**ENV H 444/544: Antimicrobial Resistance Impact on the Environment and Public Health**

Quarter: Fall 2024

Credits & Grading: 4 credits, graded

Time: M/W, 11:30-12:50 PM

Location: HSEB 245

**Instructor(s) & Teaching Assistant(s):**

**INSTRUCTOR**: Erica Fuhrmeister, PhD

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Office Hours: By appointment

**TEACHING ASSISTANT:** Rica Monis

Email: rmpmonis@uw.edu

Office Hours: By appointment

**Course Description**

Explores how the global emergence of antimicrobial resistance has profound consequences on the health of humans, animals, and the environment. Students learn about factors contributing to antimicrobial resistance around the world, mechanisms of resistance, risk communication, as well as mitigation strategies.

**Course Learning Outcomes**

*Upon completing the course, both undergraduate (444) and graduate (544) students will be able to:*

1. Explain what antibiotic resistance genes (ARGs) and antibiotic resistant bacteria (ARB) are and the origins of ARGs (the resistome).
2. Describe the various mechanisms for resistance and important classes of resistance genes.
3. Compare and analyze diverse viewpoints on controversial issues related to sources of ARGs/ARBs in relationship to humans, animals, and the environment (One Health).
4. Summarize how several different human practices influence the evolution/ecology of ARGs/ARBs.
5. Explain how the evolution of resistance differs between developed and developing countries, how the two are interconnected, and how ARGs/ARB are transmitted around the world.
6. Discuss the role that agriculture, aquaculture, food animals and food play in the transmission of ARGs/ARB and give specific examples to illustrate this.
7. Describe how various modes of horizontal gene transfer occur and compare/contrast how they impact the evolution of ARGs/ARB.
8. Communicate effectively with both scientific and non-scientific audiences about the topic of ARGs/ARB using risk communication.
9. Describe the role that sub-therapeutic use of antibiotics for “growth promotion” in agriculture plays in contaminating environments, municipal wastewaters, receiving water streams, recreational waters, etc.

*In addition to the learning objectives above, graduate (544) students will be able to:*

1. Critically evaluate papers in the scientific literature and identify strengths and weaknesses of the science presented.
2. Develop and compose a literature review on a topic related to ARGs/ARB.

**Accreditation Requirements & Degree Competencies Met by This Course**

NA

**Required Textbook and Readings**

There is no required textbook.  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.

In addition, the following general readings for the course will provide good background knowledge on the topics we will be discussing:

* Antibiotic Resistant Threats in the United States, CDC 2019 [Link](https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf)
* National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS): Human Isolates Surveillance Report for 2015 [Link](https://www.cdc.gov/narms/pdf/2015-NARMS-Annual-Report-cleared_508.pdf)
* Global antimicrobial resistance surveillance system (GLASS) report: early implementation 2020 [Link](https://apps.who.int/iris/bitstream/handle/10665/332081/9789240005587-eng.pdf?ua=1)

**Grading & Assessment**

Points will be available according to the following percentage breakdown:

|  |  |  |
| --- | --- | --- |
| **Grading category** | **ENVH 444** | **ENVH 544** |
| Reading Questions | 20.00% | NA |
| Quizzes | 40.00% | 40.00% |
| Class participation | 10.00% | 10.00% |
| Oral Presentation | 20.00% | 20.00% |
| Risk Communication | 10.00% | 10.00% |
| Research paper | NA | 20.00% |
| Total | 100% | 100% |

* Reading Questions: Reading and viewing assignments for each class session will be available through the course website. These will include readings, such as scientific articles, reports and articles from the popular press, as well as documentary videos. Students are expected to read/view the materials, then respond to questions on the reading assignments.
* Quizzes: Three quizzes will be given throughout the course of the semester covering reading and lecture materials.
* Class Participation: Answers questions in class for active learning exercises and general questions during class.
* Oral Presentations: Each student will give a 10-minute presentation on a topic related to AMR
* Risk Communication Exercise: 4 times throughout the quarter students will pick an AMR real-world event (from the last 5 years) and can pick to either write a 1-page risk communication plan or create a risk communication brochure. Students can work in groups of 2 but cannot have the same partner more than once. Components of the risk communication plan or brochure include identifying key stakeholders, identifying the target audience of the risk communication plan or brochure, hazard identification with at least 4 references, steps to take to mitigate risk, and a core communication message.
* Research Paper: Graduate students will write a literature review paper on a topic related to AMR. The paper should be double-spaced, paginated, and 6-10 pages long, not including references. A minimum of 10 references must be included, up to two can be reputable websites (e.g., CDC, WHO, US State Department, etc.). The remaining works referenced should be from relevant, peer- reviewed scientific journals. Paper topics must be submitted to the instructor for preapproval.

**Late Assignment Policy**

Late assignments will be penalized 10% for each day late. Late penalties can be waived at the discretion of the instructors.

**Excused Absence from Class**

Students are expected to attend class and to participate in all graded activities, including midterms and final examinations. A student who is anticipating being absent from class due to a Religious Accommodation activity needs to complete the Religious Accommodations request process by the second Friday of the quarter. Students who anticipate missing class due to attendance at academic conferences or field trips, or participation in university sponsored activities should provide a written notice to the instructor ahead of the absence. The instructor will determine if the graded activity or exam can be rescheduled or if there is equivalent work that can be done, as determined by the instructor.

**Student Responsibilities**

1. Come to class.
2. Arrive on time.
3. Turn in assignments on time.
4. Come to class prepared.
5. Be courteous and respectful to others.
6. Ask questions.
7. Let me know how I am doing. If we are moving too fast, not being clear, or otherwise not getting the message across, let me know.

**Session-by-Session Schedule (Subject to Revision)**

|  |  |  |
| --- | --- | --- |
|  | **Date** | **Topic** |
| Week 1 | Wed 9/25 | Introduction |
| Week 2 | Mon 9/30 | What is antimicrobial resistance |
|  | Wed 10/2 | History of AMR |
| Week 3 | Mon 10/7 | Antibiotic classes & mechanisms of resistance |
|  | Wed 10/9 | Antibiotic classes & mechanisms of resistance |
| Week 4 | Mon 10/14 | Antivirals |
|  | Wed 10/16 | Antihelminth, antifungal |
| Week 5 | Mon 10/21 | Quiz 1 |
|  | Wed 10/23 | Methods-culture |
| Week 6 | Mon 10/28 | Methods-molecular |
|  | Wed 10/30 | AMR and public communication |
| Week 7 | Mon 11/4 | AMR and one health |
|  | Wed 11/6 | Antibiotics and agriculture |
| Week 8 | Mon 11/11 | Veterans day no class |
|  | Wed 11/13 | AMR in lower middle-income settings |
| Week 9 | Mon 11/18 | AMR in high-income settings |
|  | Wed 11/20 | AMR & engineered systems |
| Week 10 | Mon 11/25 | AMR policy |
|  | Wed 11/27 | No class |
| Week 11 | Mon 12/2 | AMR mitigation/health treatment |
|  | Wed 12/4 | Quiz 3 |

**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](https://wellbeing.uw.edu/flu-vaccination/) and getting boosted with the updated COVID vaccines (available [at clinics and pharmacies, as well as through UW Medicine](https://www.washington.edu/coronavirus/vaccines/) 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.

**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/>). 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/>).

**Access & 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://depts.washington.edu/uwdrs/).

**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](https://www.washington.edu/studentconduct/) (WAC 478-120). We expect you to know and follow the university's policies on cheating and plagiarism, and [the SPH Academic Integrity Policy](https://sph.washington.edu/students/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 website.

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:
	1. Describe how you used generative AI in the assignment or project.
	2. Describe how you verified outputs were correct or true.
	3. Provide a reflection on how using generative AI tools befitted you or potentially harmed the learning goals of the assignment.
	4. 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.

**Writing Skills**

Effective communication through writing is an important transferable skill for all career pathways. Establishing a strong foundation in writing skills will help you be successful throughout your future course work and career. This course includes written assignments with the goal of helping you get feedback on and improve your writing skills. If, however, you feel that you could benefit from additional resources to improve you writing skills, a list of UW and other online resources can be found on the SPH website (<https://sph.washington.edu/sites/default/files/inline-files/Writing-Resources-4.3.19.pdf>) and on the DEOHS intranet (<https://portal.deohs.washington.edu/index.php/academic-support-writing-resources> - accessible only to DEOHS students).

**Land Acknowledgement**

Washington state is home to 29 federally recognized and multiple unrecognized tribes. We include a land acknowledgment statement as a sign of respect for the original caretakers of the land: “We acknowledge 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."

**Equity, Diversity & Inclusion**

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

* 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.
* 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.
* 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.

**Pronouns**

The University of Washington supports the expression of all gender identity, and provides frequently asked question on pronouns at the following link: <https://registrar.washington.edu/students/personal-data/pronouns/faqs/>. UW staff, faculty, and students can now also set their pronouns in the Identity. UW system to make them automatically available in Canvas and other UW systems (see <https://itconnect.uw.edu/guides-by-topic/identity-diversity-inclusion/identity/pronouns>).

We share our pronouns because we strive to cultivate an inclusive environment where people of all genders feel safe and respected. We invite everyone to share their pronouns. Professor Fuhrmeister uses she/her pronouns. Your TA, Rica Monis, uses she/they pronouns.

**Learning Environment**

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.

**Bias Concerns**

The Office of the Dean has a [student concern policy](https://sph.washington.edu/students/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 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 Harasment**

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

* 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:
	+ 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
	+ Submission to or rejection of the conduct affects tangible aspects of the individual’s employment, academic status, or use of University facilities.
* 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](https://sph.washington.edu/about/diversity/bias-concerns). The University also has designated offices to help you: [SafeCampus](https://www.washington.edu/safecampus/); [Office of the Ombud](https://www.washington.edu/ombud/); [Title IX Investigation Office](https://www.washington.edu/titleix/report/); and [University Complaint Investigation and Resolution Office](https://www.washington.edu/compliance/uciro/).