

## Welcome to *The Human Microbiome* BI 410/510

### About the Course

**Co-Instructor:** Brendan Bohannon

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**Class hours and room:** T/Th 2:00-3:50PM, Straub 251.

**Office Hours:** Brendan - Mondays 10 - 11AM and by appointment. Hannah - Wednesdays 10-11AM and by appointment.

**Prerequisites:** BI 212, 213 and 214; or BI 283H.

**Web Site:** Our web site is accessible via the UO Canvas server. Login requires your UO Information Services (Computing Center) email address and the corresponding password.

**How we will contact you:** All of our communication to you outside of class will take place via email. Specifically, we will use the email registered to you by the University of Oregon. If you use another ISP for your email, make sure you arrange to have your UO email forwarded to it, or arrange to change your registered email address with UO.

### Required readings and assignments:

We will be assigning reading from a variety of sources. By 5:00PM Friday, we will have posted the next week's

readings and writing assignment on the class website. Most of the readings will be available for download as pdf files. To read these you will need Adobe Acrobat Reader, free software that is installed on UO computers and can be downloaded from the following website:

<http://www.adobe.com/products/acrobat/readstep2.html>

There is a textbook available for this course: *Fundamentals of Microbiome Science: How Microbes Shape Animal Biology* by Angela Douglas (2018; Princeton University Press). We will be assigning background reading from this text. A copy of the text is available on reserve in the Science Library.

### About the Human Microbiome

It has long been recognized that there are microbes associated with the human body, both inside and out. Collectively, these microbes (and their genomes) are referred to as our *microbiome*. Research over the past 10 years has shown that our microbiomes are much more diverse, abundant, and important than previously recognized. Changes in our microbiomes have been associated with a number of health disorders, from inflammatory bowel disease to schizophrenia. Our microbiomes have been shown to influence a number of physiological functions, including our digestion, cellular development, and perhaps even our behavior.

Because of this new appreciation for the influence of our microbiomes on human health and wellbeing, there is great interest in managing and manipulating

the microbiome. The microbiome industry is one of the fastest growing areas of the biotechnology sector.

We will explore this recent research and its applications during our course.

## About the Instructors

Brendan Bohannon, Ph.D. joined the University of Oregon faculty in September of 2006, after 8 years on the faculty at Stanford University. His research group studies the community ecology of microorganisms (viruses, bacteria, archaea, and microeukarya), using a combination of laboratory microcosm experiments and field studies using molecular techniques. He is particularly fascinated with the diversity of microbial life and much of my research is focused on the causes and consequences of microbial biodiversity.

Hannah Tavalire, Ph.D. joined the Prevention Science Institute at the University of Oregon in 2017, after receiving her Ph.D. from Oregon State University. She is particularly interested in how host genetic and immune factors interact with environmental factors to determine the composition of the microbiomes of humans and other animals.

## Course Goals

We have two broad goals for this course.

**Provide you with the understanding necessary to critically evaluate the results of microbiome studies** — The field of microbiome science has exploded over the past 5 years. We will provide you with the perspective, basic understanding, and analytical tools necessary to critically evaluate the latest

research. The microbiome industry is also growing rapidly. Our goal is to encourage you to develop both a healthy skepticism about their claims, and excitement about opportunities in this new field.

**Help you continue your transition from student to *scholar*** —A scholar is someone who can think critically, argue logically, write clearly, and read effectively. Most importantly, a scholar understands how to organize and use knowledge, and takes responsibility for their own learning. Our goal is to provide you with opportunities to practice all of these skills.

## Strategy for Achieving these Goals

By now, 95% of your education has likely been structured around lectures. Lectures are good tools for downloading information. They require a particular dynamic. This dynamic, bluntly stated, is “professor professes, student writes it down.” Lectures, however, are pretty lousy ways to learn how to engage the literature and to learn how to read and think like a scientist. Instead, we will use the following tools to work on these skills.

**Readings and the case method**—We will use the case method to dissect the readings. Through this analysis, we get to know the material by working with it, not by memorizing it. Thus, for a typical class, you will be given a background reading, one or two readings from the scientific literature, plus some study questions. During the class period we will work our way through the readings in order to better understand the context of the research, its major findings, its flaws and strengths. We may do in-class

exercises that will help us explore the ideas in the readings. These exercises may take the form of debates, small group discussion of a scientific question, a computer simulation or other exercise.

**Essay Paragraphs** — Each week, you will be asked to write a short essay on a study question or questions key to understanding that week's topic. These essays are an opportunity to get some feedback on your writing and to engage with the material.

**Group Presentation** — You will be assigned to a group of 3 - 4 students, and together you will create a 10-minute presentation focused on the microbiome of a particular body site. Each presentation will include information on the following:

- General microbiome composition at the site.
- Aspects of the physical and chemical environment at the site that could influence composition.
- Role of the microbiome at the site in health.
- Diseases associated with dysbiosis at this site.

Additionally, students will be asked to provide critical feedback to a subset of the other groups as part of the credit for this assignment.

**Take-home exam** — You will receive a take-home essay style midterm exam that will cover all in-class material and assigned readings up to that point. You will have one week to complete the exam.

**Microbiome Analysis** — You will have the opportunity to sequence your own gut microbiome through a commercial vendor (uBiome). This is a completely

voluntary aspect of the course and will not affect your grade. If you choose to sequence your personal microbiome, you will use these data for your microbiome analysis assignment. If you decline to participate, we will provide a sample dataset for you to use for the assignment without penalty.

Each student will use the results of their analysis to write a 1-2 page report. The report will include answers to the following questions:

- How do the results of your analysis compare to that provided by uBiome? In what ways are your results similar and in what ways different? Why might they be different?
- How does your interpretation of the results compare to that provided by uBiome? Why might they be different?
- Choose one of the 'unique bacteria' in your dataset. What is its role in health and/or disease? Please use sources from peer-reviewed primary literature or review articles to answer this, and remember to properly cite any sources.

**Grading** — Your final grade will depend on your performance on the weekly essay questions (15%), the midterm (30%), the group presentation (20%), and the microbiome analysis assignment (35%). In-class participation is very important in a discussion-centered course such as this one. You will not be graded down if you choose not to participate, but we may increase your grade by up to half a grade for exemplary participation.

## Tentative course schedule

The topics on the tentative outline below are subject to change. The time schedule is just a guess -- we will take as long as needed on each subject.

| Week | Dates                      | Topic  |
|------|----------------------------|--|
| 1    | January 8<br>January 10    | Overview of course. What is a microbiome?<br>What is a host? Introduction to microbiome methods. |
| 2    | January 15<br>January 17   | Community ecology of microbiomes.<br>Introduction to microbiology of the gut.                    |
| 3    | January 22<br>January 24   | The role of host immunity in the gut.<br>The role of the gut chemical and physical environment.  |
| 4    | January 29<br>January 31   | How host genetics shapes the gut microbiome.<br>Environmental sources of microbiota.             |
| 5    | February 5<br>February 7   | Microbiome in human health & disease.<br>Microbiome & behavior: The brain-gut axis.              |
| 6    | February 12<br>February 14 | Student group presentations.<br>Student group presentations.                                     |
| 7    | February 19<br>February 21 | Microbiome analysis I: overview.<br>Microbiome analysis II: statistical approaches.              |
| 8    | February 26<br>February 28 | The use of animal models.<br>Guest speakers.   |
| 9    | March 5<br>March 7         | Ethical aspects of microbiome research.<br>Microbiome interventions and other applications.      |
| 10   | March 12<br>March 14       | Assigning causation in microbiome research.<br>Longitudinal studies and the 'core microbiome.'   |

## General UO Course Information

### Class Courtesy

Please arrive in class on time. Late arrivals distract the instructor and the other students. Please turn off cell phones during the class meeting times. Use your laptop only for class activities. Do not leave class early unless you have cleared it with the instructor in advance. Ask questions if you did not hear or understand something.

Class rosters are provided to the instructor with the student's legal name. We will gladly honor your request to address you by an alternate name or gender pronoun. Please advise us of this preference early in the quarter (or before) so that we may address you properly.

Open inquiry, freedom of expression, and respect for difference are fundamental to a comprehensive and dynamic education. We are committed to upholding these ideals by encouraging the exploration, engagement, and expression of divergent perspectives and diverse identities. Classroom courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Our classroom is a learning environment, and as such should be a safe, inclusive and respectful place. Being respectful also includes using preferred pronouns for your classmates. Disrespecting fellow students as well as combative approaches, tones and/or actions are not acceptable. Please make us aware if there are classroom dynamics that impede your (or someone else's) full engagement.

### Academic integrity

All students will be expected to adhere to the University's guidelines on academic integrity as outlined in the Student Conduct Code: <https://policies.uoregon.edu/vol-3-administration-student-affairs/ch-1-conduct/student-conduct-code>. As detailed in the policy, academic misconduct means the violation of university policy involving academic integrity. This includes cheating ("any act of deception by which a student misrepresents or misleadingly demonstrates that the student has mastered information on an academic exercise that the student has not mastered"), and plagiarism ("using the ideas or writings of another as one's own.") The instructors have a zero tolerance policy for academic dishonesty. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures.

### Discrimination and Harassment

#### *Prohibited Discrimination and Harassment*

Any student who has experienced sexual assault, relationship violence, sex or gender-based bullying, stalking, and/or sexual harassment may seek resources and help at [safe.uoregon.edu](http://safe.uoregon.edu). To get help by phone, a student can also call either the UO's 24-hour hotline at 541-346-7244 [SAFE], or the non-confidential Title IX Coordinator at

541-346-8136. From the SAFE website, students may also connect to Callisto, a confidential, third-party reporting site that is not a part of the university.

Students experiencing any other form of prohibited discrimination or harassment can find information at [respect.uoregon.edu](http://respect.uoregon.edu) or [aaeo.uoregon.edu](http://aaeo.uoregon.edu) or contact the non-confidential AAEO office at 541-346-3123 or the Dean of Students Office at 541-346-3216 for help. As UO policy has different reporting requirements based on the nature of the reported harassment or discrimination, additional information about reporting requirements for discrimination or harassment unrelated to sexual assault, relationship violence, sex or gender based bullying, stalking, and/or sexual harassment is available at [Discrimination & Harassment](#).

#### Accessible education statement of support

The University of Oregon is working to create inclusive learning environments. Please notify me if there are aspects of the instruction or design of this course that result in disability-related barriers to your participation. You are also encouraged to contact the Accessible Education Center in 360 Oregon Hall at 541-346-1155 or [uoaec@uoregon.edu](mailto:uoaec@uoregon.edu).

#### Campus resources to support your learning

*Tutoring and Academic Engagement Center* (<https://engage.uoregon.edu/services/>) Drop-in math and writing support in addition to tutoring, study skills support, and Class Encore. Located in the 4<sup>th</sup> Floor Knight Library (541) 346-3226, [engage@uoregon.edu](mailto:engage@uoregon.edu).

*Counseling Center* Call anytime to speak with a therapist who can provide support and connect you with resources. Located on the 2<sup>nd</sup> Floor of the Health Center(541)346-3227

*Accessible Education Center* The University of Oregon is working to create inclusive learning environments. The instructor believes strongly in creating inclusive learning environments. If there are aspects of the instruction or design of this course that result in barriers to your participation, please notify us as soon as possible. You are also encouraged to contact the Accessible Education Center. If you are not a student with a documented disability, but you would like for us to know about class issues that will impact your ability to learn, we encourage you to come visit during office hours so that we can strategize how you can get the most out of this course. Located on the 1<sup>st</sup> Floor of Oregon Hall (541) 346-1155, [uoaec@uoregon.edu](mailto:uoaec@uoregon.edu)

*Center for Multicultural Academic Excellence (CMAE)* mission is to promote student retention and persistence for historically underrepresented and underserved populations. We develop and implement programs and services that support retention,

academic excellence, and success at the UO and beyond. We reaffirm our commitment to all students, including undocumented and tuition equity students. Located on the 1<sup>st</sup> Floor of Oregon Hall (541) 346-3479, [cmae@uoregon.edu](mailto:cmae@uoregon.edu)

The *UO Access Shuttle* is an on-campus ride service provided at no cost to students with conditions that limit mobility. More information and a sign-up form can be found on the parking & transportation department website: <https://parking.uoregon.edu/content/access-shuttle>.

### Reporting

The instructors of this class are Student-Directed Employees. As such, **if you disclose to us, we will respond to you with respect and kindness. We will listen to you, and will be sensitive to your needs and desires. We will not judge you. We will support you.** As part of that support, we will direct students who disclose sexual harassment or sexual violence to resources that can help. **We will only report the information shared to the university administration when you as the student requests that the information be reported** (unless someone is in imminent risk of serious harm or is a minor). Please note the difference between ‘privacy’ and ‘confidentiality.’ As Student-Directed Employees we can offer privacy because we are not required to report certain information to the university. However, we cannot be bound by confidentiality in the same way that a counselor or attorney is. The sharing of information by confidential resources such as these is protected by federal and state laws. Any information that we as student-directed employees receive may still be accessed by university or court proceedings. This means, for example, that we could still be called as a witness or required to turn over any related documents or notes that we keep.

Please note also that we are required to report all other forms of prohibited discrimination or harassment to the university administration. Specific details about confidentiality of information and reporting obligations of employees can be found at [titleix.uoregon.edu](http://titleix.uoregon.edu).

### *Mandatory Reporting of Child Abuse*

UO employees, including faculty, staff, and GEs, are mandatory reporters of child abuse. Child abuse pertains to individuals who are under the age of 18. This statement is to advise you that your disclosure of information about child abuse to the instructor may trigger my duty to report that information to the designated authorities. Please refer to the following links for detailed information about mandatory reporting: [Mandatory Reporting of Child Abuse and Neglect](#).

## Safe Ride

541-346-7433 ext 2

[pages.uoregon.edu/saferide](http://pages.uoregon.edu/saferide)

Safe Ride is an **assault prevention shuttle** that works to provide free, inclusive, and accessible alternatives to traveling alone at night for **UO students, faculty, and staff**.

We are a schedule-ahead service and riders can (1) call once we open to schedule a ride with a dispatcher or (2) leave a voicemail on the day of their ride request. We do not call riders ahead of time to confirm due to capacity constraints, but riders are always welcome to call us to double-check that their ride was scheduled. We are a feminist, 'for-the-students/by-the-students' organization and operate out of the Women's Center in EMU 12F.

Operating hours:

**Spring term**            Sunday - Thursday | 7p - midnight

Friday + Saturday | 7p - 2a

**Summer term**        Sunday - Thursday | 9p - midnight

Friday + Saturday | 9p - 2a

**Fall/Winter term**    Sunday - Thursday | 6p - midnight

Friday + Saturday | 6p - 2a

Policy and rules:

1. We are a **schedule-ahead service**, we **do not call ahead**, and we can only wait for riders for 5 minutes at their pick-up time and location.
2. We only give rides to groups of **3 or fewer** to prioritize groups that are at higher risk.
3. We are a **free service** and do not accept tips.