

# ENVH 409/509 Microbiome And Environmental Health

Spring 2024

## CONTACT INFORMATION

**Instructors:** Roger Bumgarner, Associate Professor, Department of Microbiology  
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**Office hours:** By appointment over Zoom, arranged via email

## Teaching Assistants

N/A

## Course times and locations

**Lecture:** T/Th, 2:30-3:50, HSEB building room 101

## LAND ACKNOWLEDGEMENT

The University of Washington acknowledges the Coast Salish people of this land, the land which touches the shared waters of all tribes and bands within the Duwamish, Suquamish, Tulalip and Muckleshoot nations.

## Respiratory Illness - Protocols and Safety

If you feel ill or exhibit respiratory or other symptoms, you should not come to class. Seek medical attention if necessary and notify your instructor(s) as soon as possible by email. [UW Environmental Health & Safety](#) recommends that you wear a well fitting mask while you are symptomatic

Additional recommendations include getting your [annual flu shot](#) and getting boosted with the updated COVID vaccines (available [at clinics and pharmacies, as well as through UW Medicine](#) and local health agencies).

Please check your email and CANVAS announcements daily BEFORE coming to class. If we need to conduct class remotely because the instructor or a guest speaker is unable to attend in person, we will send all registered students an email and/or post a CANVAS announcement with a Zoom link for remote instruction or a plan for making up the class.

## COURSE DESCRIPTION

This course will present and review the current science behind understanding microbiome impacts on environmental public health. The course will define human, animal, and environmental microbiomes; describe the methods used to characterize these microbiomes, and discuss the impact of microbiomes on the health and well-being of human and animal populations. The course will also examine factors that have been suggested to modulate microbial populations, host-microbe interactions, and the dynamics of microbiome populations. This course will be of use to public health and health care professionals, microbiologists, civil and environmental engineers, environmental scientists, and those generally interested in understanding the health relevance of news reports on the microbiome.

## COURSE LEARNING OBJECTIVES

After completing this course, both undergraduate (409) and graduate (509) students will be able to will be able to:

- Recognize and differentiate the composition of human and environmental microbiomes;
- Discuss potential interactions between microbiomes;
- Describe the role of sampling in microbiome studies;
- Compare and contrast DNA/RNA sequencing approaches to characterize a microbiome;
- Discuss bioinformatics approaches to characterizing microbiome and metagenome sequence data;
- Explain the importance of metadata associated with a published microbiome;
- Recognize and list functional roles of microbiome in a state of good health and well-being for humans;
- Outline host-microbiome interactions and functional roles that impact health;
- Identify and characterize specific disease states (chronic, environmental, and infectious disease) associated with microbiome composition or function;
- Evaluate the weight of evidence to support connections between microbiome and health;
- Identify and categorize intrinsic and extrinsic factors that modulate a microbiome;
- Diagram the relationships between host, microbiome, and environmental factors.

In addition, graduate students (509) will be able to:

- Critically assess and evaluate the literature on a topic of interest relevant to the course.

- Synthesize the available research on a microbiome-related topic and develop a comprehensive review for a scientifically literate audience.

## COUNCIL FOR EDUCATION OF PUBLIC HEALTH (CEPH) COMPETENCIES

N/A

## REQUIRED TEXTBOOKS & READINGS

There is no required text book. Readings and course materials will be drawn from current research and new materials. All readings will be made available through the Canvas course site or handed out in class.

## GRADING

Points will be available according to the following percentage breakdown:

| Grading category                  | ENVH 409 | ENVH 509 |
|-----------------------------------|----------|----------|
| Reading and lecture comprehension | 20%      | 0%       |
| Quizzes                           | 70%      | 60%      |
| Class participation               | 10%      | 10%      |
| Critical review                   | N/A      | 30%      |
| Total                             | 100%     | 100%     |

Reading and lecture comprehension: This score will be comprised of grades on from a weekly assignment in which students are required to submit a multiple choice question that is based on the readings or lectures for that week.

There will be 5 bi-weekly quizzes consisting of ~ 5 questions/lecture.

Class participation is measured via PollEverywhere questions during lecture and class activities/discussions posted on Canvas.

Students registered for 509 will have the opportunity to complete an in-depth (but focused), critical review of the literature on a specific topic relevant to the course.

- Topics must be approved by the instructors.
- The review will consist of a 10-page (single spaced, 10 pt Ariel font, 1/2 inch margins) manuscript on the chosen topic. Critical Reviews should show synthesis and evaluation of the peer reviewed literature.

- Manuscripts must be formatted consistent with the Applied and Environmental Microbiology instructions for authors for a minireview (<http://aem.asm.org/site/misc/ifora.xhtml>).

**GRADING SCALE:** Numerical grades will typically be distributed according to the following scale:

| %   | GP  | %   | GP  | %   | GP  |
|-----|-----|-----|-----|-----|-----|
| 96% | 4   | 86% | 3   | 76% | 2   |
| 95% | 3.9 | 85% | 2.9 | 75% | 1.9 |
| 94% | 3.8 | 84% | 2.8 | 74% | 1.8 |
| 93% | 3.7 | 83% | 2.7 | 73% | 1.7 |
| 92% | 3.6 | 82% | 2.6 | 72% | 1.6 |
| 91% | 3.5 | 81% | 2.5 | 71% | 1.5 |
| 90% | 3.4 | 80% | 2.4 | 70% | 1.4 |
| 89% | 3.3 | 79% | 2.3 | 69% | 1.3 |
| 88% | 3.2 | 78% | 2.2 | 68% | 1.2 |
| 87% | 3.1 | 77% | 2.1 | 67% | 1.1 |
|     |     |     |     | 66% | 1   |

It is expected that most students will perform at a level of ~3.5.

### **Grading Criteria**

#### **Late assignment policy**

Late assignments are accepted but may be penalized 10% for each day late. Late penalties can be waived due to illness or at the discretion of the instructors.

### **Student responsibilities:**

1. Come to class, please try to let us know ahead of time if you cannot make it.
2. Arrive on time.
3. Turn in assignments on time.
4. Come to class prepared (keep up with reading).
5. Be courteous (no newspapers, no audible personal electronic devices).
6. Food and drinks are welcome (but keep it quiet).
7. Refrain from unnecessary talking.
8. ASK QUESTIONS.
9. Try to remain awake (at least no snoring please).
10. Let us know how I am doing. If we are moving too fast, not being clear, or otherwise not getting the message across, we need to know.

## COURSE SESSION SCHEDULE (SUBJECT TO REVISION)

Include dates of class meetings and corresponding topics, preparatory work, instructor (if multiple for class), due dates, etc.

| Date   | Topic  | Instructor            |
|--|--|-----------------------|
| <b>Module 1: Introduction What is a microbiome?</b>                  |  |                       |
| Tue. 3/26  | Introduction to the course and the concept of a microbiome                         | Bumgarner/Fuhrmeister |
| <b>Module 2: How to characterize a microbiome</b>                    |  |                       |
| Thur. 3/28   | PCR and DNA sequencing technology  | Bumgarner             |
| Tues. 4/2  | Sequencing targets and transcriptomes  | Bumgarner             |
| Thur. 4/4  | Study design, sampling and sample processing                                       | Bumgarner             |
| <i>Mon. 4/8 – Quiz #1 covering lectures 1-4</i>                      |  |                       |
| Tues. 4/9  | 16S and downstream analysis methods  | Fuhrmeister           |
| Thur. 4/11   | Interpreting shotgun metagenomics data   | Fuhrmeister           |
| <b>Module 3: Environmental microbiomes</b>                           |  |                       |
| Tues. 4/16   | Microbiomes and the built environment  | Fuhrmeister           |
| Thur. 4/18   | Microbiomes and Wastewater treatment   | Cotto                 |
| <i>Mon. 4/22 – Quiz #2 covering lectures 5-8</i>                     |  |                       |
| Tues. 4/23   | Microbes in the environment and remediation of pollutants that are toxic to humans | Bumgarner             |
| Thur. 4/25   | One Health and the human microbiome  | Fuhrmeister           |
| <b>Module 4: The human microbiome and its impact on human health</b> |  |                       |
| Tues. 4/30   | Establishment, changes and stability of the human microbiome                       | Bumgarner             |
| Thur. 5/2  | The gut microbiome and enteric disease   | Levy                  |
| <i>Mon. 5/6 – Quiz #3 covering lectures 9-12</i>                     |  |                       |
| Tues. 5/7  | Diet, nutrition, and the gut microbiome  | Lampe                 |
| Thur. 5/9  | The oral microbiome  | McLean                |
| Tues 5/14  | The skin microbiome  | Bumgarner             |
| Thurs 5/16   | The vaginal microbiome   | Fredricks             |
| <i>Mon. 5/20 – Quiz #4 covering lectures 13-16</i>                   |  |                       |
| Tues. 5/21   | Bugs and Brains – impact of the microbiome on                                      | TBD                   |
| <b>Module 5: What factors modulate the microbiome?</b>               |  |                       |
| Thur. 5/23   | Host factors and genetics  | Fuhrmeister           |
| Tues 5/28  | Impacts of global environmental change   | Cangelosi             |
| Thur. 5/30   | Approaches to modifying human microbiomes  | Bumgarner             |
| <i>Mon. 6/3 - Quiz #5 Covering lectures 17-20</i>                    |  |                       |
| <i>Wed. 6/5 – 509 students – review paper is due</i>                 |  |                       |

## Communication Skills

Communication through writing and speaking is an important transferable skill for all career pathways. Establishing a strong foundation in communication skills will help you be successful throughout your future course work and career. Therefore, this course includes assignments with the goal to help you identify areas of strength and improvement in your communication. If you feel that you could benefit from additional opportunities to improve your writing skills in particular, a list of resources at the UW and others accessible online can be found on the SPH website

at <https://sph.washington.edu/sites/default/files/inline-files/Writing-Resources-4.3.19.pdf>.

## IMPORTANT POLICIES & RESOURCES

### Academic Integrity

Students at the University of Washington (UW) are expected to maintain the highest standards of academic conduct, professional honesty, and personal integrity.

The UW School of Public Health (SPH) is committed to upholding standards of academic integrity consistent with the academic and professional communities of which it is a part. Plagiarism, cheating, and other misconduct are serious violations of the University of Washington [Student Conduct Code \(WAC 478-121\)](#). We expect you to know and follow the university's policies on cheating and plagiarism, and the [SPH Academic Integrity Policy](#). Any suspected cases of academic misconduct will be handled according to University of Washington regulations. For more information, see the University of Washington [Community Standards and Student Conduct](#).

Artificial Intelligence (AI) content generators, such as ChatGPT, present opportunities that can contribute to your learning and academic work. However, using these technologies may also violate academic standards of the University. Under the Student Conduct Code, cheating includes the unauthorized use of assistance, including technology, in completing assignments or exams. Students must obtain permission from the instructor before using AI tools or other artificial intelligence tools to complete assignments. Once permission is granted, AI may only be used as directed. Assignment submissions may be checked for possible AI use using AI detectors.

Where you have obtained permission to use generative AI tools for an assignment in this class, you are required to do the following. These activities are meant to a) encourage your development of appropriate attribution skills, b) reflect upon how generative AI is contributing to or harming your learning, and c) protect you in the event of an Academic Misconduct investigation.

1. Use track changes to demonstrate how much of the written product was written by generative AI, and how much was written by you.
2. Maintain a history within the AI tool of your prompts and outputs (for example the chat history in ChatGPT).
3. Provide a written statement including the following:

- a. Describe how you used generative AI in the assignment or project.
- b. Describe how you verified outputs were correct or true.
- c. Provide a reflection on how using generative AI tools befitted you or potentially harmed the learning goals of the assignment.
- d. Attest that you did not put any protected data into an AI tool during your completion of the assignment; including copyrighted materials, the intellectual property of others (including papers written by others, or the text of your instructor's assignment instructions), research or study data, interview transcripts, or personal information of others.

### **Access and Accommodations**

Your experience in this class is important to me. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law. If you have already established accommodations with Disability Resources for Students (DRS), please activate your accommodations via myDRS so we can discuss how they will be implemented in this course.

If you have not yet established services through DRS, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), contact DRS directly to set up an Access Plan. DRS facilitates the interactive process that establishes reasonable accommodations. Contact DRS at [disability.uw.edu](https://disability.uw.edu).

### **Religious Accommodations**

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at [Religious Accommodations Policy \(https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/\)](https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/). Accommodations must be requested within the first two weeks of this course using the [Religious Accommodations Request form \(https://registrar.washington.edu/students/religious-accommodations-request/\)](https://registrar.washington.edu/students/religious-accommodations-request/).

### **Inclusion & Diversity**

Diverse backgrounds, embodiments and experiences are essential to the critical thinking endeavor at the heart of University education. In SPH, we are expected:

1. To respect individual differences, which may include, but are not limited to, age, cultural background, disability, ethnicity, family status, gender, immigration status, national origin, race, religion, sex, sexual orientation, socioeconomic status and veteran status.
2. To engage respectfully in the discussion of diverse worldviews and ideologies embedded in course readings, presentations and artifacts, including those course materials that are at odds with personal beliefs and values.



3. To encourage students with concerns about classroom climate to talk to their instructor, adviser, a member of the departmental or SPH EDI Committee, the Assistant Dean for EDI, or the program's director.

## Classroom Climate

We are co-creators of our learning environment. It is our collective responsibility to develop a supportive learning environment for everyone. Listening with respect and an open mind, striving to understand others' views, and articulating your own point of view will help foster the creation of this environment. We engage our differences with the intent to build community, not to put down the other and distance our self from the other. Being mindful to not monopolize discussion and/or interrupt others will also help foster a dialogic environment.

### The following guidelines can add to the richness of our discussion:

- We assume that persons are always doing the best that they can, including the persons in this learning environment.
- We acknowledge that systematic oppression exists based on privileged positions and specific to race, gender, class, religion, sexual orientation, and other social variables and identities.
- We posit that assigning blame to persons in socially marginal positions is counter-productive to our practice. We can learn much about the dominant culture by looking at how it constructs the lives of those on its social margins.
- While we may question or take issue with another class member's ideology, we will not demean, devalue, or attempt to humiliate another person based on her/his experiences, value system, or construction of meaning.
- We have a professional obligation to actively challenge myths and stereotypes about our own groups and other groups so we can break down the walls that prohibit group cooperation and growth.

[Adapted from Lynn Weber Cannon (1990). Fostering positive race, class and gender dynamics in the classroom. *Women Studies Quarterly*, 1 & 2, 126-134.]

We are a learning community. As such, we are expected to engage with difference. Part of functioning as a learning community is to engage in dialogue in respectful ways that supports learning for all of us and that holds us accountable to each other. Our learning community asks us to trust and take risks in being vulnerable.

### Here are some guidelines that we try to use in our learning process:

- LISTEN WELL and be present to each member of our group and class.
- Assume that I might miss things others see and see things others miss.
- Raise my views in such a way that I encourage others to raise theirs.
- Inquire into others' views while inviting them to inquire into mine.
- Extend the same listening to others I would wish them to extend to me.
- Surface my feelings in such a way that I make it easier for others to surface theirs.
- Regard my views as a perspective onto the world, not the world itself.
- Beware of either-or thinking.
- Beware of my assumptions of others and their motivations.
- Test my assumptions about how and why people say or do things.
- Be authentic in my engagement with all members of our class.

## Pronouns

We share our pronouns because we strive to cultivate an inclusive environment where people of all genders feel safe and respected. We cannot assume we know someone's gender just by looking at them. So we invite everyone to share their pronouns.

## Bias Concerns

The Office of the Dean has a [student concern policy](#), a faculty concern policy and standard HR procedures for staff concerns. Our 2018 climate survey states that most people in SPH do not report bias incidents because they do not know where to go. Students are encouraged to report any incidents of bias to someone they feel comfortable with, including instructors, advisers or department staff. They can email [dcinfo@uw.edu](mailto:dcinfo@uw.edu) for immediate follow up. Bias concerns can be anonymously and confidentially reported via the online form found here:

<https://sph.washington.edu/about/diversity/bias-concerns>. Data is collected by the Assistant Dean for EDI and the Director of Program Operations for Student and Academic Services and tracked for resolution and areas are identified for further training.

## Sexual Harassment

Sexual harassment is a form of harassment based on the recipient's sex that is characterized by:

1. Unwelcome sexual advances, requests for sexual favors, or other verbal or physical conduct of a sexual nature by a person who has authority over the recipient when:
  - o Submission to such conduct is an implicit or explicit condition of the individual's employment, academic status, or ability to use University facilities and services, or
  - o Submission to or rejection of the conduct affects tangible aspects of the individual's employment, academic status, or use of University facilities.
2. Unwelcome and unsolicited language or conduct that creates an intimidating, hostile, or offensive working or learning environment, or has the purpose or effect of unreasonably interfering with an individual's academic or work performance.

If you believe that you are being harassed, or have observed harassment, you can report it to SPH using the [bias concerns link](#). The University also has designated offices to help you: [SafeCampus](#); [Office of the Ombud](#); [Title IX Investigation Office](#); and [University Complaint Investigation and Resolution Office](#).