

VOLUME XIX, 2025

UNIVERSITY OF CALIFORNIA, RIVERSIDE

UNDERGRADUATE RESEARCH JOURNAL

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UNIVERSITY OF CALIFORNIA, RIVERSIDE

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FROM THE CHANCELLOR



UC Riverside is a national leader in social mobility, educational access, and research excellence, all of which are on display in the 19th volume of the *UC Riverside Undergraduate Research Journal*. With faculty-mentored research projects across a breadth of disciplines, UCR provides a wealth of opportunities for students to investigate complex questions while building research skills. Each year, I am excited to see how students have embraced this part of their education while further developing their own scholarly interests.

As a research university, one of UC Riverside's most important duties is the creation of knowledge. Creating an environment and structure that fosters innovation to solve our community and the world's greatest challenges is in our university DNA. Our students are making

the most of these opportunities and accomplishing truly inspiring work. From parental praise to media representations of indigenous peoples to the behavior of the black soldier fly to the experiences of transfer students, this edition of the *Journal* covers significant scientific ground in a wide range of disciplines while showing research excellence of the highest order.

Yet, the *Journal* has something more to offer than discovery. It offers hope for the future led by our students' bold and brilliant minds. I congratulate all the students who contributed to this edition of the *Journal*, and I express my sincere gratitude to the faculty mentors and staff members that supported these students in their scholarly endeavors.

Sincerely,

A handwritten signature in black ink, appearing to read "Kim A. Wilcox". The signature is stylized and fluid, with the first and last names being the most prominent.

Kim A. Wilcox
Chancellor

FROM THE VICE PROVOST AND DEAN

Undergraduate students actively engaging in research is one of the major goals of any research-intensive university. Fortunately for us at the University of California, Riverside, we have programs, faculty, and an institutional culture that promotes such activities for students across the disciplines.

This *Journal* is just one venue that highlights the impressive research activities that students engage in while at UC Riverside. Whether students are involved in an individual project, working on research team, collaborating on a lab project, or engaged in some creative activity in one of the several relevant departments on campus, such research and creative engagement can be one of the most meaningful intellectual experiences for students during their time at UCR.

No less significant is the honor of having one's work published in an academic journal. Not only will students be able to share their accomplishment by listing a publication on their resume/curriculum vitae, but they also will be able to share their publication with family, peers, future professional or graduate schools, and prospective employers. Published authors also experience the power of leaving a lasting imprint of their meaningful academic work in the *Journal*, with the university, and in their respective fields of study.

Congratulations to all of the student-authors, faculty mentors, staff, and other support systems who helped make this publication possible. This is a major accomplishment, and the student-authors should be proud.

Once again, congratulations!

Sincerely,



Louie F. Rodriguez
Vice Provost and Dean,
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We are proud to unveil the 19th edition of *UC Riverside's Undergraduate Research Journal*—a testament to the creativity, intellectual drive, and diverse perspectives of UCR's undergraduate scholars. This edition showcases the groundbreaking ideas and original research that reflect the best of what UCR students have to offer. Each article represents hours of inquiry, experimentation, and revision—and together, they represent the next generation of scholars and innovators. Publishing a journal of this caliber would not be possible without the tireless efforts of our Student Editorial Board and Faculty Advisory Board. Their insight, dedication, and meticulous attention to detail helped transform a collection of manuscripts into a unified volume of scholarly excellence. To the authors: thank you for daring to ask bold, complex questions and for trusting us to share your work. Your research not only enriches your respective disciplines but also strengthens the foundation of undergraduate scholarship at UCR. It has been our privilege to serve as Editors-in-Chief and help bring this edition to life. We hope it inspires the next generation of undergraduate scholars to push the spirit of discovery forward and pursue bold ideas with a deep commitment to learning.

Sincerely,
Sreenidhi Surinei & Nandini Mannem,
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This 19th issue of the *UC Riverside Undergraduate Research Journal* comes out at a precarious time for research in America. Our ability to do research is increasingly threatened. Now more than ever, it's vitally important for the public to know about the research we do, to understand its value to society, and to help us defend it from attacks. And that's why I'm so grateful to the undergraduate researchers in this issue. They didn't just do the research—the long days in the lab, the long nights at the library, the hours spent sifting through documents or crunching numbers. They also went the extra mile to tell the world about their research. They wrote it up in a paper, submitted it to a journal, subjected it to rigorous peer review, revised it until it was perfect, and made it freely available to anyone in the world who wants to read it. Their work is a testament to the value of research. Of course, the undergraduate researchers didn't do it alone; equally essential were the members of the *Journal's* Student Editorial Board who guided submissions through review and publication, and the Faculty Advisory Board members who advised students on the peer review process. And none of this would have been possible without the tireless work of Jennifer Kavetsky and the support of Gladis Herrera-Berkowitz, the CUREL team, and the UCR Division of Undergraduate Education. Finally, I'm extremely grateful to Prof. Morris Maduro for serving as the Chair of the *Journal's* Faculty Advisory Board

for the past decade. His leadership has placed the *Journal* on a firm foundation as we approach our milestone 20th issue next year. And if you're an undergraduate researcher who would like to publish your work in our 20th issue, please consider submitting to the *Journal*!

Prof. William Grover
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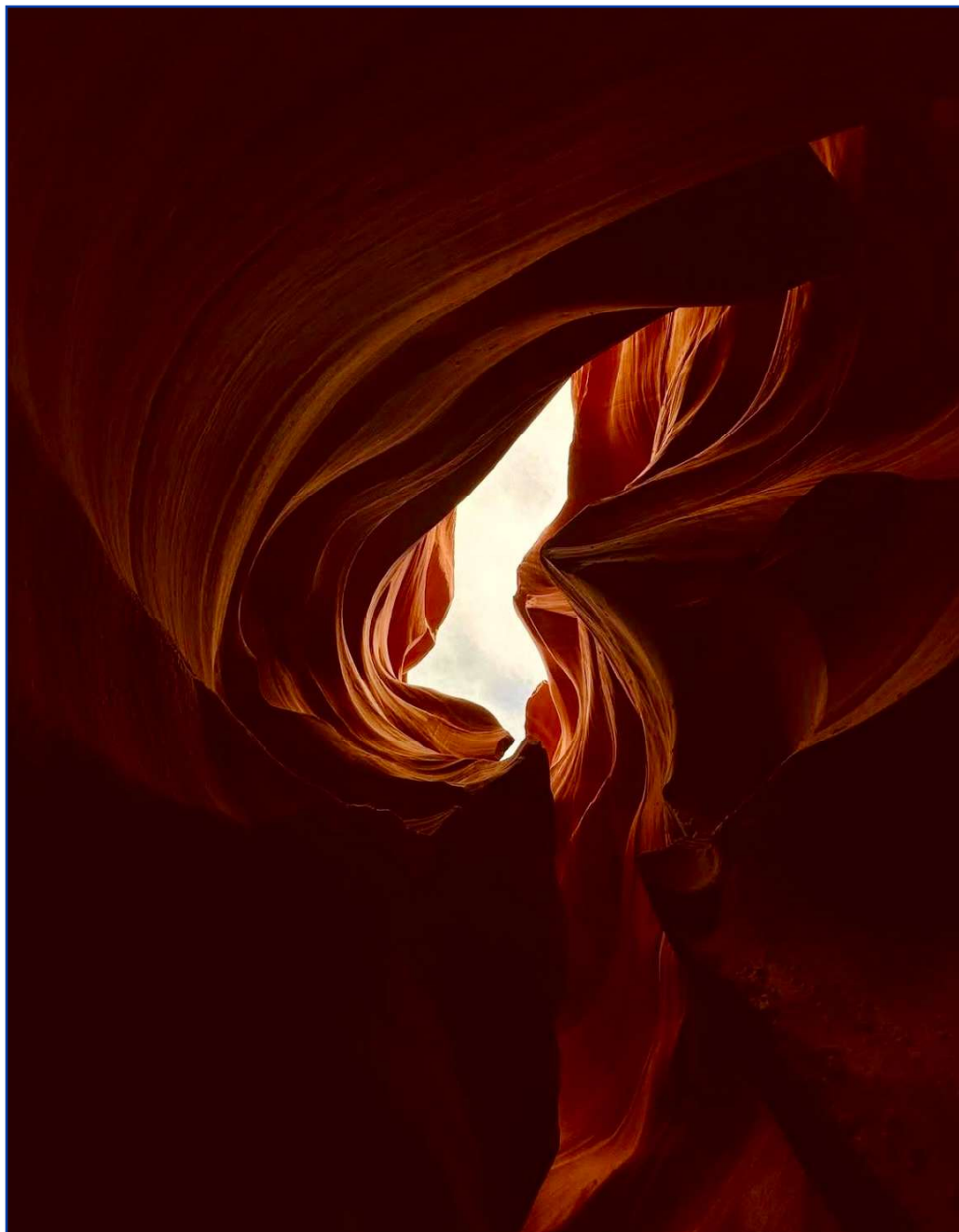


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We would like to extend our heartfelt gratitude to Laksh Athappan and Flicks UCR for generously capturing the portraits of all our Student Editorial Board members and authors. Your dedication to preserving the essence of this edition adds a personal touch that complements the hard work and brilliance showcased within these pages. Thank you for your invaluable contribution to the UCR Undergraduate Research Journal.

Sincerely,
The UGRJ Team

ABOUT THE COVER



Sreenidhi Surineni

Sreenidhi Surineni is a third-year neuroscience major at the University of California, Riverside, with a minor in philosophy. He conducts research in the Zheng Lab, where he investigates the role of alternative RNA splicing in Alzheimer's disease, and also works on machine learning-based detection of axonal swellings. Outside the lab, he is the founder of Enlight Education, a nonprofit dedicated to bringing hands-on STEM education to underserved students across the U.S. and internationally. Sreenidhi is passionate about neurotechnology, science communication, and bridging research with community impact. In his free time, he enjoys photography, doing triatholons, and reading.

This photo shows the smooth, flowing rock formations of Antelope Canyon in Arizona. The light from above highlights the natural curves and textures of the sandstone walls. The warm colors and unique shapes reflect the natural beauty created by wind and water over time.