ISB Systems Education Experiences

BOEING

SYSTEMS THINKERS IN STEM

A CONVERSATION WITH:

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Which systems thinking skills do you use?

#1: Explore Multiple Perspectives
Diversity of perspective is key to the advancement of science, and systems biology embodies this concept. Complex systems inherently integrate multiple layers of perspective: physical, chemical, biological, social. Truly transformative science requires a similar layering of complementary expertise and viewpoints from many disciplines.

#5: Use Mental Modeling and Abstraction
Whether it's answering a complex scientific question about the gut microbiome or assessing the social health of your lab environment, the ability to build a mental model is crucial.

#6: Recognize Systems
We are all embedded in systems, whether we recognize it or not. Cultural, political, economic, and biological systems. Power systems are an important component of our reality that we often do not think about. No matter who we are, there are those who have power over us (e.g. parents, bosses, government officials) and there are those over whom we wield power (e.g. younger siblings, employees, students), although we often don't think of it in this way. An insidious quality of power systems is that the more power a person amasses the less they feel constrained by others. If left unchecked, this can passively lead to systemic corruption and widening inequality. Thus, as we grow older and accumulate professional, economic, cultural, and other forms of power, we must be aware of its corrupting influences.

1. **What is your role within the STEM community?**
I run a research group dedicated to understanding the ecological and evolutionary rules governing the form and function of microbial communities living in and on the human body (aka, the human microbiome). Ultimately, we aim to harness our inner ecology to track and treat disease. My job is to build an innovative and impactful research program that advances science and attracts talented researchers and sustained funding. The work of an assistant professor is similar to that of a CEO at a small startup company. My work involves recruiting, hiring, mentoring, writing grants, speaking with donors, publishing and editing research articles, collaborating, presenting, developing STEM educational materials, and more.
2. **What complex problem do you address in your work?**
The most complex task I work on is figuring out how to best serve each person in my group. Each person is unique and requires a different mentoring approach. A major complication arises when researchers feel embarrassed or ashamed to ask for help when they need it. These feelings are common in academia and give rise to imposter syndrome. Most professional scientists have experienced imposter syndrome at one point or another. These feelings are toxic and unfounded, and a good mentor should diffuse them as soon as possible. However, even in a supportive lab culture, it can be difficult for a trainee to show vulnerability. Empathy is a crucial muscle that team leaders need to cultivate. They should think about each individual team member regularly and consider how to best serve and support them in the current moment.
3. **What elements do you need to consider when addressing this problem?**
When a researcher first joins the lab, I provide them with an orientation document that outlines expectations and responsibilities for both mentee and mentor. We have an on-boarding meeting where we talk about their immediate research interests and career objectives. I try to get to know each person and understand their strengths and where they might need support. I want each person to feel adequately secure and properly challenged, at the same time. It is important not to get too comfortable. Growth requires some amount of struggle and discomfort. At least half of our time should be spent doing the things that we aren't yet good at.
4. **How did you get to where you are today?**
I grew up in Montana. My parents were blue-collar. I did ok in high school, but I was never at the top of my class. I did not apply for colleges or scholarships, but I was offered a partial scholarship to go the University of Montana (UM). I worked full time over the summers as a furniture mover and part-time during the school year to pay tuition and living expenses. I took way-too-many courses over a 5-year period and ended up with three bachelor's degrees in French language and literature, molecular biology, and microbiology (with a minor in chemistry). I spent a year abroad in France teaching high school English. I received a Fulbright Scholarship and studied synthetic biology at Uppsala University in Sweden where I was awarded a master's degree in microbiology. I was then accepted into the biophysics PhD program at the University of Chicago (UChicago), and my dissertation was on environmental microbial ecology and evolution. Afterwards, I joined the Department of Biological Engineering at MIT and the Broad Institute to study the ecology and evolution of the human gut microbiome. I am now faculty at the Institute for Systems Biology and started a lab focused on harnessing our inner ecology to track and treat disease.
5. **What advice do you have for becoming a systems thinker?**
Cultivate an appreciation for the humanities and the arts. The best scientists I know are artists at heart. Science is inherently creative, and art allows for a more unconstrained exploration of your creative self. Whether it's standup comedy, classical music, poetry, literature, painting, sculpture, or haute cuisine, find something outside of science that you are passionate about.