

Symbiosis between microbes and eukaryotes is a globally important phenomenon that has powerful effects on the physiology, ecology, and evolution of all living organisms and is a source of biological innovation. An outstanding example is that of mitochondria and chloroplasts, eukaryotic organelles arising from bacteria that became established within primitive single-cell organisms 1-2 billion years ago. Microbial symbioses expand the potential ecological niches and metabolic capabilities of the host-symbiont combinations, playing essential roles in ecosystem processes, evolution of new species, agriculture, and human health. Symbiosis has evolutionary potential in that the partnership can result in a "new organism", charging us to think about biodiversity on a different level.

Within the last decade, it has become evident that the human microbiome, collectively the communities of microorganisms that live on and in us, is intimately connected with human health and disease. With colonization at birth and developing throughout our lives, our microbiome plays a role in human nutrition and development, immunity and protection from pathogens, and is implicated in numerous diseases including obesity, inflammatory bowel disease, and mental disorders. These discoveries have prompted exciting new research areas focused on exploring the microbiome both in health and with the goal of eventually managing and curing related diseases.

This course will provide a broader understanding of microbial symbioses ranging from intimate associations (e.g., intracellular microbes) to the human microbiome in the context of ecology and evolution. The book *I Contain Multitudes* by Ed Yong will serve as backdrop for the course combined with critical review and discussion of current research. Discussions and presentations will draw heavily from the primary literature, focusing on recent discoveries in the field.

The course is open to graduate students and to interested upper-level undergraduates who have taken LS1a, LS1b, OEB 10 or equivalent(s), courses in microbial sciences, or permission from instructor.

**Notes:** In addition to our regular class meetings, the 4<sup>th</sup> Annual MIT-Harvard Microbiome Symposium (Friday, 8 March 2019, 10am to 5pm at MIT) is a component of the course. Attendance is required though alternate assignment can be substituted for those with conflicts. More information on this exciting symposium can be found at <https://microbiome2019.wordpress.com/>