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Revised HLTH285: Microbiome in Health & Disease Syllabus

For the Fall 2015 semester I created a new course on the role of the human microbiome in physical and mental health (HLTH285: Microbiome in Health & Disease). When it came to the determinants of our individual microbiomes, we focused our discussion on nutrition. This included an assignment in which the students were required to keep a food log and find primary literature research to support the effect of a single food. We also discussed the microbiomes of environments from the New York subway (Afshinnekoo et al. 2015) to our mattress (Karvonen et al., 2012). However, through my participation in the Piedmont Project, I realized that the environmental determinants were covered in a much more general and less individually applicable manner than nutrition. Prior to the Piedmont Project, I had hoped to develop a 1 or 2-day case study or project emphasizing the impact of water treatment on the development of biofilms when I revised the course. However, the discussions in the Piedmont Project inspired me to develop a 4-day module and student project on the impact of the built environment instead. This broad view could include the influences of green spaces, pollution, air conditioning, and urbanization. An assignment requiring students to evaluate their personal built environment will emphasize the application of the information to their daily lives. Many of the students majoring in Human Health aspire to a career in Public Health, Business, or Law. Including a module on the built environment provides a more expansive view of how sustainability impacts health. Inclusion of a student-directed project provides an opportunity for students to follow their interests and identify potential areas of application in accordance with their individual career goals. Beyond the microbiome, the concept of the built environment's impact on health is applicable throughout our curriculum, although it is not usually addressed specifically. Introducing this link in this class would hopefully encourage students to consider the link between sustainability and the built environment throughout other courses.

Potential reading assignments:

Adar, S.D., Huffnagle, G.B., and Curtis, J.L. (2016). The respiratory microbiome: an underappreciated player in the human response to inhaled pollutants? *Ann Epidemiol* 26, 355-359.

Beck, I., Jochner, S., Gilles, S., McIntyre, M., Buters, J.T., Schmidt-Weber, C., Behrendt, H., Ring, J., Menzel, A., and Traidl-Hoffmann, C. (2013). High environmental ozone levels lead to enhanced allergenicity of birch pollen. *PLoS One* 8, e80147.

Hoisington, A.J., Brenner, L.A., Kinney, K.A., Postolache, T.T., and Lowry, C.A. (2015). The microbiome of the built environment and mental health. *Microbiome* 3, 60.

Kembel, S.W., Meadow, J.F., O'Connor, T.K., Mhuireach, G., Northcutt, D., Kline, J., Moriyama, M., Brown, G.Z., Bohannon, B.J., and Green, J.L. (2014). Architectural design drives the biogeography of indoor bacterial communities. *PLoS One* 9, e87093.

Lax, S., Nagler, C.R., and Gilbert, J.A. (2015). Our interface with the built environment: immunity and the indoor microbiota. *Trends Immunol* 36, 121-123.

Mahnert, A., Moissl-Eichinger, C., and Berg, G. (2015). Microbiome interplay: plants alter microbial abundance and diversity within the built environment. *Front Microbiol* 6, 887.

Meadow, J.F., Altrichter, A.E., Kembel, S.W., Kline, J., Mhuireach, G., Moriyama, M., Northcutt, D., O'Connor, T.K., Womack, A.M., Brown, G.Z., *et al.* (2014). Indoor airborne bacterial communities are influenced by ventilation, occupancy, and outdoor air source. *Indoor Air* 24, 41-48.

Mhuireach, G., Johnson, B.R., Altrichter, A.E., Ladau, J., Meadow, J.F., Pollard, K.S., and Green, J.L. (2016). Urban greenness influences airborne bacterial community composition. *Sci Total Environ.*

Obersteiner, A., Gilles, S., Frank, U., Beck, I., Haring, F., Ernst, D., Rothballer, M., Hartmann, A., Traidl-Hoffmann, C., and Schmid, M. (2016). Pollen-Associated Microbiome Correlates with Pollution Parameters and the Allergenicity of Pollen. *PLoS One* 11, e0149545.

Prussin, A.J., 2nd, and Marr, L.C. (2015). Sources of airborne microorganisms in the built environment. *Microbiome* 3, 78.

Ruiz-Calderon, J.F., Cavallin, H., Song, S.J., Novoselac, A., Pericchi, L.R., Hernandez, J.N., Rios, R., Branch, O.H., Pereira, H., Paulino, L.C., *et al.* (2016). Walls talk: Microbial biogeography of homes spanning urbanization. *Sci Adv* 2, e1501061.

Ruokolainen, L., von Hertzen, L., Fyhrquist, N., Laatikainen, T., Lehtomaki, J., Auvinen, P., Karvonen, A.M., Hyvarinen, A., Tillmann, V., Niemela, O., *et al.* (2015). Green areas around homes reduce atopic sensitization in children. *Allergy* 70, 195-202

HLTH285-000: Microbiome in Health and Disease Syllabus

Class Time and Location

Monday and Wednesday – 1:00-2:15p
Anthropology 107

Learning Objectives and Course Summary

- To compare and contrast components of the microbiome
- To explain potential mechanisms by which the microbiome influences healthy states and disease states
- To identify how choices in our daily lives impact our microbiome and ultimately our health
- To evaluate how components of the built environment impact our microbiome and ultimately our health
- To appraise the medical implications of an alteration the microbiome
- To propose evidence-based, preventative or therapeutic approaches to address the microbiome in disease states
- To interpret scientific findings presented in peer-reviewed primary and secondary literature
- To support arguments with scientific evidence

Microorganisms living in, or on, our body outnumber our human cells by an estimated ratio of 10 to 1. Sometimes considered “the forgotten organ”, this collection of bacteria, viruses, and single-cell eukaryotes is crucial for our health. We will examine the vital functions provided by the microbiome, as well as the conditions under which the microbiome is associated with disease. Areas of focus will include obesity, insulin resistance, inflammatory bowel disease, asthma, and more.

Instructor

Dr. Amanda Freeman
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Office: Candler Library Room 115
Office Hours: Wednesdays 2:30-4:00p, Thursday 11:30-1:00p, and other times by appointment

Blackboard (Bb)

The course will use a Blackboard site for communication, posting of assignments, and assignment submission. Please make sure to check this site regularly.

Assignment Overview

Specific formats and requirements for each assignment will be posted on Bb.

Reading assignments: Reading assignments will be announced on our Bb site at least one week in advance. It is your responsibility to check Bb for updates on readings and you are responsible for reading these assignments prior to class.

Reading quizzes and reading reflections: For each reading assignment there will be a multiple choice quiz or reading reflection which will be specified when the assignment is posted. Quizzes will be administered the first 10 minutes of class and no make-up quizzes will be given; therefore, prompt arrival is important. Reading reflection questions will be posted on Bb and must be submitted on Bb by 12:45pm on the date due. No late submissions will be accepted. You will be able to drop your lowest 4 grades on the 16 reading quizzes/reading reflections. (12 quizzes/reading reflections; 150 pts total)

Exams: During the semester there will be two mid-term exams. These exams may contain multiple choice, short answer, and/or essay questions. If take-home components are included in the exam, these are to be completed in accordance with the honor code and only using the specified resources. Make-up exams may be oral exams. At the end of the semester there will be a cumulative final exam. (3 exams; 150 pts each)

Personal microbiome projects: During the semester there will be two assignments that require you to reflect on how your behaviors and environment influence your own microbiome; one will focus specifically on diet and the other on the built environment. This will require keeping a log for several days and interpreting the data. Each project will require a written evaluation, supported by primary literature findings, of the factors you monitored. (2 projects; 150 pts each)

Class participation and discussion: This class does not have a traditional lecture format; it is designed around classroom discussion and debate. Your active participation is a crucial component of the course. You have a responsibility to question, reflect deeply on the course material, find new information, identify learning issues, and relate course content to previous beliefs, ideas and conceptions. You must learn to recognize the fallacies of an argument and to discern whether evidence presented in support of an idea is reliable, reasonable, and as unbiased as possible. You must learn to find evidence in support of opposing arguments and interpretations. Absences will have negative consequences for this component of your grade. (100 pts)

- All assignments must be posted to the "Assignment IN Box" on our Bb site, by 12:45pm on the date due. Any assignment received after this time will be considered late and will receive a 10% penalty on the final score for each 24-hour period that it is late. (*Note:* No late submissions of quizzes or reading reflections will be accepted.)
- References for assignments should be peer-reviewed primary or secondary literature unless otherwise specified.

Course Expectations

All members of the course are expected to active learners and participants and to actively engage in their own learning and to share the learning process with the class. Evidence of active learning includes:

- *Attending all weekly classes* which is critical to promoting a learning community within the class.
- *Reading all assigned materials prior to class* and making note of questions, areas of interest, and connections you find to other readings.
- *Active participation in classroom discussion*, allowing each student to test his or her own assumptions, as well as expand the worldview of others in the class. Even if there is a difference of opinion, this discourse must be conducted in an atmosphere that encourages everyone to contribute.

Absence Policy

Missing 25% or more of class meetings will result in automatic failure of a course. In other words, students absent seven (7) or more times will receive a grade of "F" for the course. Absences include trips, appointments, interviews, conferences, illness, injury, as well as simply not showing up. Religious observances, school business, and major illness will be considered; however, notify me by email in advance of any planned absences and submit your assignment prior to the event. After any absence, it is your responsibility to find out what material, assignments, or announcements you missed.

Class Grade

Reading quizzes/reading reflections	150
Exam I	150
Exam II	150
Final Exam	150
Personal Microbiome Project (Diet)	150
Personal Microbiome Project (Built environment)	150
Class participation	100
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Total points	1000

Letter grades will be assigned at the end of the course based on total score achieved based upon the following scale for letter grade assignments: A = 100-93%, A- = 92.99-90%, B+ = 89.99-87%, B = 86.99-83%, B- = 82.99-80%, C+ = 79.99-77%, C = 76.99-73%, C- = 72.99-70%, D+ = 69.99-67%, D = 66.99-60%, F = <60%.

Honor code

The Emory University honor code is in place throughout this course and you are explicitly responsible for taking care to present work that is your own; there is a no tolerance policy for plagiarism from any source, inclusive of internet sites, and the written and spoken work of others. If you do not understand what plagiarism is, please read the honor code carefully and seek assistance from the instructor.

Course schedule: Subject to Updates

Day 1	Course overview
Day 2	Introduction to the microbiome
Day 3	
<i>Labor day holiday</i>	
Day 4	Immune system overview
Day 5	
Day 6	
Day 7	Commensal Bacteria
Day 8	
Day 9	Exam I
Day 10	Studying the microbiome
Day 11	Dietary effects on the gut microbiome
Day 12	
<i>Fall Break</i>	
Day 13	Obesity, Gut health, and Fecal transplants
Day 14	
Day 15	
Day 16	Exam II
Day 17	Brain-gut axis
Day 18	
Day 19	Allergies and Asthma
Day 20	
Day 21	Influences of the built environment on the microbiome
Day 22	
Day 23	
Day 24	Medical implications of the environmental microbiome
<i>Thanksgiving Holiday</i>	
Day 25	Medical implications of the environmental microbiome
Day 26	Presentations - Evaluation of personal microbiome environments
Day 27	

Final Exam

