Microbiota-Informed Strategies to Combat Disease: Leveraging Human-Microbiota Molecular Mechanisms of Action in Therapeutic Applications

Lynn Bry, MD, PhD
Director, Massachusetts Host-Microbiome Center, BWH; Associate Professor of Pathology, HMS
lbry@bwh.harvard.edu

Dr. Bry is the Director of the Massachusetts Host-Microbiome Center (MHMC) at BWH, which promotes further understanding of host-microbiome interactions in health and disease, emphasizing a Focus-on-Function to define causative effects of the microbiota in vivo and to harness this knowledge in developing new therapies, diagnostics and further commercial applications.

Defining the molecular mechanisms by which our microbiota modulates risks for human disease has enabled new therapeutic approaches in areas ranging from gastrointestinal, immunologic and infectious to ones for cardiovascular disease, diabetes, and cancer. While the field has had a major focus on correlative aspects of microbiome signatures with disease, the MHMC seeks to identify causative effects of the microbiota on our physiology and on disease pathogenesis.

We bring unique approaches using machine learning, deep knowledge of anaerobe and host physiology and genomics, and high-dimensional multi-omic platforms that integrate pre-clinical models with human studies to provide an in vivo context for defining the causative mechanisms by which populations of colonizing microbes modulate our own physiology. Platform approaches in metabolomic analyses, anaerobe-host metabolic modeling, and longitudinal dynamics of the microbiota relative to patient factors, dietary, or druggable interventions, have progressed patented new therapeutic approaches for diseases such as human food allergies, diabetes, and reduction of infection risk in newborns and hospitalized patients.

With investment from the Massachusetts Life Sciences Center (MLSC), the MHMC has a long-standing outreach program with academic and industry partners to develop microbiota-informed applications. Example program will be presented, including underlying mechanisms by which the microbiota promotes constructive immunomodulation, as well as metabolic reprogramming of the gut nutrient environment, and use of this knowledge to inform new approaches to human disease.