing researchers as they push past boundaries and venture into the stars.

Happy Reading,

Sriya Pallapothu

Editor-in-Chief

Gazing Into Early Intervention

How Souza uncovered correlational research amongst infants at high and low risk for ASD

Written by Haley McKelvey, Associate Writer
Edited by Angelina Joby Chacko, Associate Editor & Graphic Designer
Designed by Anuvarshini Rajaji Sivaranjani, Graphic Designer
Featuring Jaelyn Souza, Neuroscience, Class of 2026

As infants, many of us had a variety of toys to play with, maybe even a favorite one. For some, it was a toy that made lots of noise, like a rattle or noisemaker, stimulating our brains. Others may have favored a more strategic toy, like a ring stacker, engaging the problem-solving portion of our frontal lobes. Interestingly, emerging research suggests that how infants interact with objects in their environment, through visual attention, may serve as an early indicator of Autism Spectrum Disorder (ASD). Jaelyn Souza has been involved in ASD research since her freshman year of college. Connections at her lab here at USC landed her an internship at Brown University this past summer studying emotional regulation and how it supports early visual attention in babies in the NICU.

Jaelyn Souza, research assistant at the Early Social Development Lab.

Souza, originally from Boston, Massachusetts, found herself at home at Carolina during her senior year of high school, after attending Admitted Students Day. She initially started at USC as a Psychology major, but she changed to a Neuroscience major as she found it more invigorating since she was on the pre-medicine track. In her first year, she applied for and received the Temper Scholarship, an award offered to first-year USC students, courtesy of the owners of the Carolina Panthers. Because of this generous scholarship, Souza was able to focus on her studies at USC and start her research career. Later, she received the Galen Magellan Grant, which funded a full year of her research.

Souza works at the Early Social Development Lab at USC under the guidance of the study's principal investigator, Dr. Jessica Bradshaw, and her graduate student mentor, Emma Platt. Her work examines differences in visual attention between infants at elevated and low familial likelihood for ASD. Infants with an elevated likelihood of ASD have a full biological sibling with the disorder, with a sibling recurrence rate of approximately 20 percent. Souza is specifically interested in "sticky attention", which is prolonged attention to a specific object or stimulus and is commonly observed within ASD children. Sticky attention is measured by examining infants interacting with a variety of toys during playtime. Infants in the study ranged from 3-12 months, and follow-ups were conducted at 2 and 3 years of age.

If the infant was visually attending to a toy, it was coded as "1", and if they were not, it was coded as "0". This binary coding system is a useful data processing method that quantifies moment-by-moment behavior (i.e. visual attention to toys) and enables the application of advanced data analysis techniques. Data at four months showed that infants with a low likelihood of ASD, referred to as the LL group, had higher visual attention than the infants with an elevated likelihood of ASD, referred to as the EL group. Between six and eighteen months of age, the data fluctuated but was comparable amongst the groups, steadily increasing across time points. At twenty-four months, EL infants displayed greater visual attention to objects, potentially due to increased instances of "sticky attention," a behavior observed in children with ASD. Overall, Souza's results indicate an intriguing pattern of visual attention in infants at an elevated likelihood for ASD, where it is significantly reduced at 4 months of age but gradually increases until it becomes notably augmented by twenty-four months.

When asked about the social implications of the study, Souza said, "It brings USC to the community; it helps make connections with families." Souza's ability to impact her community is the most rewarding part of her research and is why she studies what she does. The connections she has made fuel further research in early identification of ASD as well as assist families with finding resources and the services they need to support their child's development. Through the study, Souza's lab has fostered a community for families by providing them with resources and being a place to go to for support. The results of the study have the potential to improve outcomes for children with ASD and can apply to early education initiatives and even government policies. If given the chance, Souza would continue her research, honing in on four-month and twenty-four-month data, examining where and why there tend to be neurological shifts amongst infants. Her long-term goals include following the neurological development of a group of participants over three years and examining the specific visual patterns of infants who were later diagnosed with ASD. While discussing the importance of her research, Souza remarked, "Our brain is our most beautiful thing." The human brain is infinitely complex, formed by a myriad of memories, experiences, and genetics. It is this very complexity that makes the human brain so intriguing and extraordinary.

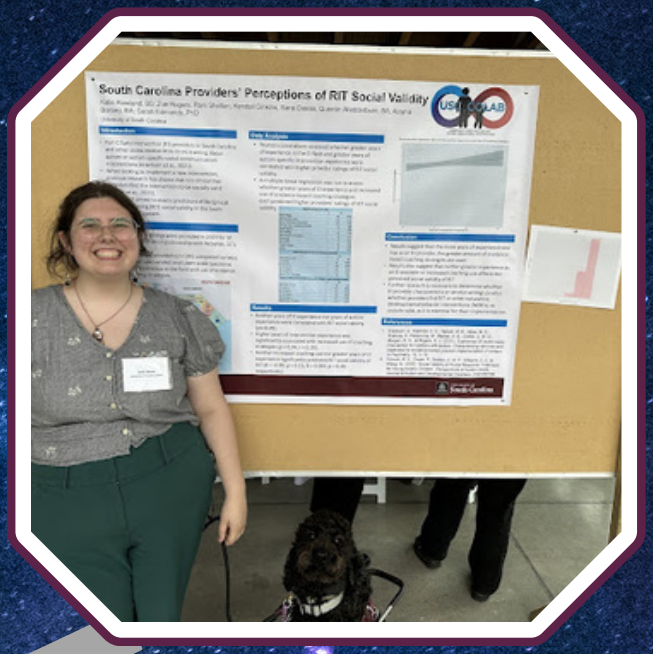
From left to right: Jaelyn's PI Dr. Jessica Bradshaw, Cocky, Jaelyn, and Jaelyn's mentor graduate student Emma Platt. Photo taken at Discover USC 2024 where Jaelyn presented her project this past spring.

Photos provided by Jaelyn Souza

Science to Practice: Pushing the Boundaries of Autism Research

Written by Lilly Kosoglow, Associate Writer
Edited by Darnell Norman, Associate Editor
Designed by Angelina Joby Chacko, Associate Graphic Designer
Featuring Sarai Deese, BARSC major, Class of 2025

Sarai Deese has been pushing the boundaries of what is considered "traditional" in every aspect of her Honors College experience. Deese has crafted her own degree—a combination of psychology, social work, public health, special education, and medical humanities—and her coursework enables her to understand how and why families use and trust (or distrust) public and private systems. This interdisciplinary approach to education is equipping her for her dream career as a children's therapist in Appalachia.



Sarai and her service dog, Archer, in front of the COLAB poster for SCAND (South Carolina Autism and Neurodevelopmental Disorders Consortium) on early interventionists' opinions on training the lab offered.

Coming into college, Deese knew that she wanted to conduct research. In high school, she worked in a science communication role at a children's museum, performing science experiments with kids and sharing science with the public. Now, Deese is combining her passions for science and people to take an innovative community-based approach to conducting autism research while simultaneously addressing the science-to-practice gap. The science-to-practice gap explains the break in time between when an idea is developed in a lab to when it reaches the public and is applied on a broader scale. Researchers such as Deese must be intentional about recognizing and reducing this gap. Addressing the gap will enable the public to easily access research breakthroughs that could improve their quality of life.

Deese began her research journey by joining the Community-Oriented Lab for Autism and Behavioral Interventions (COLAB) and working with her mentor, Dr. Sarah Edmunds, to apply for the Magellan Journey Grant. She aimed to investigate what kinds of emotional regulation resources are available to parents of autistic children in South Carolina to assess the quality of these resources. To do this, she looked at the language that psychoeducational websites use to communicate information about autism with parents of autistic children. These sources are supposed to be understandable to 4th graders—however, Deese found that most sources

are far above that reading level. Parents use these websites to learn about how they can improve their child's quality of life, so the readability of this information is critical. Deese discovered that the resources parents use to learn about autism are typically easy to read but inaccurate. However, the materials that parents use to get services for their child are often more accurate but also difficult to read due to complex scientific terminology.

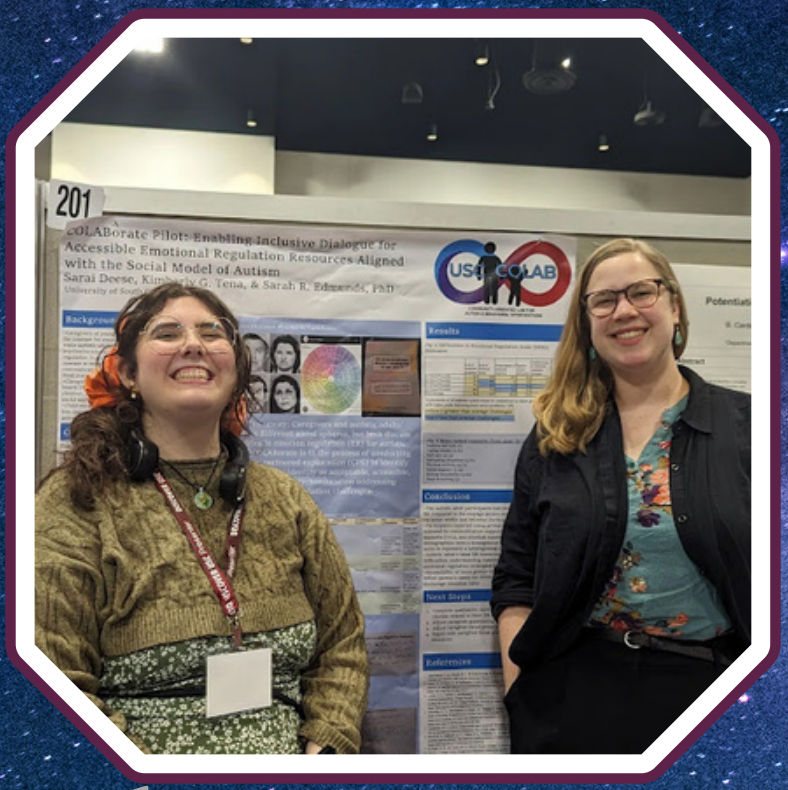
Deese expanded upon her findings from her Magellan Journey project after obtaining the Pilot Grant through the Honors College. Deese explained that she was grateful that her projects have been so rewarding to work on and said, "It's pure luck that it all built off of each other the way it did." This luck was most likely due to Deese joining a lab and receiving mentorship early on at the University of South Carolina, which has enabled her to learn to think like a scientist and answer new questions that each completed study generates. To build on her initial findings, Deese brought the community into her study and began to investigate what autistic adults and parents of autistic children think about how resources to support emotional regulation are communicated. She aims to investigate the following: what autistic adults know, what they have discovered, and whether they find the things researchers have discovered helpful. To answer these questions, she held focus groups with autistic adults. Deese found that these adults had more challenges with emotional regulation compared to the average person seeking therapy. Their ideal resources focused on addressing interoception difficulties, understanding nuanced expressions, and teaching these strategies directly to children. Next semester, she will build upon this initial focus group by including parents of young autistic children. Based on her experiences and literature search, she anticipates finding that parents want to do their best to help their children, and they tend to do so given the resources available. From talking with parents in the community, she was pleasantly surprised to discover they are relatively informed on evidence-based practices compared to what the literature would suggest.

Fall 2024 COLAB (Community Oriented Lab for Autism and Behavioral Interventions) lab group

Deese took an interdisciplinary approach to this project, combining different elements from the language, public health, and social work fields. Most research is typically confined to one discipline because, as Deese explained, "interdisciplinary research is a nightmare" within the typical university model. She credits the Carolina Autism and Neurodevelopment Research Center (CAN) for introducing her to so many scientists, community engagement activities, and methods of research. This unique approach has enabled Deese to push the boundaries of what has been done previously in autism research. Deese's interdisciplinary community-based approach to her research has allowed her to share her findings with the public far quicker than the 17 years it usually takes for research to be integrated into society. Deese says, "Decreasing the science-to-practice gap and

involving people is the most important thing." To achieve this, she plans to create plain-language graphics and attend community events so the public immediately sees the results of her research. This shows the parents who were involved in Deese's study that their participation makes real-world impacts while simultaneously demonstrating how to better serve these families through the adaptation of evidence-based practices.

Overall, the implications of Deese's research extend far beyond the findings of this study. The research conducted in Deese's study was planned and facilitated by a team that included 3 autistic individuals. Because Deese's autism study was developed with the help of autistic people, Deese is helping to decolonize research: a movement that aims to readdress how society produces and uses knowledge. This is important because traditional research methods are often representative of power dynamics that are rooted in colonialism. Deese explained, "There are systemic reasons why people don't trust research and that's worth addressing." Her project sets a precedent for following a community-based approach in future autism research. Deese's approach to her study has challenged the status quo of traditional research projects and can serve as inspiration to fellow researchers looking to amplify the impact of their research.



Sarai (left) and her mentor, Dr. Sarah Edmunds (right), in front of a COLABorate poster at DiscoverUSC 2024. (photo provided by Sarai Deese)

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A Bonus Without Benefits:

RETHINKING NORTH CAROLINA'S APPROACH TO TEACHER RETENTION

Written by Sinaayah Mathis, Associate Writer
Edited by Shaivee Fozdar, Associate Editor
Designed by Sriya Pallapothu, Editor-in-Chief

Sam Maloney, a Robert C. McNair Scholar majoring in mathematics and economics, has taken on the ambitious task of evaluating one of North Carolina's contentious education policies: a teacher performance bonus program aimed at reducing turnover rates. This program rewards the top 25% of educators with $3,000 annually, and it has been a focus of North Carolina's debates over retaining quality teachers in public schools. With family members in the public education system, Maloney has a personal stake in understanding the nuances and challenges that teachers face. His research takes a critical yet balanced approach, recognizing the potential of performance bonuses to motivate educators while also highlighting significant limitations. He argues that the policy falls short due to not providing enough of an incentive or through losing teacher morale. This raises important questions about the long-term viability of such an approach.

Maloney's curiosity about the topic was sparked in "The Art of Lawmaking" honors course by a guest lecture discussing teacher shortages and the role of inadequate wages in driving educators out of the profession. Inspired by the discussion, he set out to identify a policy experiment that tested the effectiveness of increasing teacher salaries to determine if it could truly make a difference. The North Carolina bonus program quickly caught his attention, given its somewhat arbitrary focus on 4th through 8th-grade mathematics and 3rd through 5th-grade reading, which offered the foundation to analyze the causal effects of a performance bonus implemented across an entire state. The intervention could directly improve student performance but likely would also lead to indirect impacts on the teacher labor market, both of which needed to be measured.

Central to Maloney's research is a crucial question: do these bonuses genuinely achieve their goal of boosting student performance, or do they merely offer an unclear incentive that ultimately doesn't affect teachers? To find answers, he analyzed data and indirectly incorporated insights from educators who were impacted by the policy, offering a broader understanding of its effects. His work is bolstered by the support of the Magellan Research Grant and collaboration with the North Carolina Education Research Data Center.

“EDUCATION IS THE ONLY REAL WAY WE HAVE IN THE U.S. TO BUILD UP HUMAN CAPITAL.”

-Sam Maloney

To explain his strong interest in the topic, Maloney says, “Education is the only real way we have in the U.S. to build up human capital.” His aim isn’t to completely disrupt the public education system but rather to add to a mature debate on how funds can be used more effectively to support educators. With a strong grounding in economics, he argues that the existing program offers little evidence of achieving its intended outcomes, and he suggests that the funds could be better invested in policies that yield long-term benefits for both teachers and students.

His commitment to advancing the conversation extends beyond the university. In the spring of 2024, Maloney presented his findings at the Eastern Economic Association conference in Boston, where he received positive feedback from academics. The experience not only validated his ideas but also reinforced his confidence in challenging established norms that may no longer serve the evolving needs of educators. As his first major research endeavor, this project marks just the beginning of Maloney’s journey toward influencing policies, not only in North Carolina but also potentially nationwide. He hopes to encourage policymakers to embrace evidence-based strategies that prioritize sustainable investments.

Headshot of Sam Maloney

Photo provided by Sam Maloney

Inspiring Greatness:

The Work of a Dedicated Faculty Mentor

Written by Sriya Pallapothu, Editor-in-Chief
Edited by Amber Holowiecki, Senior Editor
Designed by Anna Cully, Senior Designer
Featuring Dr. Johannes Stratmann, Professor, Department of Biological Sciences

"A researcher is only as good as the people they mentor," said Dr. Johannes Stratmann, a 2024 recipient of USC's Distinguished Undergraduate Research Mentor Award (DURMA). DURMA is an annual award presented to faculty members who go above and beyond mentoring undergraduate researchers. Nominated by his own students, Dr. Stratmann pushes his students toward excellence while helping them discover their interests within the expansive field of plant biology.

From a young age, Dr. Stratmann had always been interested in the life sciences. At first, he was fascinated with animals, specifically toads and frogs. He studied how these amphibians would grow differently in cold versus warm water. Next, he developed an interest in birds, and he started bird-watching around the age of 14. Dr. Stratmann's interest in animals is what led him to study biology. However, it wasn't until he started working on his PhD that Dr. Stratmann became interested in plants. As a PhD student, he was studying the developmental biology of sea lettuce, a green alga, and this is what developed his initial appreciation of plants. Then, as a postdoctoral researcher, he studied how tomato plants respond when they are wounded by insect herbivores - this furthered his passion for plant biology.

Today, Dr. Stratmann is working on a project concerning plant communication. When plants are attacked by herbivores, such as caterpillars and other insects, they emit volatile chemicals into the air. These volatiles alert neighboring plants of the threat and upregulate their defense systems. Additionally, these plant chemicals also work to attract predators of the herbivores feeding off the plants. "The enemy of your enemy is your friend," said Dr. Stratmann, referring to how plants signal predators to defend themselves against herbivores.

Dr. Stratmann is specifically interested in the biochemistry and molecular biology aspects of plant communication. When plants release volatiles, these chemicals are only perceived by neighboring plants once the volatile binds to a receptor on their cells. However, the specific receptors that bind volatiles have not been identified yet, and this is the focus of Dr. Stratmann's research.

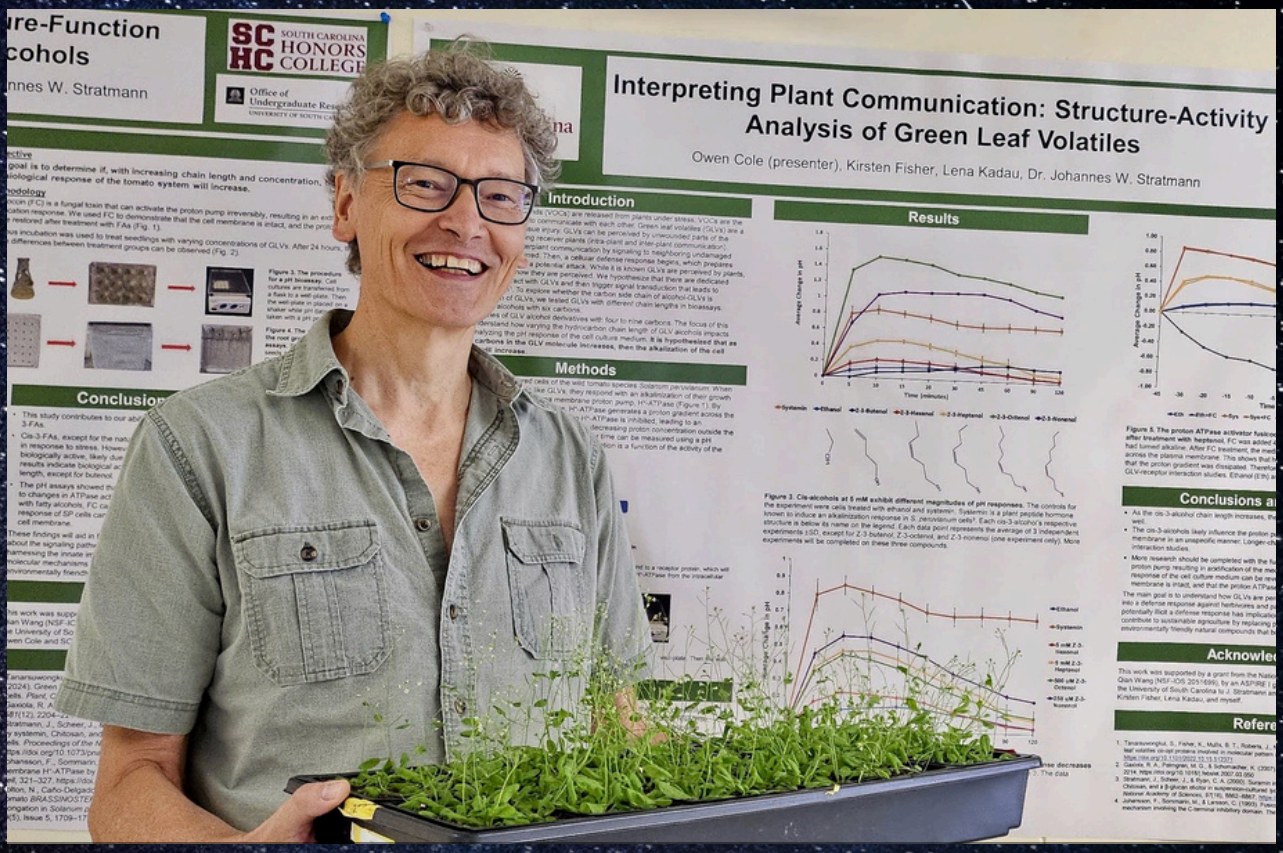
Currently, most agriculture in the United States depends on chemicals, such as pesticides. Pesticides can contaminate the environment and harm organisms like birds, fish, and beneficial insects. Plant researchers are hard at work figuring out how to increase plant innate immunity against herbivores, which would eliminate or reduce the need for pesticides. Dr. Stratmann's work is basic science, meaning it aims to increase the knowledge repertoire in his field. This is opposed to applied science, which builds upon the results of basic science and aims to solve a specific practical problem. The goal of Dr. Stratmann's research is to increase the scientific knowledge surrounding receptors for volatiles, so that in the future, applied scientific research can develop a way to augment

the innate immunity of flora, paving the way toward more environmentally sustainable agriculture.

However, he doesn't hope to accomplish this alone. Working with several PhD and undergraduate students, Dr. Stratmann has built a team of dedicated people. Currently, Dr. Stratmann's undergraduate students are working on his plant communication project. Although many undergraduates don't have an extensive background in plant biology, they are able to learn skills like experimentation and troubleshooting from working in the lab. These skills are essential because they are the basics of lab work and teach students how to develop problem-solving abilities.

Undergrads often start out with simple group projects where they play a small role, but after gaining hands-on experience, they can begin their own independent projects. For independent projects, students learn to design the experiment as well as perform data collection, analysis, and statistics themselves. Though time-consuming, this process is immensely rewarding. Many of Dr. Stratmann's undergrads have gone on to publish papers, some even achieving first-author status, a remarkable feat for an undergraduate.

Working closely with his students, Dr. Stratmann helps them analyze the results of their projects and modify experimental designs when needed. He hopes his students will develop a deeper understanding of the scientific process through working in his lab. "You learn about this theoretically in lab classes," said Dr. Stratmann, but "if you're working in the research lab on a project, you approach science from a different angle. You see what it takes to obtain useful data."



Dr. Stratmann with Arabidopsis plants before a poster that his undergraduate students presented at Discover USC.

(photo provided by Dr. Stratmann)

Research can be frustrating. Desired results may not always occur, and there may be a trivial explanation for why an experiment didn't work.

"If you're working in the research lab on a project, you approach science from a different angle. You see what it takes to obtain useful data."

Biological systems are variable, which is another thing Dr. Stratmann hopes his students will take away from their research experiences. Though not all students will pursue a career in plant biology, they can still apply the lessons they have learned from plant research to their future careers in any field. Many of his undergrad students hope to become physicians one day. "This research is important because it teaches undergrads how living things are variable. People are also different, which is important to understand and appreciate as a doctor," said Dr. Stratmann.

When asked what he would do with additional resources, Dr. Stratmann said he would invest in the personnel. He would like to hire postdocs and graduate students who can mentor additional undergrads. In Dr. Stratmann's own words, "What makes a difference is the human resources, the people who are in the lab." Ultimately, he believes students drive research and are able to transform ideas into amazing findings.

Start your research today!

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Navigating the Lab:

A FRESHMAN'S GUIDE TO UNDERGRADUATE RESEARCH AT USC

Written by Rachel Kiser, Associate Writer
Edited by Neha Rayala, Associate Editor
Designed by Anna Cully, Senior Designer
Featuring Rachel Kiser, Biochemistry & Molecular Biology, Class of 2026

As a freshman entering USC, "research" was a mysterious process I mostly associated with stock photos of a smart-looking person with a lab coat using a microscope. I didn't know how those smart-looking people found their way to a microscope or what they were doing there, nor did I imagine myself joining their ranks someday. I am now a junior wearing a lab coat (and goggles) and occasionally using a microscope, but more importantly, I have learned how to get involved in different labs, what the process of research actually is, and the skills necessary to be successful as an undergraduate in research.

My dive into research was facilitated by a National Institutes of Health summer internship program through the National Institute on Drug Abuse. The application for the program was sent out through an on-campus organization, the American Society for Biochemistry and Molecular Biology (ASBMB), and the program was geared towards undergraduates with little to no experience in a research-based environment. I was selected to work at USC with Dr. Peter Vento in a behavioral neuroscience lab looking at the neural pathways that mediate decision-making and understanding how those pathways relate to addiction.

For eight weeks, I was able to develop and pursue a project under the supervision of Dr. Vento and the other graduate students in the lab (shoutout to Emma Carlson, Jake Watson, and Caroline Toburen!). The objective was to understand where dopamine is in the brain when "avoidance" behavior, or behavior that seeks to minimize perceived danger, is exhibited.

To do so, we used a protein called cFos to mark neurons that were active inside the rodent brain and used light to stimulate a specific part of the rodent brain, called the rostromedial tegmental nucleus. After performing immunohistochemical procedures to stain the brain tissue, we were able to see what cells were expressing cFos and were active during this stimulation.

After the NIH program finished, I continued my project for course credit through the Honors College with the Vento Lab for the Fall 2023 semester before switching to a new discipline. Currently, my research is more focused on molecular biology/biochemistry with Dr. Lydia Matesic in the Department of Biology, and it's funded through the South Carolina Honors College Research Grant.

Dr. Matesic's lab focuses on proteins called ubiquitin ligases, which play unique roles in the degradation of proteins and in maintaining homeostasis within a cell. Previously, it was found that ubiquitin ligase WWP1 is essential for a normal, functioning heart; overproduction of this protein is correlated with age-associated heart diseases, like heart failure. My project specifically narrows in on the ubiquitin ligase WWP1, exploring what occurs with heart cell structure and function when WWP1 is overproduced as well as analyzing other proteins that might interact with WWP1 in the cell. Studying ubiquitin ligases and other proteins that deal with the cellular process of protein degradation will lead to novel therapeutic treatments for diseases like heart failure.

While I could discuss the technical aspects of my research, I would rather focus on the process of getting involved in a lab and how to be successful as an undergraduate student in research.

I only have 18 months of lab experience, but I can still testify to the fact that the process of getting involved and developing a project is daunting. In my experience, becoming involved in organizations of academic interest and finding a mentor are both great ways to handle the initial unknown variables of getting started in research. My involvement with ASBMB was the only way I would have found out about the NIH program; for other Biochemistry/ Biology/Chemistry majors, clubs like TriBeta are helpful for connecting students with each other or with faculty who may know of professors looking for undergraduate students. I was also fortunate to have been mentored early on in my college career by Dr. Jerry Hilbish, who connected me to the Matesic lab and helped me brainstorm what kind of research I wanted to pursue. For those looking to get into a lab, go to office hours and connect with your professors, especially if you find their course interesting and are doing well. With no guidance, finding a lab can involve a lot of cold emailing and hours spent on the Faculty Research Database trying to find a topic of interest. Help from faculty will make this process significantly easier.

Prior to joining a lab, the act of "doing" research was also an undefined variable. Most undergraduate students going into STEM research will have already learned about various assays applicable in a lab setting, but it is a massive step to actually master those techniques. What research looks like varies from lab to lab. In Dr. Vento's lab, I was able to handle the lab rats and do immunohistochemical assays (working with brain tissue). The more time-consuming side of research is the data collection and analysis. Performing cell counts took hours as I had to count thousands of individual neurons from specific slices of brain tissue. With Dr. Matesic's lab, I am doing work with yeast and bacteria in transforming them to express our proteins of interest, and this involves a lot of waiting with incubation times and working with cells on a Petri plate.

Personally, I have enjoyed learning different methods as I have gained experience. For an undergrad going into research (specifically STEM students), what research actually looks like on a daily basis depends on the project and topic at hand. For any biology or biology-adjacent labs, there is likely to be a lot of benchwork (e.g. making solutions, pipetting samples, working with other chemicals/cell cultures). For others, there might not be any benchwork, and it could be more analysis-heavy.

"Most undergraduate students going into STEM research will have already learned about various assays applicable in a lab setting, but it is a massive step to actually master those techniques."

Rachel Kiser

Covering what research is and how to get involved is important, but arguably, the most critical piece for any undergraduate to consider is why they want to get involved. I knew from a young age that I loved to ask questions and was curious about the world around me. Research is a way I can exercise my curiosity and help others in the process. Knowing that the questions I ask when I do research can benefit others and answer something previously unknown to science is incredible, and it's exactly why I wanted to join a lab. It is amazing knowing the work I did was either going to help people with addictions (Dr. Vento's lab) or is currently going to help people with heart failure and other related illnesses (Dr. Matesic's lab). For any undergraduate student looking to pursue research, as long as there is a motivation to ask the "Why?," something will come of it!

Rachel Kiser, undergraduate research assistant at the Matesic Lab
(photo provided by Rachel Kiser)

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Groundbreaking Beginnings

Shaping the Future with SKIP+CODE

Written by
Hailey Smith

Edited by
Rachel Kiser,
Associate Editor

Designed by
Sriya Pallapothu,
Editor-in-Chief

Featuring
Hailey Smith,
Biology major,
Class of 2025

As undergraduate students—especially those pursuing STEM degrees—we commonly hear about the value of research involvement. It's often highlighted as a way to enhance our resumes, gain entry into competitive graduate programs, and foster valuable learning experiences. However, despite the multitude of research labs at the University of South Carolina, securing a research position—particularly one that aligns with your interests—can feel like an uphill battle. The process can be intimidating; from sending initial emails to meeting with faculty, I've realized the path isn't always easy, but persistence and curiosity make a significant difference. By sharing my journey, I hope to motivate others to follow what excites them, even if it leads to unexpected areas of interest.

Finding My Way into Research

As a junior, feeling slightly behind in my pursuit of research, I decided it was time to dive into this new chapter. I began by asking my peers already involved in research how they got started. Many pointed me toward the Faculty Research Database, where they found and emailed faculty members whose work aligned with their interests; following their advice, I began cold emailing. The first few emails were nerve-wracking, and when I didn't get a response right away, the fear of bothering busy faculty members nearly discouraged me from continuing. But I pushed through, driven by a determination to find a lab that resonated with my passions.

After a few weeks of silence, I was thrilled to receive a response from Dr. Ali Brian, the Associate Dean for Research in the College of Education, whose research focuses on developing multi-component prevention intervention strategies for preschoolers, targeting their physical, psychological, and cognitive development. Dr. Brian's email was both warm and inviting, expressing her eagerness to arrange a meeting with me and her collaborator, Dr. Angie Starrett. Dr. Starrett is an Assistant Professor of Educational Research and Measurement and Assistant Director of the Institute for Rural Education and Development (IRED) at the Yvonne & Schuyler Moore Child Development Research Center (CDRC). Curious about Dr. Starrett's work, I discovered her focus is on advanced statistical methods and measurement techniques within childhood development, particularly in rural educational settings.

When I arrived at the CDRC for my interview, I was welcomed by a graduate research assistant named Shea Ferguson, whose enthusiasm immediately made me feel at home. The interview with Dr. Starrett and Shea was more than I could have hoped for—they listened intently to my responses, made me feel valued, and even cracked a few jokes to ease my nerves. Then, when they began talking about all the remarkable rural education and development projects at the CDRC, I knew I had to be a part of their team. At the end of the interview, I still remember them even taking the time to walk me around the research center and introduce me to everyone there before I left.

From the interview, Dr. Starrett and Shea knew I didn't have any research experience and wasn't directly involved in education studies like most students in the lab, but they took a chance on me. Thus, my initial responsibilities included becoming CITI certified in human subjects research, annotating research articles, creating annotated bibliographies, and finding articles about early childhood education in rural America and satisfaction with professional development for rural teachers. As time passed and I immersed myself in the conversations and work happening around me, I grew deeply connected to the research efforts with IRED. I understood the profound impact their research was having on both the lives of educators and children in underserved rural communities in South Carolina and nationally. Although their research wasn't directly related to my Biology major, it still provided me with meaningful experiences and novel perspectives I wouldn't have gained if I were in a traditional biology laboratory setting. My involvement helped me realize that your research doesn't have to match your major to matter—it just has to matter to you.

"Sometimes, stepping outside of predetermined boundaries leads to the most rewarding discoveries."

– Hailey Smith

Project SKIP+CODE

SKIP+CODE is an innovative initiative of the IRED aimed at creating a unique curriculum for preschoolers in rural, high-poverty areas. The SKIP+CODE curriculum integrates fundamental motor skills and computational thinking with early unplugged coding manipulatives to promote kindergarten readiness, executive function, and healthy development in rural preschoolers. By addressing motor and cognitive skills simultaneously, SKIP+CODE aims to support children in developing the foundational skills necessary for academic success and future STEM careers. This innovative approach links physical activity with cognitive growth, enhancing motor competence, cognitive abilities, and social skills to increase the likelihood of positive educational outcomes.

To guide the development of this curriculum, we researched multiple computational thinking frameworks, which emphasize the importance of particular concepts, practices, and perspectives. Specifically, computational thinking *concepts* are

the constructs children need to master to understand the mechanics of programming. Some computational thinking concepts we will apply in the SKIP+CODE curriculum include sequencing, loops, events, conditionals, and representation. Computational thinking *practices* are the problem-solving strategies children will use, such as algorithmic thinking, pattern recognition, abstraction, debugging, decomposition, iteration, and generalizing. Lastly, computational thinking *perspectives* are the attitudes and learning dispositions we hope children will adopt, including expressing and creating, connecting, perseverance, and choices of conduct.

As we move forward in the early evolution of SKIP+CODE, we aim to incorporate a computational thinking framework with the South Carolina Early Learning Standards (SC-ELS), a set of comprehensive guidelines across six developmental domains: Approaches to Play and Learning, Emotional and Social Development, Health and Physical Development, Language Development, Mathematical Thinking, and Cognitive Development. By integrating a computational thinking framework with the SC-ELS, we aspire to create a curriculum that comprehensively addresses every facet of a child's early development, ensuring a well-rounded and holistic approach to their growth and learning. However, as many of you know, progress isn't always linear. We've been meticulously analyzing possibilities for integration of the six domains of SC-ELS with computational thinking practices and processes in developmentally appropriate lesson plans for preschoolers that effectively teach computational thinking. It's essential to ensure our lesson plan is structured to not only teach computational thinking but also to provide methods to accurately measure computational thinking proficiency. We anticipate SKIP+CODE will positively impact executive functioning and kindergarten readiness, while promoting an active lifestyle and advancing gross motor skills in preschool-aged children.

Hailey Smith, Undergraduate Child Development Research Assistant
Yvonne & Schuyler Moore Child Development Research Center

(photo provided by Hailey Smith)

Life as an Undergraduate Research Assistant at the CDRC

Since Fall 2023, I have been a part of the IRED research team, working alongside an inspiring group of researchers, including Dr. Brian, Dr. Starrett, Dr. Bridget Miller (Associate Professor of Early Childhood Science Education), Dr. Matthew Irvin (Director of IRED and Professor of Educational Psychology), Dr. Devan Jones (Postdoctoral Scholar), and my graduate research assistant mentors: Shea Ferguson, Beatrice Quiroz, and Alyssa Raygoza. They have guided me through comprehending complex qualitative and quantitative data, understanding pedagogical

approaches, and instilling their knowledge from their degrees in educational psychology and research. Most importantly, they have introduced me to the world of computational thinking and fundamental motor skills and their intersection with SKIP+CODE, a core undertaking within IRED. Over the summer of 2024, I transitioned into a paid undergraduate research assistant position funded by IRED, dedicating my efforts to the development of SKIP+CODE. Through this role, I honed my ability to collaborate effectively with graduate-level students and faculty to contribute meaningfully to the development of SKIP+CODE's conceptualization. As of Fall 2024, I am still in a paid position at the CDRC, working with Dr. Brian, Dr. Starrett, Dr. Miller, Dr. Jones, Beatrice, and Shea on developing lessons that integrate fundamental motor skills and computational thinking for rural preschoolers.

"Beyond just data, research is about exploring possibilities, constantly questioning assumptions, and collaborating between diverse perspectives."
- Hailey Smith

The Importance of the Research Process

One of the most profound lessons I've learned through my involvement in SKIP+CODE is the critical role of the research process, particularly during the conceptualization phase. Often, people think of research as a collection of data or the analysis of results, but so much foundation must be laid before reaching that stage. Planning, designing, and revising the SKIP+CODE framework and lesson plans has been a deeply iterative process, requiring input from educators and researchers to create something that truly serves the needs of young learners. Therefore, beyond just data, research is about exploring possibilities, constantly questioning assumptions, and collaborating between diverse perspectives. Every decision made during the conceptual phase—choosing which methodologies to employ, designing lesson plans, or aligning the curriculum with developmental standards—plays a crucial role in shaping the eventual outcomes. In these early moments, the integrity and impact of the research are truly built. Through this process, I've learned the value of patience, flexibility, and the willingness to revisit initial ideas to ensure the final product truly embodies the most thoughtful and effective approach.

Looking Forward

As I continue working on SKIP+CODE throughout the remainder of 2024 and into the Spring of 2025 —my final semester before graduation—I am filled with a sense of purpose and excitement for what lies ahead. Our hope for the future is that SKIP+CODE will equip preschoolers with the skills they need to pursue an active lifestyle and a lifelong interest in STEM, opening doors to opportunities they may not have otherwise encountered. Through my involvement in SKIP+CODE's conceptualization, I've deepened my love for STEM and solidified my passion for research. This experience has shown me research doesn't always have to align perfectly with your major to be meaningful—it's about pursuing what truly resonates with your passions. Sometimes, stepping outside of predetermined boundaries leads to the most rewarding discoveries. By sharing my journey, I hope to inspire other undergraduate students to explore research opportunities beyond their chosen disciplines. The personal and professional growth that comes from embracing what inspires you is immeasurable and, in the end, far outweighs any challenges along the way.

Transforming the Field of Brain Cancer

Written by Rachel Joel, Associate Writer
Edited by Iangel Tolaka, Associate Editor
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Featuring Dev Patel, BARSC-MD major, Business Administration minor, Class of 2026

Glioblastoma. It's a terrible diagnosis to receive. Glioblastoma is a cancer that originates in the brain or spinal cord. More specifically, the cancerous tumor begins in astrocytes, which are cells that make up most of the human central nervous system. Glioblastomas are known to be an aggressive form of cancer as they quickly grow and invade healthy tissues, making the five-year survival rate for glioblastoma no more than 7% (Mayo Clinic, 2014). Since the location of the tumor tends to be in the brain or spinal cord, this form of cancer is difficult to treat. Chemotherapy targeting the destruction of malignant cells must be very careful not to injure the essential healthy cells surrounding the tumor. Other than these typical treatment options, there are not many alternatives available to specifically target glioblastoma or cure this type of cancer (Glioblastoma Foundation, n.d.).

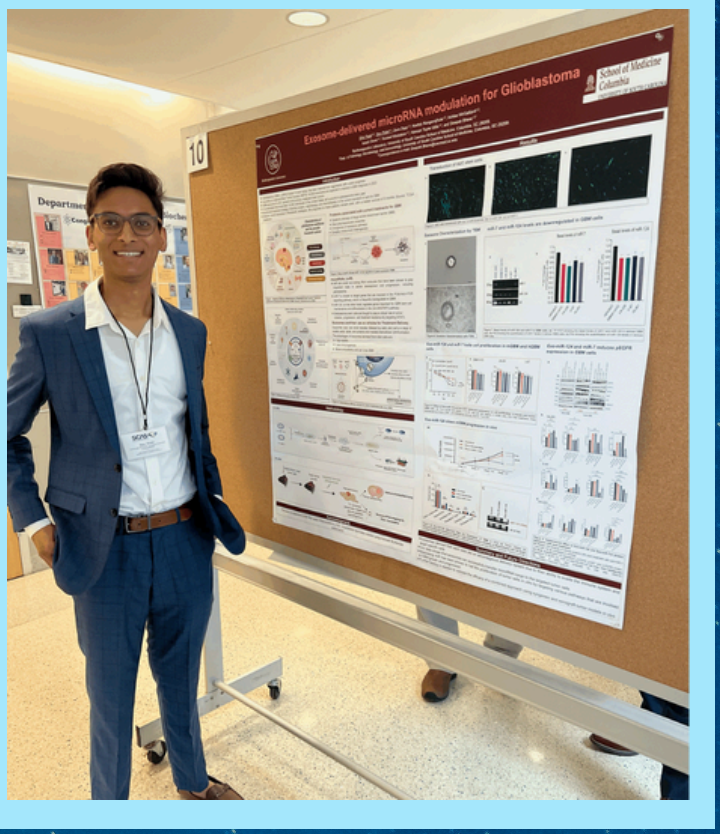
Thus, Dev Patel's research regarding a possible treatment plan for this devastating disease may offer thousands of glioblastoma patients a brighter future. Dev Patel, a junior in the University of South Carolina's Accelerated Undergraduate to MD program, is working on research that utilizes microRNAs to treat glioblastomas. MicroRNAs are smaller snippets of RNA that can modify gene expression by attaching to certain sections of mRNA and influencing proteins of interest. Vesicles released by cells-also known as exosomes-transport these microRNAs, which can then alter the effects of proteins and target the typical molecular pathway that contributes to the development of glioblastoma. Under the mentorship of Dr. Deepak Bhere, Patel aims to create a treatment option that can increase the lifespan of glioblastoma patients and hopefully improve their prognosis.

"I didn't know where my project would lead me," Patel explained when describing his research experience. At times, he would face challenges or "small frustrations here and there," as he put it. Yet, despite the long hours of waiting, the unexpected results, the frustration caused by microbiological contamination, and other such issues, he knew the satisfaction of doing something right was worth it. He learned to treat his research "like an opportunity, not a job." Though he had expected research to consist mainly of work in the laboratory, he was surprised to find that much of it was more intensive than he thought. Science involves a lot of critical thinking, being prepared for if things go wrong, and using all that waiting time to plan ahead.

Through the funding of several scholarships, such as the Top Scholar Research Fund and the Honors Research Grant, Patel is grateful for his opportunity to explore this new foray into immunotherapy. In February 2024, thanks to the Honors College Travel Grant, he presented his research at the South Carolina Academy of Science research conference in Charleston. Through a mix of nerves and

excitement, Patel went on to win first place in his division of Biochemistry and Molecular Biology. He later said, "Being nervous and then coming out winning...was a really great experience because it shows how much success you get is directly paralleled by how much effort you put in. [There's a] little bit of luck, but...a lot of it is hard work and effort."

Today, Patel continues his pursuit of becoming a physician while remaining dedicated to his research. He encourages all students to get into research, whether that's through emailing professors for lab experience or exploring options in the Office of Undergraduate Research's database. "It really gives you an edge when applying to graduate school," he advises. Much like Patel and his study of glioblastoma, research serves as a way for students to truly make an impact on the world around them. Whether it's cancers like glioblastoma, forays into the world of psychology, or statistics in business ethics, every USC student can have a meaningful impact on their community.



Dev presenting at the SC Academy of Sciences in Charleston, SC, about his lab's premise on the exosomal delivery of microRNA as a therapeutic for glioblastoma. Dev and his colleague, Shiv Patel, won first place in their division for Cellular and Molecular Biology.

Photo provided by Dev Patel

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