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Title: 2024 International Conference on Microbiome Engineering
(ICME)

Institution: American Institute of Chemical Engineers, New York, NY

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PI & Final Report Author: Evan Flach

Project Abstract

The 2024 International Conference on Microbiome Engineering (ICME) took place November 12-14 at Tufts University in Medford, MA. ICME connected experts from academia and industry to share the most recent developments in the field of microbiome engineering. This included genetically engineered organisms that function within microbiomes, control of microbiomes through environmental/nutrient modifications, and inference of engineering principles from analysis of synthetic and natural microbiomes. The conference was unique and distinct from other microbiome conferences in that it specifically highlighted the integration of engineering design principles with microbiome research (others are more focused on basic biological principles). The conference thus integrates synthetic biology, systems biology, microbial ecology, and bioinformatics across a range of application spaces from the environment to manufacturing, food, and human health.

Support from the Department of Energy's (DOE) Office of Biological and Environmental Research (BER) helped trainees and early career faculty attend ICME. It provided discounted and complimentary registrations to graduate students, post-docs and assistant professors at U.S. institutions who would have otherwise not had financial funding to attend the conference. Over 20 researchers received conference support through this DOE grant, strengthening the future pipeline of U.S. researchers in this rapidly developing field.

The goals and interests of ICME investigators at this conference were directly aligned with the mission of BER. As stated in the FOA, BER is looking to invest in research to understand "molecular and regulatory mechanisms governing genotype to phenotype translation needed to predictively understand genome-scale functional properties of microbes, plants, and microbiomes", as well as "advanced characterization, measurement and imaging technologies to visualize the spatial and temporal relationships of key metabolic processes governing phenotypic expression in plants and microbes". The 2024 ICME was well aligned with these research interests, as evidenced by session topics, including: Engineering Plant and Soil Microbiome Systems, Microbiome and Probiotic Engineering for Non-Biomedical Applications and Microbiome Engineering Tool Development. The conference covered microbiome engineering broadly across applications, ecological systems, and spatial/temporal scales, again in good alignment with the research goals of BER. ICME engaged speakers and participants from across the microbiome space, including environmental microbiomes, microbial/fungal and microbial/plant interactions. One of the unique and valuable aspects of ICME was its focus on sharing tools and strategies for microbiome engineering across the microbiome research landscape. Medical microbiome experts have insights to gain from environmental and industrial experts, and vice versa.

Final Technical Report

The 2024 International Conference on Microbiome Engineering (ICME) took place November 12-14 at Tufts University in Medford, MA. The conference gathered scientists and engineers across the quickly growing field of microbiome engineering. It integrated synthetic biology, systems biology, microbial ecology and bioinformatics across a range of applications. Session topics included:

- Engineering Animal Microbiome Systems
- Engineering Plant and Soil Microbiome Systems
- Microbiome Engineering Tool Development
- Microbiome and Probiotic Engineering for Human Health
- Microbiome and Probiotic Engineering for Non-Biomedical Applications
- Underlying Science of Microbial Dynamics in Microbiomes

ICME gathered 157 attendees, maintaining the ~40% growth the conference has seen since returning to an in-person format after Covid. The conference serves as an event for members of the community to learn from leading researchers, engineers and industry experts. Featured speakers included:

- Eric Alm, Massachusetts Institute of Technology
- Jonatan Conway, Princeton University
- Matthew Dunn, ArkeaBio
- Linda Kinkel, University of Minnesota
- Sarah Lebeer, University of Antwerp
- Stephen Lindemann, Purdue University
- Tagbo Niepa, Carnegie Mellon University
- Ophelia Venturelli, Duke University
- Benjamin Wolfe, Tufts University

The meeting Chairs and Organizing Committee were made up of technical leaders, as well as up and comers, who have a wide range of backgrounds and expertise areas. They included:

Chairs

- Kirsten Benjamin, Pivot Bio
- Tae Seok Moon, J. Craig Venter Institute
- Nik Nair, Tufts University

Organizing Committee

- Chris Belnap, Resilient Biotics
- Jenn Brophy, Stanford University
- Nathan Crook, North Carolina State University
- In Young Hwang, Singapore Institute of Technology
- Michelle O'Malley, University of California, Santa Barbara
- Kevin Solomon, University of Delaware
- Qing Sun, Texas A&M

- Ruben Vazquez-Urbe, KU Leuven
- Sung Sun Yim, KAIST
- Eric Young, Worcester Polytechnic Institute

The goal of this DOE-funded project was to make ICME accessible for trainees and early career professionals, allowing the future generation of microbiome engineers to learn from the current leaders. In addition to technical presentations, ICME offered people early in their careers professional development opportunities through poster sessions, presenting and receiving feedback on their work. Networking events also offered time for informal discussions to develop new connections and foster collaboration.

DOE support allowed over 20 U.S.-based students, post-docs and early career faculty members to receive discounted or complimentary registrations to the conference on an as-needed basis. Supporting these individuals helped to ensure the strength of U.S.-based talent in industries impacted by microbiome engineering, including agriculture, energy and healthcare.