UC SANTA BARBARA

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Organic Prize for Inorganic Researcher

Alison Butler is one of those lucky few who realize their calling early in life. In her case, that calling was metal.

“I remember in preschool, playing with iron filings and a magnet,” Butler recalled. “I just was fascinated and it’s always stuck with me.” As she learned more, she became ever more captivated by the patterns and relationships that underlie all of chemistry.

Butler today is a professor of chemistry and biochemistry at UC Santa Barbara. She also is one of only 10 researchers nationwide selected to receive the American Chemical Society’s 2019 Arthur C. Cope Scholars Award, which recognizes and encourages excellence in organic chemistry.

“It’s particularly gratifying to be recognized with an organic chemistry award, I have to say, given that all my training is as an inorganic and bioinorganic chemist,” said Butler, who received the society’s Alfred Bader Award in Bioinorganic or Bioorganic Chemistry just last year.

“Professor Butler is one of our department’s leaders in every academic category: research, teaching and service,” said chemistry department chair Steve Buratto. “The Cope Scholar award is certainly well deserved and reinforces the fact [that she] is one of the top bioinorganic chemists in the world.”

Butler suspects that it's her work at the interface of organic chemistry and inorganic chemistry and biochemistry that sparked the recent interest and recognition by the American Chemical Society.

Her research focuses on metallo-enzymes. Many of us have heard of hemoglobin, the iron protein in red blood cells that ferries oxygen around our bodies. Hemoglobin is just one of a large family of metal-containing proteins common throughout the tree of life. It's also only one example of the myriad uses that life has found for iron. Bacteria need iron to survive, explained Butler, but it's not readily available. In the environment, iron is generally locked up in rust or other minerals, and in host organisms iron is locked up in proteins.

To obtain the iron they crave, bacteria secrete small molecules, called siderophores, that bind to iron extremely strongly. And each species of bacteria creates its own type. Scientists discovered siderophores in the late 1950s, but now researchers like Butler are analyzing the genomes of bacteria to identify the pathways of siderophore production. In addition to expanding our understanding of the natural world, insights into these processes could, perhaps, be used to thwart the growth of pathogens, said Butler.

A few years ago, she and her colleagues at UC Santa Barbara discovered that certain siderophores become sticky when wet. This opens a whole range of possible applications to her research.

Bonding things underwater is a real challenge, said Butler. "For instance, a Band-Aid doesn't work in water, but there's a real need to have compounds that do stick to surfaces and tissues when wet," she explained. "If you have small molecules that are adhesive in water, maybe we can make new, functional wet adhesive materials."

The siderophores appear to mimic proteins that mussels use to anchor themselves to wet rocks. Butler plans to investigate whether bacteria use these siderophores as a wet adhesive in addition to their role in obtaining iron. It seems advantageous to use the same substance to cling to a substrate and obtain resources from it.

All of this from that early interest in metals, which led Butler to earn her bachelor's degree in chemistry from Reed College, and then a doctorate from UC San Diego. "I was fascinated by the colors of these compounds," she said, laughing, "That's really why I got my Ph.D. in inorganic chemistry."

In graduate school Butler happened across an article in The New Yorker magazine about metallo-enzymes, which changed her life. “I thought, wow, there are proteins that have metals in them? I have to go into this field,” she recalled. So she set off to the land of bioinorganic chemistry, where she’s lived ever since.

Blessings abound in Butler’s career. She’s followed her curiosity into a profession she loves, and has attracted the respect and admiration of her peers. What’s more, she has the pleasure of mentoring the next wave of budding young chemists.

“It’s just fun to discover new things, but it’s mostly fun to work with the students in the discovery of new things,” said Butler. “I’ve just always had this fabulous group of students that get as excited as I do, and that’s what makes it all worthwhile.”

About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.