

Internal Medicine Microbiome Research Initiative (IMMRI) and the Microbiome Research Center (MRC)

The Division of Pulmonary and Critical Care Medicine, working together with the Divisions of Gastroenterology and Infectious Diseases, and supported by the Department has recently launched the IMMRI, a multidisciplinary research and training initiative. Investigators in the IMMRI have also been working with faculty from Microbiology & Immunology, ULAM and Pharmacology to expand this to a broader inter-divisional and inter-departmental program (tentatively titled "The Microbiome Research Center," MRC). The mission of the MRC will be to: a) promote development of interdivisional and interdepartmental research programs and grants involving the microbiome; b) mentor new investigators; c) provide reagent exchange; d) participate in grant preparation and review; e) sponsor internal and external seminars on the microbiome; and f) educate fellows, house officers and graduate students in this new field. The MRC's goal is to be a catalyst for interdivisional and interdepartmental collaborations.

In February 2007, the NIH announced five new initiatives in its Roadmap for Medical Research. The first on the list was the **microbiome**. The NIH defined the microbiome as "the full collection of microbes (bacteria, fungi, viruses, etc.) that naturally exist within the human body." Thus, the objective is to create a research center to facilitate (a) the culture-independent analysis of the indigenous microbiota and (b) the identification of the relevant changes in the human microbiome that influence health and disease.

Rationale for the Development of the MRC at the University of Michigan

We have an increasing number of investigators (new and established) whose research, clinical interests and academic interests focus on the health and disease states of the mucosa. A significant amount of recent evidence indicates that changes within the polymicrobial communities of the

indigenous microbiota are likely important factors in the onset of a number of chronic inflammatory diseases, digestive disorders and metabolic syndromes. However, the precise changes and mechanisms still remain to be elucidated.

The study of mucosal biology is a multi-disciplinary field that does not easily fall within the old standard framework of research disciplines and understanding the biology of the microbiome is central to understanding mucosal biology. For example:

- changes in the microbiology of the GI tract can alter mucosal immunity, rendering an individual more susceptible to developing allergic diseases in the airways
- in rats genetically prone to developing autoimmune diseases of the colon and joints, disease in these animals can be prevented or ameliorated by altering the microbiology of the GI tract through probiotics or antibiotics
- visceral hypersensitivity and altered peristalsis, are affected by agents that target the nervous system, the immune system, or the microbiology of the GI tract
- changes in the microbiome can increase or decrease susceptibility to infectious diseases related organisms like *Clostridium difficile*, *Candida albicans*, MRSA and *Klebsiella pneumoniae*.

Understanding mucosal biology and the activity of the microbiome has implications for preventing and treating the following diseases:

- Allergies & asthma
- Ulcers
- Gastritis/gastroenteritis
- Inflammatory bowel diseases
- Irritable bowel syndrome
- Antibiotic-induced side effects
- Mucosal cancers
- Rheumatoid arthritis
- Metabolic syndromes and diseases, including obesity

Recent research in mucosal biology has underscored our lack of knowledge of this field, especially in our understanding of the role and community dynamics of the microbiota, and also highlighted the tremendous research opportunities in this arena.

Therapies aimed at positively altering the microbiota, such as probiotics and

prebiotics, is a rapidly emerging arena of research for all of the diseases listed above. In an era of more competitive NIH funding, it is important to generate multi-disciplinary, broad-based, multi-PI disease-based projects - intra-institutional collaboration will be key to successfully compete in this new era.

Dr. Vincent Young (Infectious Diseases), an expert in microbial ecology of the gastrointestinal tract, was recently recruited to the Department through a joint Pulmonary/ID/GI effort as part of the IMMRI. Multiple investigator NIH proposals have been and continue to be generated from the IMMRI labs. An additional resource available to labs interested in the microbiome are the germ-free/gnotobiotic animal facility within ULAM (under the direction of Dr. Kate Eaton).

For further information about the developing microbiome research initiative within the Department and for questions about expanding it to other Divisions, contact:

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