

Interactions of Biotechnology with Human Physiology and Function – A Workshop

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MEETING GOAL AND OBJECTIVES

The goal of this meeting is to identify biotechnologies that have enabled discoveries of the many interconnections along the gut-brain axis and to examine these in the context of recent research developments and their supporting ecosystem. The following objectives will be addressed through speakers and interactive sessions. The objectives are to:

- Highlight new research into connections and mediators along the gut-brain axis
- Recognize challenges or limitations across related fields
- Identify transdisciplinary technologies and their potential applications
- Explore the ecosystem that supports or is needed to support future development
- Envision where the field could be in 10 years

All sessions will address the following questions: What are current areas of convergence across gut-brain axis research, and how can biotechnologies best be integrated to overcome barriers to application?

THURSDAY, DECEMBER 15, 2022

11:00-11:15 am EST Welcome

Kavita Berger, National Academies of Sciences, Engineering, and Medicine
Diane DiEuliis, National Defense University

Housekeeping Remarks

Kanya Long, National Academies of Sciences, Engineering, and Medicine

Workshop Overview

Elliot Chaikof, Harvard University

11:15-12:30 pm EST Integrating Sensory and Immunological Input

The goal of this introductory session is to set the stage for considering the links between gut microbiota and nervous and immune systems, or the gut-brain axis. Microbiota can control the immune system locally and systemically, and the source of many of the molecular and sensory inputs that contribute to animal behavior is the microbiota of the gut. Characterizing and modeling the interactions of metabolites and host signaling molecules may contribute to an understanding of how signals are transmitted and received within the gut-brain axis.

Moderator: *Elliot Chaikof, Harvard University*

Sriram Chandrasekaran, University of Michigan

Kevin Tracey, Northwell Health

Mauro Costa-Mattioli, Altos Labs

12:30-1:30 pm EST Lunch

1:30-2:45 pm EST Microbial Modulation, Immunity, Health, and Disease

As the influential role of the gut/microbiome/brain axis is clarified, studies have expanded into its role in specific disease states and the potential for therapeutic intervention. Understanding the formation, maintenance, and evolution of microbial populations leads to the possibility of manipulation of these microbes to influence their roles to the advantage of the host.

Moderator: Diane DiEuliis, National Defense University

Elaine Hsiao, University of California Los Angeles

Sarkis Mazmanian, California Institute of Technology

2:45-3:00 pm EST Wrap Up Remarks

Elliot Chaikof, Harvard University

LIVESTREAM ENDS

3:00-4:30 pm EST Asynchronous Jamboard Reflection for Livestream Attendees

Livestream participants are encouraged to provide written reflections on the [Google Jamboard](#)

END OF FIRST DAY

FRIDAY, DECEMBER 16, 2022

11:00-11:10 am EST Welcome and Summary of Day 1

Elliot Chaikof, Harvard University

11:10-12:30 pm EST Integrating Microbial and Host Signaling Molecules

The gut/microbiome/brain axis has multiple mechanisms for detecting and transducing signals. Gut sensory epithelial cells send signals via multiple neurons, including the vagus nerve. Microbes produce metabolites that enter the circulation and affect such processes as neuroinflammation and brain development. The intricate connections between the microbiome and the immune system can be probed to understand susceptibility to infection. Understanding these activities requires the resolution of the structural interactions between gut microbes and mucosal elements.

Moderator: Mauro Costa-Mattioli, Altos Labs

Diego Bohorquez, Duke University
Mark Lyte, Iowa State
Melody Zeng, Cornell University
Vanessa Ridaura, Gates Foundation
Michael Fischbach, Stanford University

12:30-1:30 pm EST Lunch

1:30-2:45 pm EST Neuromodulation, Immunity, and Health

Advances in understanding how the nervous system maintains homeostasis suggest that devices targeting the central nervous system and peripheral neural circuits can be exploited to learn about and potentially modify the underlying pathology of some diseases. This session will highlight technologies in use and identify potential gaps in the availability of those technologies for applications related to the gut-brain axis.

Moderator: Amina Qutub, The University of Texas at San Antonio

Todd Coleman, Stanford University
Hubert Lim, University of Minnesota
Stewart Campbell, Axial Therapeutics

2:45-3:45 pm EST Innovation Ecosystem and Envisioning the Future of Gut-Brain Research

During this session, speakers will discuss future vision for research and application of multi-system studies in human physiology. This discussion will focus on both scientific and technological developments and the broader enterprise enabling such advances, including exploration of funding models, education and workforce needs, and infrastructure.

Moderator: Jun Axup, E11 Bio

William Bonvillian, Massachusetts Institute of Technology

Panelists:

Elaine Hsiao, University of California Los Angeles
Mauro Costa-Mattioli, Altos Labs
Hubert Lim, University of Minnesota
Vanessa Ridaura, Gates Foundation

3:45-4:00 pm EST Closing Remarks

Moderator: Elliot Chaikof

MEETING ADJOURNS