



Leadership Profile

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Atomic Space and Scientific Tribes: Dr. Emily Scott on a Career Built on Curiosity and Community

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Scientific careers rarely follow a straight path. They are shaped by unexpected questions, mentors who open doors, experiments that fail, and discoveries that reveal something entirely new. For this year's [Brodie Award](#) recipient, Dr. Emily Scott, that

journey began with a fifth-grade science fair project that did not go as planned.

"I 'failed' a fifth-grade science fair because I didn't have a hypothesis," she recalls. But that early setback quickly became the beginning of a lifelong fascination with understanding how the world works through ecology, biology, earth science, chemistry, physics—every branch of science offered a new way to make sense of nature's underlying logic for Dr. Scott.

By high school, with the encouragement of a great teacher, she returned to science with a stronger foundation and greater success, eventually becoming president of the [Illinois Junior Academy of Science](#). Her project on starfish regeneration sparked an interest that would ultimately lead her to marine biology as an undergraduate. During NSF-funded field research in the Gulf of Mexico, she encountered a discovery that redirected the course of her scientific career: In seasonal oxygen-depleted

"dead zones," the last organisms surviving were brittle stars containing hemoglobin.

The finding raised a fundamental biological question: "How could that hemoglobin have such a high affinity for oxygen from the water, yet also be able to unload it to use physiologically?"

"That was when I was hooked on heme proteins," she says.

That question became a turning point, eventually leading her from marine biology into the world of enzymes, and ultimately cytochrome P450s (CYPs)—a field where understanding the precise three-dimensional arrangement of atoms can reveal how enzymes function, interact with molecules, and influence human health.

Exploring the Hidden Architecture of Biology

The defining moment when structural biology became her scientific home came during her postdoctoral training. While studying CYP2B4, she generated the first electron density maps revealing the protein's three-dimensional structure. Seeing the arrangement of atoms from experimental data transformed the way she viewed biological questions.

"When I first saw CYP2B4 electron density maps, I realized that placing all the atoms into it was a fascinating 3D puzzle whose solution was incredibly meaningful scientifically," she explains.

For Dr. Scott, solving a new protein structure still carries the excitement of exploration, “What we do is discovery—akin to being an astronaut. It’s just atomic space instead of outer space.

“I still get this same feeling every time we solve a new structure. There is a moment when you know a cool new secret of the universe that no one else on the planet knows,” she says. “And then you get to share it with others in support of making the world a better place.”

That sense of discovery has guided her research on human cytochrome P450 enzymes, a family of proteins central to understanding how the body processes drugs and other compounds.

The Value of Unexpected Results

Some of the most important discoveries in science come from moments when experiments do not produce the expected answer. For her, one of the most memorable examples came from research on CYP2E1. A graduate student in her laboratory solved the first structure of CYP2E1, an enzyme well known for metabolizing ethanol. The structure contained a small molecule similar in size to ethanol, and the team used the structural information to make predictions about how much larger fatty acid substrates might bind within the enzyme.

Then they tested those predictions, and the results contradicted their expectations.

“I remember the same student showing up at my office door with a horrified look,” Dr. Scott said, “and telling me, ‘We were totally wrong about how fatty acids bind!’”

But Dr. Scott reacted with excitement, not disappointment: “We’d learned something totally unexpected that changed how we think about the enzyme functions, and sometimes you learn the most when you are wrong.”

While computational homology modeling is often quite successful at the level of the overall protein fold and can be a useful hypothesis-generation tool, it does not yet successfully predict the detailed atomic-level interactions needed to understand ligand binding to P450 enzymes, so experimental methods such as crystallography and cryoEM are still critical.

“But however one arrives there, the prevalence of structural thinking helps people ask more relevant questions,” she explains. “Instead of broadly speculating about how molecular interactions might occur, researchers can use structural clues to narrow the possibilities.”

Her own research has also challenged long-standing assumptions in drug metabolism. “I still find many colleagues who think that when a CYP’s reduced carbon monoxide difference spectrum has a maximum at 420 nm (P420) that the enzyme is irreversibly “damaged” and catalytically inactive. But that isn’t necessarily true—often a change of the buffer conditions or addition of a ligand and the enzyme is back to absorbing at 450 nm (P450) and fully active.”

The Brodie Award and the Future of Drug Metabolism

Receiving the Brodie Award represents a milestone in a scientific journey shaped by curiosity, collaboration, and discovery.

“Growing up in the P450 field, the Brodie award always seemed the pinnacle,” she says. Previous recipients represented the scientists whose clever experiments and insights shaped the field, making the recognition deeply meaningful. “Seeing our structural work become part of the field’s growth and evolution is deeply humbling.”

Dr. Scott hopes the next generation will continue building on structural discoveries by developing computational approaches ultimately capable of accurately predicting

binding for all kinds of ligands—including substrates, homo- and heterotopic allosteric regulators, and type II inhibitors—in the right orientation(s) into all human P450 enzymes, something that remains a significant challenge in the field.

At the heart of her career has been one fundamental question: How do molecules recognize and interact with one another?

“All we’ve ever done is play a highly technical version of the child’s game where you fit the moon shape in the moon-shaped hole and the star in the star-shaped hole,” she says. “Shape and chemical complementarity is the central theme, but there are as many variations as there are endogenous human P450 enzymes and xenobiotic/P450 drug pairs.”

Yet she believes the most meaningful measure of a scientific career is not only publications or awards—it is the people who continue the work: “I think every mentor delights in seeing the successes and contributions of our trainees, and then their trainees, and then their trainees.”

Mentorship: Helping Scientists See Their Own Potential

Mentorship has been central throughout her career. She credits every mentor she encountered with helping shape the next stage of her scientific journey.

Her high school teacher encouraged her interest in science, despite limited resources, and helped her find opportunities beyond the classroom. Her undergraduate mentor created opportunities for marine research at a time when women faced barriers in field science. Her doctoral mentors introduced her to heme protein biochemistry while also showing her the value of family and a sense of the historical journey in a scientific career. Her postdoctoral

mentor, the late [Dr. James Halpert](#), was particularly influential in giving her the freedom to pursue structural biology at a time when few around her had experience in the field. She also credits the many mentors and collaborators who supported her throughout her independent career, including those who guided her as she established herself as an independent faculty member. “Even as a faculty member, I was fortunate to have mentors and collaborators who made a difference,” she reflects. Among them, she highlights [Bob Hanzlik](#) for hiring her at the University of Kansas, [Jeff Aubé](#) for his example as an outstanding scientist, [Bettie Sue Masters](#) as a role model and source of support, and Richard Okita at the NIH for providing invaluable career and funding guidance.

She also remembers a small but powerful moment from her graduate training. After completing her PhD candidacy exam, she overheard a faculty member say, “Someone should actually do this project.”

That simple statement—that her ideas were worth pursuing—left a lasting impression.

“It was a small comment not intended as mentorship in any formal sense. But it was incredibly affirming to know that someone I highly respected and admired thought my ideas were worth pursuing. That moment has always reminded me how powerful it can be to take someone’s thinking seriously.”

As a mentor herself, she tries to recognize those moments in trainees.

“Trainees are asked to propose, critique, defend, and troubleshoot many ideas before they fully see themselves as scientists. But when a student asks a sharp question, designs a clever control, or sees a connection that others missed, I try to recognize it explicitly as a way of helping them value and evolve their own scientific instincts.”

Often, she believes, the most meaningful mentoring does not come from grand pieces of advice, but from helping someone recognize that their ideas belong.

Resilience, Community, and Advice for the Next Generation

Scientific discovery requires persistence. Many of her own projects, particularly attempts to determine structures of new human P450 enzymes, involve years of effort before success is possible. The first crystals of a new protein can represent a breakthrough after countless failed attempts. Those moments are why “new crystal days” in the laboratory feel magical.

But resilience is not just about experiments—it is also about navigating scientific culture. She believes isolation, self-doubt, and inadequate support systems can quietly discourage early-career researchers. Departments and institutions must recognize scientific contributions beyond simple metrics such as publication counts or citation numbers.

Dr. Scott’s advice to young scientists is to find their scientific community. “Finding your scientific tribe is really important,” she says. “These are the people who understand what you do, become collaborators, review your papers and grants, ask you to give talks, write support letters, and share professional strategies for success.”

She also emphasizes that building these connections requires actively engaging with the broader scientific community, particularly through conferences. Early in her career, she learned that skipping conferences to save money can be a false economy—even when you are not presenting. It is a message she believes should be shared more explicitly with junior faculty, who may underestimate the long-term value of these opportunities.

For women and scientists from underrepresented backgrounds, she offers a message of encouragement: “You matter. Your science matters. You have so much to contribute. You belong here.” At the same time, she emphasizes that success should not come at “the expense of personal health and a support system.” Hard work is essential, but so is working sustainably and smart.

Across her reflections on mentorship, collaboration, and career development, a consistent theme emerges: science advances through people. By fostering connections, supporting emerging scientists, and prioritizing sustainability, she hopes to help create a field where more individuals can contribute and succeed. Her advice reflects a broader vision of scientific success—one that values both achievement and the well-being of the scientists who drive discovery forward.

“Emily is a phenomenal mentor and role model. Her patience, kindness, and respect created a supportive lab environment that was obvious from my very first day in lab. Throughout my PhD, she provided the training and encouragement I needed to present my research at conferences, and to ultimately become an independent scientist. Now, even after leaving her lab, she is a supportive figure in my career and life, checking in and giving advice and resources where she can. I feel I am a better mentor myself for having learned from her, and I am so grateful for her support.” – Dr. Sarah Burris-Hiday (Former Scott Lab Graduate Student, now Postdoctoral Fellow at University of Michigan)

“Emily sees the potential in people long before they see it for themselves. My experience in her lab has strongly influenced the way I mentor my students today.”

– Dr. D. Fernando Estrada (Former Scott lab Postdoctoral Fellow, now Associate Professor at SUNY Buffalo)

“Dr. Scott has made a lasting impact on how I approach not only science, but also mentorship and leadership as a woman in STEM. Her intellectual curiosity, scientific rigor, and generosity have shown me how thoughtful leadership can foster a supportive, collaborative environment where confidence and productivity thrive. One of her greatest strengths is recognizing her students’ potential and empowering them to see it in themselves. I am deeply grateful to have her as my PhD mentor, and her guidance will continue to shape how I navigate challenges, collaborate with colleagues, and mentor others throughout my career.” – Alexandria Chabez (Current Scott lab Graduate Student, University of Michigan)

Commentary on Dr. Scott’s career from Dr. Richard Okita (Former NIH NIGMS Program Officer):



Dr. Scott received her first NIH R01 grant award in 2006, shortly after starting her faculty career as an Assistant Professor at the University of Kansas. This grant award was titled “The Structural Basis of Cytochrome P450 2A13 Activity.” This grant project was subsequently submitted for further funding in 2011 and 2015 with a slight change in the project title to “The Structural Basis of Cytochrome P450 Activity.” All 3 grant applications were considered to be highly significant with excellent progress achieved during each funding period. In these grant applications, Dr. Scott demonstrated her superb use of X-ray crystallography to advance our understanding of P450s and their binding to therapeutic drugs or other compounds. She also brought additional techniques to study P450

structures when X-ray crystallography alone could not be used to examine these interactions. Her research on the binding between redox partners with P450s has made major advances in our understanding of how this multi-protein complex may function in catalyzing enzymatic reactions. The scores given to her three grant applications were in the top 5% of all projects reviewed, which allowed Dr. Scott to receive a R37 MERIT Award to fund her research for a 10-year period, one of the highest honors a researcher could receive at that time from the NIH.