Elizabeth Bess

Transformer

From organometallic chemistry to gut microbiota to cancer

by Jeffrey Maloy

In Peter Turnbaugh's microbiology laboratory at UC San Francisco, **Elizabeth Bess** is an undercover chemist. After spending her graduate career at the University of Utah training as an organometallic chemist, Bess found herself increasingly attracted to the gut microbiota as a milieu of complex chemical reactions. "I became intrigued by the exquisite specificity with which enzymes can perform some very challenging chemical reactions," says Bess. "The opportunity to explore new ways of making and breaking bonds, via microbes, drew me to microbiology."

Since Bess joined the Turnbaugh lab in 2015, she has focused her chemistry expertise on microbial metabolism. As it has become increasingly clear that the gut microbiota plays an astounding variety of roles in animal physiology, Turnbaugh's lab has emerged as a leader in the study of xenobiotic metabolism and the resultant small-molecule products of our gut microbes. "Depending on the suite of bacteria that each individual uniquely harbors, the reactions that can take place are variable," Bess explains. The resulting molecules produced in these reactions may in turn have an impact on human health. As Bess points out, "Perhaps the saying shouldn't be 'We are what we eat,' but instead, 'We are what our microbes eat.'"

In particular, Bess is interested in how microbes digest compounds called lignans that are found in many of the fibrous plant-derived foods commonly consumed by humans.

While lignans by themselves are more or less biologically inert, they are often converted by gut microbes to metabolites known as enterolignans. These enterolignans have been implicated in protection against breast, colon, and prostate cancer. Because the conversion of lignans to enterolignans relies on our gut microbes, Bess is interested in discovering what microbial genes are

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responsible for this conversion and whether the presence of those genes can prevent breast cancer in animal models.

Although she has found a home in the microbiology community, Bess brings a unique perspective to her microbial research as a classically trained organic chemist. "While I'm now using bacteria as my catalysts rather than small-molecule transition metal catalysts, I think about biological problems from a chemical perspective," she says. In fact, Bess has found that her interdisciplinary approach to microbiology has allowed her to become a more creative an imaginative scientist than she might be otherwise. "Science is a continuum from math to physics to chemistry to biology," Bess explains. "The more fluidity that exists in how these fields are defined, the less confined we are to particular boxes, and the easier it is to follow where our curiosity might take us and find new ways to address scientific challenges."

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In addition to her research, throughout her academic career Bess has cultivated a passion for teaching. "I discovered a love for teaching as a violin instructor during my undergraduate days," she recalls. "I love to see moments of clarity and awe dawn on students' faces." As a chemist and microbiologist, Bess has continued to teach in formal classroom settings and through public outreach. As Bess puts it, "These experiences are particularly rewarding because they plant seeds of appreciation for the beauty, complexity, and simplicity of the world."

As a crossdisciplinary scientist with a knack for scientific teaching, an infectious sense of curiosity, and a passion for finding creative solutions to important challenges in the field of microbiology, Bess has found a like-minded and supportive community in ASM. Recently, she was awarded an ASM Career Development Grant for Postdoctoral Women, which she will use to delve deeper into her new community of microbiologists as she attends the Keystone Symposium on the Microbiome in Health and Disease this year. "Coming from a chemistry background, and relatively new to the microbiology field, I was delighted to find ASM supportive of this diversity and the creativity that it can foster," Bess says of receiving the grant.

Bess is already an accomplished organic chemist and as she delves ever deeper into the world of microbiology as a recently christened ASM member, her academic future looks promising. As she contemplates her future in microbiology, Bess muses, "The more that is discovered about the human gut microbiota and its complex interactions and feedback loops, the more excited I am to learn about how these bacteria are communicating and the role that small molecules play in this interaction."

Regardless of what future directions her science takes her, Bess is sure of her most important career goal: "To keep being curious." If her path from organic chemistry to xenobiotic metabolomics research is any indication, that curiosity promises to direct Bess to new frontiers in microbiology.