Human Microbiome Syllabus

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Introduction

The human microbiome is the collection of microorganisms that live in or on the human body. In a healthy adult the human microbiome is home to over 35 trillion microorganisms, that is ~1 microbial cells for every one human cell. Moreover, while the human genome consists of just over 20 thousand genes, the human microbiome contributes as many as eight million unique genes. Recent advances in DNA sequencing technology and culture-independent microbial community analysis have allowed researchers to explore how the human microbiome and its associated metagenome contributes to human development and health. The wealth of new data has uncovered important roles for the human microbiome related to immune system development, nutrition, drug metabolism, protection from pathogenic invaders, and behavior.

This course will introduce students to the human microbiome and its influences on health and disease. Students will study the composition of the human microbiome at various taxonomic levels, from the domains of bacteria, fungi and viruses down to species and strain-level differences. They will examine the role of distinct environments within the human body and how they contribute to supporting regionally specific communities within the human microbiome. Students will examine the temporal dynamics of the human microbiome from birth to adulthood, as well as on the time scale of days to weeks, and how discrete events, such as antibiotic treatment, can dramatically alter the composition of the microbiome. They will contrast the wide variations from individual to individual in the taxa composition of microbiomes with the surprising uniformity of the functional contribution provided by the microbiome to each individual at the level of metabolic potential. The class will include discussions of comparative microbiomes across a range of other organisms, as well as looking at the exchange of microbial community members from the human microbiome and the environment.

The course will include short introductory lectures to each major topic, but will emphasize seminar-style discussions of recent articles from the primary literature related to the human microbiome. There will be one midterm exam and one final exam. Students will also be required to give an oral presentation on a topic related to the course material that they choose.

Rationale: The role of the human microbiome in maintaining health has recently been recognized as more significant than originally thought. An understanding of the composition of an individual's microbiome will become increasingly important in determining treatments for a variety of diseases and illnesses. Recent research has shown that manipulating the composition of the microbiome can effectively treat some acute and chronic diseases. Students entering into the biomedical fields will need to be well informed regarding the role of the human microbiome in maintaining and promoting human health.

Learning Objectives of Course:

- To improve the students' critical thinking and scientific literature reading skills.
- To demonstrate to students the importance of the human microbiome to development and health.
- To understand the role of the human microbiome in evolution and adaptation.

- To develop the students' understanding of the current technologies in next generation sequencing and metagenomics.
- To expose students to the growing importance of considering the human microbiome in the treatment and prevention of diseases and illness.

Method of evaluation: Grades will be determined by a midterm and final exam (each will be worth 30% of final grade each; short essay format), quizzes (10% of final grade), students' class participation (15% of final grade; this includes coming to class prepared having read the papers and answering and asking questions during class), and students' presentations and assignments (15% of final grade).

Materials requirements for class:
There is no assigned textbook and all required articles discussed in class will be made available on-line as PDF files.

It is strongly recommended that you bring to each class a web-enabled device (ideally a laptop computer or tablet/iPad, but a smartphone may be used as a last resort). We will be conducting on-line searches during class.

Tentative Timetable:

Week 1	• Introduction to the human microbiome and the holobiont theory of evolution • Discussion of topic specific articles
Week 2	• Introduction to metagenomics and next generation sequencing • Discussion of topic specific articles
Week 3	• Other microorganisms of the human microbiome • Discussion of topic specific articles
Week 4	• Colonization of the human body following birth • Discussion of topic specific articles • Students submit their presentation topic
Week 5	• The gut microbiome • Discussion of topic specific articles
Week 6	• Dysbiosis and the gut microbiome • Student presentations
Week 7	• Antibiotics and the human microbiome • Discussion of topic specific articles • Student presentations
Week 8	• **Midterm exam (topics of weeks 1-7) October 30th 2018**
Week 9	• Diet and the human microbiome • Discussion of topic specific articles • Student presentations
Week 10	• Probiotics, prebiotics and the human microbiome • Discussion of topic specific articles • Student presentations
Week 11	• Drug metabolism by the microbiome • Discussion of topic specific articles • Student presentations

Week 12	• Behavior and the microbiome (the gut brain axis) • Discussion of topic specific articles • Student presentations
Week 13	• The skin microbiome and Exchange between the human microbiome and the built environment • Discussion of topic specific articles • Student presentations
Week 14	• Comparative microbiomes form other animals • Student presentations

FINAL EXAM: TBA

Center for Disability Notice:
In order to receive disability-related academic accommodations students must first be registered with the Center for Student Disability Services. Students who have a documented disability or suspect they may have a disability are invited to set up an appointment with the Director of the Center for Student Disability Services, Ms. Valerie Stewart-Lovell at (718) 951-5538. If you have already registered with the Center for Student Disability Services, please provide your professor with the course accommodation form and discuss your specific accommodation with him/her.

University's policy on Academic Integrity:
The faculty and administration of Brooklyn College support an environment free from cheating and plagiarism. Each student is responsible for being aware of what constitutes cheating and plagiarism and for avoiding both. The complete text of the CUNY Academic Integrity Policy and the Brooklyn College procedure for policy implementation can be found at www.brooklyn.cuny.edu/bc/policies. If a faculty member suspects a violation of academic integrity and, upon investigation, confirms that violation, or if the student admits the violation, the faculty member MUST report the violation.

Important Dates to Include in Syllabi (Undergraduate Courses):
TBA