

17TH ANNUAL
MICROBIAL SCIENCES
SYMPOSIUM



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APRIL 18, 2020



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MICROBIAL SCIENCES
INITIATIVE AT HARVARD

INTRODUCTION

Today's Symposium has been organized by the Microbial Sciences Initiative (MSI) at Harvard University. MSI is an interdisciplinary science program aimed at a comprehensive understanding of the richest biological reservoir of the planet, the microbial world. Microbes are ubiquitous and have an impact on every aspect of our existence. Yet, their intrinsic invisibility has meant that they have remained largely unknown, their effects and enormous potential often unrecognized. The recent realization of the vastness of microbial diversity and the genomics revolution have propelled the microbial sciences into an exciting new era of investigation.

MSI is playing a key role in this emerging area by creating an organizational focal point for microbial studies with strong links to already existing science departments and schools at Harvard. MSI encourages broad interactions among microbial scientists across the Boston area and connects work on microbial sciences to ongoing work in related areas including molecular biology, medicine, biogeochemistry, evolutionary biology, and environmental engineering. Thus, MSI has built a community across the entire University including students, postdoctoral fellows, and faculty.

MSI supports a variety of activities that foster interdisciplinary research, including colloquia, seminars, and weekly discussions of microbial science issues. Additionally, MSI runs several programs for students, such as a graduate consortium and, for undergraduates, a summer fellowship program and a secondary field. Further, the MSI has played a key role in the recruitment of several new faculty.

It is our hope that this Symposium will, by presenting some of the breadth and depth of microbial sciences today, stimulate discussion among members of our scientific community that will help strengthen this integrative science initiative. We thank you for your attendance and welcome you to today's activities.

PROGRAM SCHEDULE

OPENING REMARKS

9:45

Peter Girguis, PhD
MSI Co-Director

SESSION I

10:00 – 12:00

10:00-10:30

Elizabeth Fozo, PhD
University of Tennessee, Knoxville
“To persist or not to persist? Questioning the ZorO toxin”

10:30-10:45

Jane Hartman
Trilobite Glassworks

10:45-11:15

Brett Baker, PhD
University of Texas, Austin
“Exploring new branches on the tree of life”

11:15-11:30

Frank Santoriello
Microbial Miscellanea

11:30-12:00

Mohammad Seyedsayamdost, PhD
Princeton University
“Illuminating the Dark Matter of Microbial Metabolomes”

BREAKOUT Q&A FOR SESSION I

12:00-1:00

Elizabeth Fozo
Brett Baker
Mohammad Seyedsayamdost

Please note that Session I Q&A meetings take place in parallel in separate Zoom calls.
Each Q&A can be accessed using the corresponding Zoom link provided in post-registration emails.

BREAK

1:00-1:30

SESSION II**1:30-3:30****1:30-2:00****Ariel Furst, PhD**

Massachusetts Institute of Technology

*“Controlling microbial adhesion using DNA ‘velcro’”***2:00-2:15****Christine Liu**

Two Photon Art

2:15-2:45**Michael Gilmore, PhD**

Harvard Medical School

*“Evolution of the enterococci parallels planetary events”***2:45-3:00****Tracy Debenport**

Wee Floof

3:00-3:30**Petra Levin, PhD**

Washington University in St. Louis

*“The environment shapes the cell”***BREAKOUT Q&A FOR SESSION II****3:30-4:30**

Ariel Furst

Michael Gilmore

Petra Levin

Please note that Session I Q&A meetings take place in parallel in separate Zoom calls.

Each Q&A can be accessed using the corresponding Zoom link provided in post-registration emails.

SESSION III – SPECIAL TOPIC**4:30-5:00****Erica Shenoy, MD, PhD**

Massachusetts General Hospital

*“COVID-19 on the Front Lines: One Hospital’s Transformation”***CLOSING REMARKS****5:00-5:15****Michael Gilmore, PhD**

MSI Co-Director

Elizabeth Fozo

Associate Professor
Department of Microbiology
University of Tennessee, Knoxville

[LAB WEBSITE](#)

[TWITTER](#)

**Education & Training:**

B.A. University of Delaware
Ph.D. University of Rochester
Postdoctoral Fellow, NIH

Selected Honors and Awards:

- UT Knoxville Undergraduate Faculty Award
- Extraordinary Collaborations in Research Compliance and Safety

Research Interests:

Bacteria are faced with a constantly changing environment. These changes often include great fluxes in nutrient availability, variations in pH, temperature swings and reactive oxidative species. Bacteria employ many strategies in order to survive environmental stresses, and many of these adaptations are important for pathogenesis as well. The Fozo lab seeks to understand how bacteria adapt to stressful conditions and how these adaptations are linked to pathogenesis. In particular, our studies focus on two organisms that are capable of adapting to a variety of stress conditions: *Enterococcus faecalis*, a vancomycin-resistant organism responsible for many hospital acquired infections, and *E. coli* O157:H7, a potentially deadly food-borne pathogen.

Jane Hartman
Trilobite Glassworks

[SCIART WEBSITE](#)



Education:

B.S. University of Michigan
M.S. University of Wyoming

Selected Honors and Awards:

- Workhouse Arts Center 5th Annual Glass National Exhibit
- Small is the New Big Show, National Capital Art Glass Guild

Sci-Art Summary:

I am an artist who works in both fused glass and stained glass. My educational background in science is evident in my unique choice of subjects, which may include anything from insect, fish, and trilobites; to protozoa, planarians and viruses. Though my art is stylized, I pay particular attention to scientific details and embrace the vivid colors found in nature. I try to find and incorporate humor when I can, whether it's with the crossed-eyes of a two-headed planarian, or the simple appeal of a trilobite. Trilobites make me smile. I hope my work makes you smile.

Brett Baker

Assistant Professor
Department of Marine Science
University of Texas at Austin

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Education:

B.S. University of Wisconsin-Milwaukee
M.S. University of Wisconsin-Milwaukee
Ph.D. University of Michigan

Selected Honors and Awards:

- Simons Foundation Early Career Investigator
- Sloan Foundation Fellowship in Ocean Sciences
- University of Texas College of Natural Science Visualizing Science Contest

Research Interests:

Microorganisms are key mediators in nearly all of the planet's elemental cycles. However, our understanding of the ecological roles of many groups of microbes has been hampered by low-resolution analytical approaches to studying the staggering diversity present in nature. As a result, the tree of life is full of branches, which remain undiscovered, and those, which have only been identified in single-gene sequencing surveys (Baker and Dick, 2013). This is a fundamental gap in our understanding of biology. Filling in the genomic gaps in the tree of life will provide a rich context to understand the evolution of life on the planet and will provide us with a genetic understanding of how microbial communities drive biogeochemical cycles.

Frank Santoriello

Microbial Miscellanea

[SCIART WEBSITE](#)



Education:

B.S. Pennsylvania State University

M.S. New York University

Selected Honors and Awards:

- NYU Biology Department Poster Prize
- NYU Masters Student Research Grant

About Frank:

Frank Santoriello is a Ph.D. candidate at the University of Colorado, Anschutz Medical Campus, studying *Vibrio cholerae* and the type 6 secretion system (T6SS). Frank is also a pen-and-ink illustrator, whose work puts a human face on microbes in order to help people make a more lasting connection with microbial concepts. As Frank's knowledge of microbiology deepened, he realized that these miniscule organisms represent a wealth of illustration subject matter. The work featured on Microbial Miscellanea bridges the gap between complex microbial concepts, and familiar anthropomorphic expressions and pop culture references.

Mohammad Seyedsayamdost

Associate Professor
Department of Chemistry
Princeton University

Associated Faculty
Princeton Environmental Institute &
Department of Molecular Biology

[LAB WEBSITE](#)



Education:

B.S./M.S. Brandeis University
Ph.D. Massachusetts Institute of Technology

Selected Honors and Awards:

- Camille Dreyfus Teacher-Scholar Award
- NIH Director's New Innovator Award
- Princeton Environmental Institute Innovative Research Award

Research Interests:

Much of what we know about bacteria has come from investigations of single, purified bacterial strains in nutrient-rich monocultures. In a natural setting, however, bacteria co-exist in astounding numbers and compete for limited resources. The discovery of staggering bacterial diversity in various habitats, such as soil or the human gut, and the impact of these communities on the environment or the host have highlighted the need to understand bacterial intra- and interspecies interactions. Bacteria use a wide range of small molecules to detect and respond to their environment and to communicate, collaborate, or compete with other microbes. The small molecules underlying this complex chemical dialogue, their functions, biosynthetic pathways, and the enzymatic reaction mechanisms involved in their production comprise the primary focus of our research efforts.

Ariel Furst

Assistant Professor

Department of Chemical Engineering
Massachusetts Institute of Technology

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[TWITTER](#)

**Education:**

B.S. University of Chicago

Ph.D. California Institute of Technology

Selected Honors and Awards:

- Remsen Bird Lecturer
- Arnold O. Beckman Postdoctoral Fellowship

Research Interests:

The Furst lab combines electrochemical methods with biomolecular and materials engineering to address challenges in human health and clean energy. We develop new technologies to combat antimicrobial resistance, detect disease, and improve microbial interactions with electrodes. Electrochemistry offers direct access to study redox activity. By combining the tools of chemical engineering with electrochemistry, we can elegantly probe fundamental chemical and biological questions.

Christine Liu

Two Photon Art

[SCIART WEBSITE](#)



Education:

B.S. University of Oregon

Selected Honors and Awards:

- Exhibitions at Society for Neuroscience, Mission Science Workshop, and Cal Academy of Sciences
- HHMI Gilliam Fellowship
- New England Biolabs Passion in Science Award

About Christine:

Hi there! I'm a PhD candidate in Neuroscience at UC Berkeley researching the relationship between nicotine and the brain's dopamine system. By doing experiments that allow me to tease apart circuits in the brain by targeting different cell types and their connections, I hope to contribute to our understanding of how addiction manifests in the brain. In my spare time I make art to communicate science. I co-founded the Two Photon Art collective with Tera Johnson, an environmental scientist, a few years after we met doing summer research programs at University of Oregon and Stanford University. Together we make zines, or self-published booklets, that capture the wonder in scientific topics. We delve into the oddity that is Face Blindness while providing an introduction to neuroscience and raising awareness for prosopagnosia. With Neuro Retreat, we package current neuroscience research summaries in an accessible format that is also fun to read. To round out our science communication efforts through art, we also make pins and patches that allow all to express their love for science.

Michael Gilmore

Sir William Osler Professor of Ophthalmology,
Microbiology & Immunology
Harvard Medical School

Director
Infectious Disease Institute

Co-Director
Harvard Microbial Sciences Initiative



[FACULTY PROFILE](#)

Education:

B.A. Kalamazoo College

M.S. Kansas State University

M.S., Ph.D. University of Oklahoma Health Sciences Center

Selected Honors and Awards:

- Fellow, American Academy of Microbiology
- Keynote Speaker, International Symposium Frontiers in Microbiology, 2018
- Neil Groman Lecturer, 2017

Research Interests:

My laboratory focuses on developing new ways to prevent and treat antibiotic resistant infections. We believe the core genome of enterococci and staphylococci evolved to enable stable commensal relationship with the host. However, this stability is undermined by environmental changes, changes in the host, or the introduction into the microbe of new traits on mobile elements. We identify traits on mobile elements that destabilize the host commensal relationship, determine their origin, and define how they undermine the balance. These studies employ epidemiology, molecular genetics and genomics, cell biology and pathogenesis in animal models.

Tracy Debenport

Wee Floof

[SCIART WEBSITE](#)



Education:

B.A. University of Delaware

Ph.D. University of Rochester

Selected Honors and Awards:

- Nikon Small World Photomicrography Competition

About Tracy:

The first time I looked at mold under a microscope it completely blew my mind. What I witnessed and experienced were not the images and emotions traditionally associated with the term ‘mold’. I saw flowers, stars, gorgeous landscapes and otherworldly scenes. I was elated and inspired by the beauty. I felt compelled to share this newfound passion. Molds are often thought of in terms of function (being harmful or beneficial), but they’re rarely thought of in terms of artistic quality. I found that witnessing this quality made molds (and microbes in general) relatable in a new way. They’re wonderful. They’re unexpected. They’re absolutely adorable! There is so much we can learn from these amazing organisms.

Petra Levin

Professor

Department of Biology

Washington University in St. Louis

Associate Director

Center for Science & Engineering of Living
Systems, Washington University

Co-director

Plant and Microbial Biosciences Graduate
Program, Washington University

[LAB WEBSITE](#)

[TWITTER](#)



Education:

B.A. Biology Williams College

Ph.D. Harvard University

Selected Honors and Awards:

- Fellow, American Academy of Microbiology
- Fulbright U.S. Scholar, Netherlands
- Distinguished Lecturer, American Society for Microbiology

Research Interests:

The Levin Lab studies how cells respond to changes in the environment, specifically changes in the availability of essential nutrient, by altering their growth rate, cell shape, and composition. For example, the Levin Lab asks how cells “know” when they are starving for carbon and how they reduce growth rate and daughter cell production to compensate. Because nutrient starvation typically increases the ability of bacteria to survive in the presence of antibiotics, research in the Levin Lab’s will hopefully help us understand how human pathogens are so adept at acquiring antibiotic resistance, a growing crisis in today’s world. What is it about starving that makes cells more resistant to antibiotics and how can we influence this?

Erica S. Shenoy

Associate Chief, Infection Control Unit
Massachusetts General Hospital

Medical Director, Biocontainment Unit
Massachusetts General Hospital

Assistant Professor of Medicine
Harvard Medical School

[MGH PROFILE](#)

[TWITTER](#)



Education:

B.S. Princeton University
MD, Ph.D. Harvard University

Selected Honors and Awards:

- Fellow, Infectious Diseases Society of America (IDSA)
- Fellow, Society for Healthcare Epidemiology of America (SHEA)

Research Interests:

Dr. Shenoy's research has evaluated the clinical, operational and economic impact of competing infection control strategies for methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant *Enterococcus* (VRE) through clinical studies and mathematical modeling, has leveraged electronic health records for infection control surveillance, and applied machine-learning techniques to create real-time risk prediction models for *Clostridioides difficile* infection. She is Medical Director of the MGH Biocontainment Unit, one of 10 facilities supported by the US Department of Health and Human Services as part of the regional treatment network for Ebola and other special pathogens. She has served as the Infectious Diseases and Infection Control advisor to MGH and Partners Healthcare for the COVID-19 response. Dr. Shenoy is co-chair, along with Dr. David Weber, of the Sterilization and High Level Disinfection guidelines committee of the Society for Healthcare Epidemiology of America (SHEA).