# Discovery starts here



PHOTOS: DAN Z. JOHNSON

# Hands-on research at CST

by Elisa Ludwig

## Research and Leadership Symposium showcases student and faculty collaboration

Not so long ago, it was rare for undergraduate students to have hands-on research opportunities—not to mention the chance to author and present papers at national conferences. Today, College of Science and Technology undergraduates work alongside experienced faculty from CST as well as researchers from the Lewis Katz School of Medicine, Fox Chase Cancer Center, Temple Ambler Field Station and other schools and departments across the university.

"Students often throw the word 'research' around but until they have worked in a lab, they don't understand what it is," said Adam Stefanile, director of the Research Scholars Program (RSP). "When you see these experiences on a resume it demonstrates the proclivity to learn."

RSP, open to students who demonstrate interest via an application, augments the lab experience with a seminar that covers professional skills: presentation and public speaking; creating and formatting a poster; and responding to lines of questioning. Each semester, a Research and Leadership Symposium on campus gives students the chance to share both their findings and their newly acquired skillsets. Around 120 students presented at the 2026 spring symposium.

"It's gratifying to see the trajectory—they start out nervous but when they actually present, they shine," Stefanile said.

Students with a qualifying GPA can take it a step further and apply for the CST Summer Undergraduate Research Experience (SURE), a nine-week research fellowship and mentoring program supported by both the university and a faculty mentor. SURE participants attend a weekly seminar where they discuss ethics and career options. They are expected to work full time during the span of the program, present their research in the fall, and create a short research leadership video.

"We have had students who've been included on patents," said Susan Jansen Varnum, senior associate dean for undergraduate affairs, science education and community engagement. "It generally takes more than one semester, but by the time a student puts a year into a lab, they can be a published author."

The real power of the program, according to Varnum, is in the mentoring. "You're next to an MD, PhD, lab director and graduate students on the bench. They're investing in you and training you. It also gives older students an opportunity to mentor younger students. For a scientist, it puts you in all the right places to be successful."

## FINDING A NICHE

Jack Brownfield knew before he even stepped foot on Temple's campus that he wanted to conduct research, and a serendipitous early encounter with Mariana Bonfim, managing director of the Ambler Field Station and assistant professor of biology, who would become his mentor, gave him the chance to jump in immediately.

"Research has always been one of my goals. I grew up in Santa Cruz, California, and as much as I looked forward to living in an East Coast city, I knew I needed a way to get out into the forest," said Brownfield, an ecology, evolution and biodiversity major.

At the Field Station, where a tornado created new ephemeral pools in place of uprooted trees, Brownfield has the unique opportunity to observe a new ecosystem evolving.

"We look at 'community assembly' and 'niche partitioning,'" Bonfim said. "Organisms in an ecosystem have their own role to fulfill—their own niche—but when two bird species go after the same bugs in the same tree they have to work out an agreement. They might choose a different part of the tree for each to hunt in. But this is difficult to research because you don't often get to see the process happening."

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Brownfield remembers the moment he realized he had six months' worth of data and could visualize partitioning happening—a thrilling discovery. What started as a short-term project has lasted through his senior year and he now plans to continue focusing on freshwater ecology from a systems perspective.

Brownfield has since presented multiple times, including at CST's undergraduate symposium, the Creative Arts and Research Symposium, and the Field Station Symposium, and he has two publication credits. He brought his research to the Ecological Society of America last summer.

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## TEEING UP OPPORTUNITIES FOR STUDENTS

Like Brownfield, Mazen Rukhsar arrived at Temple with a well-defined idea of his career path. "I knew I wanted to study synthetic biology," he said, "but I thought that it would take until at least my junior year to get into research."

As an honors student, however, Rukhsar was invited to join a lab his freshman year. Through the SURE program, he worked with Kelly Whelan, a researcher with the Fels Cancer Institute for Personalized Medicine at the Lewis Katz School of Medicine, to help optimize a software tool for image analysis. By the fall of 2025, Whelan wanted to start a new project looking at organoids, and she tapped Rukhsar for the team.

"If you take an esophageal epithelial cell and you put it in specific culture conditions, it will generate a 3D structure that looks like the esophageal epithelium in your body," Rukhsar explained.

To support graduate work in the lab, Rukhsar is putting cells with a genetic modification into organoids to see how the depletion of mitochondria influences the ability of a cell to generate an organoid and what shape it will take. Rukhsar is also looking at the effects of the cytokine IL-13 on organoid formation and structure, and how the timing of the addition of IL-13 may influence phenotypes.

While this research is not in the synthetic biology space, it gives Rukhsar relevant experience to prepare him for what comes next. One particular hurdle he has encountered is with the materials and media he's using, requiring some problem-solving.

"Mazen learned that sometimes you have to work on optimizing materials and processes in a very systematic way. And sometimes something that's unexpected is actually incredibly interesting," Whelan said.

Giving undergraduates a chance to engage in hands-on research is a core value for Whelan as an educator. "I went to a small liberal arts school and didn't have the chance to conduct research," she said. "Luckily, someone did take a chance and gave me a job eventually, but I don't want students to have to be lucky."

## WHEN LEARNERS LEAD

"In my lab, we believe research should be student-led," said Stephen MacNeil, assistant professor of computer science. "When students come in, they're free to choose the projects in the lab that interest them. We try to scaffold them towards leading their own research."

Data science major Jeni Sorathiya found a project in MacNeil's lab that piqued her interest: A PhD project investigating how students learn complex bioinformatics concepts using traditional tutorials versus a retrieval-augmented generation (RAG) AI tutor.

The goal was to understand how AI changes information-seeking behavior and learning.

"We created our own RAG AI system and compared it to a general AI model," Sorathiya said. "It retrieved information from a dedicated tutorial before generating responses, which helped reduce hallucinations and kept answers grounded in verified educational content."

The result was that users felt less overwhelmed with the new chatbot. Sorathiya shared her work—developing the AI tutorial, analyzing participant interactions and co-authoring the research paper—at the research symposium and she's hoping to collect more data with the aim of submitting it to a bigger academic conference.

MacNeil spends a lot of time with students trying to identify what their "blocks" are. "It's not just the skills that they need to complete the tasks, but training them and supporting them holistically as people," he said. The real magic happens, he explained, during the twice-weekly meetings where everyone in the lab shares their work and gives each other feedback, building a sense of camaraderie and support.

For Sorathiya, the project helped her hone her own career goals, as she has discovered a newfound passion for research. "In the lab I'm doing something new every day, gaining experience with AI development, user studies, qualitative analysis and scientific publication," she said. "I'm now thinking about going to grad school for a PhD or maybe going into the industry as a research analyst."

## FINDING COMMUNITY AND OPPORTUNITY

As a first generation, pre-med student commuting to campus, Salina Zhang felt isolated, both socially and academically. During her first stint in the SURE program, however, she found her people in Assistant Professor Daniel Kim's organic chemistry lab.

"I connected with a community of graduate and other undergraduate students I could talk to. They have the same interests and they can mentor me in a lot of different ways," said Zhang.

Kim's research revolves around deploying light, or photoredox catalysis, to fashion molecules, a process which could be replicated in pharmaceutical drug or agrochemical development.

Zhang enjoyed it so much she continued on through the school year in the RSP, and the time spent has built up her knowledge, her confidence—and her publishing credits. Zhang was a key undergraduate author on a research paper she presented at the national American Chemical Society meeting as well as at two Temple symposia.

"Talking about chemistry at a high technical level is really a second language," Kim said. "Salina is now sounding like an organic chemist to me, and that's really gratifying to hear."

Zhang is now thinking beyond a career in medicine to potentially focus on organic chemistry research. "Before I came here, I thought pre-med was my only option. This program and this experience have really opened my eyes to what I can do."

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