

Course Syllabus


[Jump to Today](#) [Edit](#)

Course Number: ENVH 444/544 (Fall 2020, 4 credits)

Course Title: Antibiotic Resistant Bacteria/Genes Impact on the Environment and Public Health

Course Times: T/Th 1:30 – 3:20

Course Location: Zoom classes will be recorded but it will be extremely useful to view class live as you will be breaking into groups to answer questions during class time this is important for your understanding of course material. Please let me know if you are in a different time zone.

Zoom link: <https://washington.zoom.us/j/91435664098?pwd=a0lTUmpNSTJqR2daVHA3Y3BBbDJGZz09> 
<https://washington.zoom.us/j/91435664098?pwd=a0lTUmpNSTJqR2daVHA3Y3BBbDJGZz09>

Instructor:

Marilyn C. Roberts, PhD
Professor, Department of Environmental & Occupational Health Sciences
Adjunct Professor, Department of Global Health and Pediatric Dentistry
Office: Roosevelt 2340
Email: marilynr@uw.edu
Phone: 206.543.8001

TA:

Tyler Gerken
Email: tgerken@uw.edu

Office Hours: By arrangement

Course Website: <https://canvas.uw.edu/courses/1397858/>

Course Description: Addressing issues of antibiotic resistant bacteria and genes through an interdisciplinary “One Health” approach that integrates human, animal and environmental health. This course explores how the global use and abuse of antibiotics has profound consequences on the health of humans, animals, and the environment.

Learning Objectives:

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:

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

Writing Resources (for courses with written assignments): All written assignments for this class must be high quality, well researched, well organized, and well written. Use plain language instead of jargon. The instructors will consider the clarity of writing when grading assignments. Writing is an important transferable skill for all career pathways. Establishing a strong foundation in writing skills will help students be successful throughout their future course work and career.

Therefore, this course includes written assignments with the goal to helping students identify areas of strength and improvement in writing. However, if a student feels that they could benefit from additional opportunities to improve their writing skills, a list of resources at the UW and others accessible online can be found on the SPH website

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

(<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>)

(<https://portal.deohs.washington.edu/index.php/academic-support-writing-resources>).

Course Overview and Format: This course is designed to combine lectures by the instructor and invited guest lecturers with opportunities for students to engage in active, investigative learning through active learning. Students are expected to do the assigned readings prior to each class session and submit reflections from the reading through the course website. Three quizzes and one final exam will assess learning throughout the course.

Course Requirements

Textbook: There is no textbook for this course. Instead, a list of required readings will be provided on the course website for each class session. 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 (<https://www.cdc.gov/drugresistance/pdf/threats-report/2019-ar-threats-report-508.pdf>) (<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 (https://www.cdc.gov/narms/pdf/2015-NARMS-Annual-Report-cleared_508.pdf) (https://www.cdc.gov/narms/pdf/2015-NARMS-Annual-Report-cleared_508.pdf)
- Global antimicrobial resistance surveillance system (GLASS) report: early implementation 2020 (<https://apps.who.int/iris/bitstream/handle/10665/332081/9789240005587-eng.pdf?ua=1>) (<https://apps.who.int/iris/bitstream/handle/10665/332081/9789240005587-eng.pdf?ua=1>)

Preparing for Class: 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. Responses will be submitted via the course website prior to the applicable class session and will be reviewed and graded (complete/incomplete) by the instructor and/or the TA for the course.

Communication Exercise: There will be discussion throughout the course on what communication is and how it can be used to communicate science to specific stakeholders. The last few weeks in class each student will present their risk communication project. **The project is due Nov 19 by Noon.**

1. Each student will prepare a communication document or video which can include, but is not limited to, a fact sheet, an informational pamphlet, poster or a public service announcement. Nov. 19, 2020.
2. Students need to identify a specific stakeholder and method of communication and submit these to the instructor for approval by Oct 8, 2020.
3. Completed assignments will be turned in online via Canvas website by noon Nov. 19, 2020. The assignment needs to be a pdf, u-tube video, or power point presentation (2007 format)

Research (Graduate/544 Students and 444/undergraduate honors): Graduate students enrolled in the 544 section and undergraduates in 444 that are doing honors for the course will research and write a literature review paper on a topic related to ARGs/ARB. The paper should be double-spaced, paginated, and no fewer than 6 and no more than 10 pages long, not including references. A minimum of 10 references must be included, up to three of which 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 approval by Oct. 13, 2020 by noon and due by Nov. 24, 2020 by noon.

Exams: There will be three quizzes and one final exam for this course. The quizzes will be in-class and the final will be last class of the quarter.

For undergraduate (444) students, grades will be based on the following:

- 20%** - Reflections on reading (will include questions about reading assignments each week on Canvas)
- 20%** - Communication Exercise (each student will create a risk communication brochure, fact sheet, or poster) for specific stakeholders and present the last week in class
- 20%** - Quizzes
- 40%** - Final Exam

For graduate (544) students, grades will be based on the following:

- 10%** - Reflections on reading (will include questions about reading assignments each week on Canvas)
- 25%** - Communication Exercise (each student will create a risk communication brochure, fact sheet, or poster) for specific stakeholders
- 15%** - Quizzes
- 30%** - Final Exam
- 20%** - Research Paper

Access and Accommodation

Your experience in this class is important to me. If you have already established accommodations with Disability Resources for Students (DRS), please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs 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), you are welcome to contact DRS at 206-543-8924 or uwdrs@uw.edu (<mailto:uwdrs@uw.edu>) or disability.uw.edu (<mailto:uwdrs@uw.edu>). DRS offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and DRS. It is the policy and practice of the University of Washington to create inclusive and accessible learning environments consistent with federal and state law.

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/) [\(https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/\)](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/) [\(https://registrar.washington.edu/students/religious-accommodations-request/\)](https://registrar.washington.edu/students/religious-accommodations-request/).

UW Academic Integrity Statement

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 478-120). We expect you to know and follow the university's policies on cheating and plagiarism, and [the SPH Academic Integrity Policy](http://sph.washington.edu/students/academicintegrity/) [\(http://sph.washington.edu/students/academicintegrity/\)](http://sph.washington.edu/students/academicintegrity/). 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.

Classroom Climate

The UW School of Public Health seeks to ensure all students are fully included in each course. We strive to create an environment that reflects community and mutual caring. We encourage students with concerns about classroom climate to talk to your instructor, your advisor, a member of the departmental or SPH Diversity Committee and/or the program director. vg@uw.edu (<mailto:vg@uw.edu>) is a resource for students with classroom climate concerns.

Recording of Remote Class Sessions

The Zoom class sessions will be recorded. The recording will capture the presenter's audio, video and computer screen. Student audio and video will be recorded if they share their computer audio and video during the recorded session. The recordings will only be accessible to students enrolled in the course to review materials. These recordings will not be shared with or accessible to the public. The University and Zoom have FERPA-compliant agreements in place to protect the security and privacy of UW Zoom accounts. Students who do not wish to be recorded should change their Zoom screen name to hide any personal identifying information such as their name or UW Net ID, and not share their computer audio or video during their Zoom sessions.

Course Outline

Week 1: Course Overview, Introduction to ARGs/ARBs

Readings:

- PBS Frontline episode, Hunting the Nightmare Bacteria. <http://www.pbs.org/wgbh/pages/frontline/hunting-the-nightmare-bacteria/> [\(http://www.pbs.org/wgbh/pages/frontline/hunting-the-nightmare-bacteria/\)](http://www.pbs.org/wgbh/pages/frontline/hunting-the-nightmare-bacteria/)
- Davies J, Davies D. 2010. Origins and evolution of antibiotic resistance. Microbiol. Mole Biol. Rev. 74:417-433 <http://mmlr.asm.org/content/74/3/417.full.pdf+html> [\(http://mmlr.asm.org/content/74/3/417.full.pdf+html\)](http://mmlr.asm.org/content/74/3/417.full.pdf+html/)
- Levy SB, Marshall B. 2004. Antibacterial resistance worldwide: causes, challenges and responses. Nature Med. 10:S122-S139. <http://www.nature.com/nm/journal/v10/n12s/pdf/nm1145.pdf> [\(http://www.nature.com/nm/journal/v10/n12s/pdf/nm1145.pdf\)](http://www.nature.com/nm/journal/v10/n12s/pdf/nm1145.pdf/)

- FACT SHEET: Obama Administration Takes Actions to Combat Antibiotic-Resistant Bacteria
<http://www.whitehouse.gov/the-press-office/2014/09/18/fact-sheet-obama-administration-takes-actions-combat-antibiotic-resistan> ↗ [_\(http://www.whitehouse.gov/the-press-office/2014/09/18/fact-sheet-obama-administration-takes-actions-combat-antibiotic-resistan\)](http://www.whitehouse.gov/the-press-office/2014/09/18/fact-sheet-obama-administration-takes-actions-combat-antibiotic-resistan)

Oct. 1, 2020:

- Introductions and overview of student responsibilities and instructor expectations
- Group warm-up activity and zoom discussion {see how this will work}

Week 2: Overview of Antibiotic Resistance

Readings:

- Marinez JK, Baquero F. 2014. Emergence and spread of antibiotic resistance: setting parameter space. Upsala J Med Sciences. 119:68-77. <http://informahealthcare.com/doi/pdf/10.3109/03009734.2014.901444> ↗ [_\(http://informahealthcare.com/doi/pdf/10.3109/03009734.2014.901444\)](http://informahealthcare.com/doi/pdf/10.3109/03009734.2014.901444)
- Heuer H., Smalla K. 2007. Horizontal gene transfer between bacteria. Environ Biosafety Res. 6:3-13. <http://dx.doi.org/10.1051/ebr:2007034> ↗ [_\(http://dx.doi.org/10.1051/ebr:2007034\)](http://dx.doi.org/10.1051/ebr:2007034)
- Antimicrobial Resistance: Tackling a crisis for the health and wealth of nations
http://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%20crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf ↗ [_\(http://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%20crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf\)](http://amr-review.org/sites/default/files/AMR%20Review%20Paper%20-%20Tackling%20a%20crisis%20for%20the%20health%20and%20wealth%20of%20nations_1.pdf)

Assignments Due:

- Reflections on PBS Frontline and readings, Due by 1 pm on Tue Oct 6
- Communication identification of stakeholder and type of document to be produced (all students) by 1 PM October 8th

Oct 6, 2020:

- History of antibiotic use since 1945
- Mobile elements [plasmids, transposons, integrons]
- Bacterial gene exchange [conjugation, transformation, transduction]

Oct 8, 2020:

- Basic overview of antibiotic resistance, differences between bacteria, viruses, fungi, parasites

Week 3: Antibiotic Classes and Mechanisms of Resistance

Readings:

- Roberts MC, Schwarz S, Aarts H 2012. Acquired antibiotic resistance genes: an overview. Frontier in Microbiol: Antimicrobials Resistance & Chemotherapy 2012
http://www.frontiersin.org/Antimicrobials,_Resistance_and_Chemotherapy/10.3389/fmicb.2012.00384/full ↗ [_\(http://www.frontiersin.org/Antimicrobials,_Resistance_and_Chemotherapy/10.3389/fmicb.2012.00384/full\)](http://www.frontiersin.org/Antimicrobials,_Resistance_and_Chemotherapy/10.3389/fmicb.2012.00384/full)
- Farias P et al., 2015. Natural hot spots for gain of multiple resistance:
<http://aem.asm.org/content/81/7/2534.full.pdf+html> ↗ [_\(http://aem.asm.org/content/81/7/2534.full.pdf+html\)](http://aem.asm.org/content/81/7/2534.full.pdf+html)

Assignments Due:

- Reflections on Reading: Due by 1 pm on Tuesday October 13th
- Paper topics approved by instructor (544 students and 444 honor students only) by noon Oct 13th (544 students and 444 honor students only)

Oct 13, 2020:

- Linkage between antibiotic/heavy metal resistance genes and virulence

Oct 15, 2020:

- Antibiotic classes and how they are targeted specifically for bacterial pathways
- Mechanism of antibiotic resistance genes [ARGs] and antibiotics resistant bacteria [ARBs]
- **In-class quiz on content covered during the first 2 weeks of class**

Week 4: Antibiotic Resistome**Readings:**

- Dantas G, Sommer MOA. 2014. How to fight back against antibiotic resistance. American Scientist 102:42-51.
<http://www.americanscientist.org/issues/id.16136/issue.aspx> ↗
(<http://www.americanscientist.org/issues/id.16136/issue.aspx>)
- Mao D, Luo Y, Mathieu J et al. Persistence of extracellular DNA in river sediment facilitates antibiotic resistance gene propagation. Environ Sci Technol. 48:71-78. <http://pubs.acs.org/doi/pdf/10.1021/es404280v> ↗
(<http://pubs.acs.org/doi/pdf/10.1021/es404280v>)
- Forsberg K et al., 2012. The shared antibiotic resistome of soil bacteria and human pathogens. Science. 337:1107-1111.
<http://www.sciencemag.org/content/337/6098/1107.full.pdf> ↗
(<http://www.sciencemag.org/content/337/6098/1107.full.pdf>)

Assignments Due:

- Reflections on Reading: Due by 1 pm on Tuesday October 20th
- Find 2 recent (last 2 years) articles in the popular press talking about antibiotic resistant bacteria. Post the urls to canvas site by 1 pm on Tuesday October 20th. Provide a 1 full paragraph finding on how this article could influence thinking in the general population and if it is this accurate or not.

Oct 20, 2020:

- What is the antibiotic resistome?

Oct 22, 2020:

- Sources of ARGs

Week 5: ARGs/ARBs the role of the popular press and ARG/ARB costs to society**Readings:**

- Roberts et al., 2009. Hospital and societal costs of AR infections in a Chicago teaching hospital:
<http://cid.oxfordjournals.org/content/49/8/1175.full.pdf+html> ↗
(<http://cid.oxfordjournals.org/content/49/8/1175.full.pdf+html>)

Assignments Due:

- Be prepared to discuss one of your articles in class Oct 27, 29 (2 min presentation on who the audience was and what the main message of the article was- (this will be audio only no pictures)

Oct 27, 2020:

- How the popular press impacts the science
- **Student presentations on popular press (audio only)**

Oct 29, 2020:

- ARGs/ARBs costs to society: Who pays?
- **Student presentations on popular press (audio only)**

Week 6: One Health

Readings:

- Berkner S, Konradi S, Schonfeld J. 2014. Antibiotic resistance and the environment-there and back again. EMBO reports <http://embor.embopress.org/content/embor/15/7/740.full.pdf> [↗]
(<http://embor.embopress.org/content/embor/15/7/740.full.pdf>)
- McEwen SA, Collignon PJ. 2018. Antimicrobial resistance: a One Health Perspective. Microbiology Spectrum. Mar;6(2). doi: 10.1128/microbiolspec.ARBA-0009-2017
<http://www.asmscience.org/docserver/fulltext/microbiolspec/6/2/ARBA-0009-2017.pdf?expires=1532725393&id=id&accname=esid057303&checksum=F9925F043C3F3BC19B4841E43725D4E9> [↗]
(<http://www.asmscience.org/docserver/fulltext/microbiolspec/6/2/ARBA-0009-2017.pdf?expires=1532725393&id=id&accname=esid057303&checksum=F9925F043C3F3BC19B4841E43725D4E9>)
- [↗] (<http://www.asmscience.org/docserver/fulltext/microbiolspec/6/2/ARBA-0009-2017.pdf?expires=1532725393&id=id&accname=esid057303&checksum=F9925F043C3F3BC19B4841E43725D4E9>) **Nathalie Bleyzac** [↗] (https://www.ncbi.nlm.nih.gov/pubmed/?term=Bleyzac%20N%5BAuthor%5D&cauthor=true&cauthor_uid=32533455), **Sylvain Goutelle** [↗] (https://www.ncbi.nlm.nih.gov/pubmed/?term=Goutelle%20S%5BAuthor%5D&cauthor=true&cauthor_uid=32533455), **Laurent Bourguignon** [↗] (https://www.ncbi.nlm.nih.gov/pubmed/?term=Bourguignon%20L%5BAuthor%5D&cauthor=true&cauthor_uid=32533455), **Michel Tod** [↗] (https://www.ncbi.nlm.nih.gov/pubmed/?term=Tod%20M%5BAuthor%5D&cauthor=true&cauthor_uid=32533455). **Clin Drug Investig** [↗] (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7290142/>). 2020 Jun 12 : 1–4. Azithromycin for COVID-19: More Than Just an Antimicrobial? <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7290142/> [↗]
(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7290142/>)

Reflections on Reading:

- Write a paragraph describing why it is important to look at antibiotic resistance in a One Health approach: Due by 1 pm on Tuesday Nov. 3 on canvas. Late submission will be marked down

Nov. 3, 2020:

- One Health and why it is a global issues
- **In class quiz on content covered during the first 5.5 weeks of class**

Nov. 5, 2020:

- COVID-19 and antibiotic use
- **Student presentations on popular press (audio only)**

Week 7: Vaccines and behavior changes/Why are ARGs/ARBs a Global Issue?

Readings:

- Ferrero et al. 2015. Efficacy and safety of a decision rule for using antibiotics in children with pneumonia and vaccinated against pneumococcus. A randomized controlled trial. Arch Argent Pediatr. 113:397-403.
<http://www.sap.org.ar/docs/publicaciones/archivosarg/2015/v113n5a04e.pdf> [↗]
(<http://www.sap.org.ar/docs/publicaciones/archivosarg/2015/v113n5a04e.pdf>) (Links to an external site.)
- Riddle MS, Chen WH, Kirkwood CD et al. 2018. Update on vaccines for enteric pathogens. Clinical Microbiology and Infection Accepted doi: 10.1016/j.cmi.2018.06.023
<https://reader.elsevier.com/reader/sd/B7BDF4A2A40248A04D598132C5D51994B5A0C722AB> [↗]
([https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X\(18\)30488-9/abstract](https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X(18)30488-9/abstract))
[FFFBAB61B94EADB42F4971078B01982F04801D617E9253F6479AE4](https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X(18)30488-9/abstract) [↗]
([https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X\(18\)30488-9/abstract](https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X(18)30488-9/abstract)) (Links to an external site.)
- Casey JA, Curriero FC, Cosgrove SE et al. 2013. High-density livestock operations, crop field application of manure, and risk of community-associated methicillin-resistant Staphylococcus aureus infection in Pennsylvania. JAMA Intern Med. 173:1980-1990.
<https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/1738717> [↗]
(<https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/1738717>) (Links to an external site.)

Assignments Due:

- Reflections on Reading: Due by 1 pm on Tuesday November 10th

Nov 10, 2020:

- Vaccines, behavior changes

Nov 12, 2020:

- Agriculture and ARGs/ARB

Week 8: Alternative therapies to antibiotics/ Waste water treatment

Readings:

- Nakonieczna A, Cooper CJ, Gryko R. 2015 Bacteriophages and bacteriophage-derived endolysins as potential therapeutics to combat Gram-positive spore forming bacteria. J App Microbiol 110:620-631
<http://onlinelibrary.wiley.com/doi/10.1111/jam.12881/pdf> [↗] (<http://onlinelibrary.wiley.com/doi/10.1111/jam.12881/pdf>)
- Sybesma W, Rohde C, Bardy P. Et al., Silk route to the acceptance and re-implementation of bacteriophage therapy=Part II. Antibiotics 2018 7,35; doi.103390/antibiotics/7020035 <http://www.mdpi.com/2079-6382/7/2/35> [↗]
(<http://www.mdpi.com/2079-6382/7/2/35>)
- McFarland LV. 2015: From yaks to yogurt: The history, development, and current use of probiotics. CID 60(suppl) S85-S90. <http://www.ncbi.nlm.nih.gov/pubmed/25922406> [↗] (<http://www.ncbi.nlm.nih.gov/pubmed/25922406>)

- Ho HJ. In press. Am J Infect Cont Alcohol handrubbing and chlorhexidine handwashing are equally effective in removing methicillin-resistant Staphylococcus aureus from health care workers' hands: A randomized controlled trial <http://www.sciencedirect.com/science/article/pii/S0196655315006653> [↗](http://www.sciencedirect.com/science/article/pii/S0196655315006653)
(<http://www.sciencedirect.com/science/article/pii/S0196655315006653>)
- Purden A. 2013. Balancing water sustainability and Public Health goals in the face of the growing concerns about antibiotic resistance. Environ Sci & Tech <http://owlfoundation.net/web-pix/pdf-files/Pruden%20ES&T%202013%20Antibiotic%20Resistance%20and%20Water%20Sustainability%20Feature.pdf> [↗](http://owlfoundation.net/web-pix/pdf-files/Pruden%20ES&T%202013%20Antibiotic%20Resistance%20and%20Water%20Sustainability%20Feature.pdf) (<http://owlfoundation.net/web-pix/pdf-files/Pruden%20ES&T%202013%20Antibiotic%20Resistance%20and%20Water%20Sustainability%20Feature.pdf>)
- Michael I, Rizzo L, McArdell CS et al. 2013. Urban wastewater treatment plants as hotspots for the release of antibiotics in the environment : A review. Water Res. READ THE TEXT ONLY http://ac.els-cdn.com/S0043135412008391/1-s2.0-S0043135412008391-main.pdf?_tid=453cd014-89bd-11e7-8fbf-0000aab0f6c&acdnat=1503683346_257f8e056bed9d2ab5b22bbedd54e4d3 [↗](http://ac.els-cdn.com/S0043135412008391/1-s2.0-S0043135412008391-main.pdf?_tid=453cd014-89bd-11e7-8fbf-0000aab0f6c&acdnat=1503683346_257f8e056bed9d2ab5b22bbedd54e4d3) (http://ac.els-cdn.com/S0043135412008391/1-s2.0-S0043135412008391-main.pdf?_tid=453cd014-89bd-11e7-8fbf-0000aab0f6c&acdnat=1503683346_257f8e056bed9d2ab5b22bbedd54e4d3)

Assignments Due:

- Reflections on Reading: Due by 1 pm on Tuesday Nov. 17th, 2020
- **Risk Communication exercise turned in by everyone Nov. 19, 2020**

Nov 17, 2020:

- Alternative therapies, phage, probiotics
- **In class-quiz**

Nov 19, 2020:

- **Guest lecture: Dr. Mike Dodd Associate Professor Civil and Environmental Engineering UW**
- Antibiotic Resistance in Wastewater Treatment and the Role of Chemical Oxidation and Disinfection as Mitigation Strategies

Week 9: The Role of Agriculture and Humans (in the Spread of ARGs/ARBs)/Global antibiotic resistant clones

Readings:

- Millman JM, Waits K, Grande et al., 2014. Prevalence of antibiotic-resistant E. coli in retail chicken: comparing conventional, organic, kosher, and raised without antibiotics. [v2] 2:155 <http://f1000research.com/articles/10.12688/f1000research.2-155.v2/doi> [↗](http://f1000research.com/articles/10.12688/f1000research.2-155.v2/doi)
(<http://f1000research.com/articles/10.12688/f1000research.2-155.v2/doi>) (Links to an external site.) [↗](http://f1000research.com/articles/10.12688/f1000research.2-155.v2/doi)
(<http://f1000research.com/articles/10.12688/f1000research.2-155.v2/doi>)
- Zurek, L, Ghosh A. 2014. Insects present a link between food animals, farms and the urban environment for antibiotic resistance traits. Appl Environ Microbiol. 80:3562-3567. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4054130/> [↗](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4054130/)
(<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4054130/>) (Links to an external site.) [↗](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4054130/)
(<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4054130/>)
- Melendez, D., **M.C. Roberts**, A.L. Greninger, et al., 2019 Whole genome analysis of extraintestinal pathogenic *E. coli* (ExPEC) multidrug resistant ST73 and ST127 isolated from endangered Southern Resident killer whales (*Orcinus orca*). J. Antimicrob. Chemother. 74:2176-2180. <https://academic.oup.com/jac/advance-article/doi/10.1093/jac/dkz159/5481182?guestAccessKey=aa942cae-9eba-413c-a041-d877e3e25645> [↗](https://academic.oup.com/jac/advance-article/doi/10.1093/jac/dkz159/5481182?guestAccessKey=aa942cae-9eba-413c-a041-d877e3e25645)

(<https://academic.oup.com/jac/advance-article/doi/10.1093/jac/dkz159/5481182?guestAccessKey=aa942cae-9eba-413c-a041-d877e3e25645>).(Links to an external site.)

- Nilsson O. 2012. Vancomycin resistant enterococci in farm animals-occurrence and importance. Infect Ecol Epidem. 2:16969- <http://www.infectionecologyandepidemiology.net/index.php/iee/article/view/16959> [↗]
(<http://www.infectionecologyandepidemiology.net/index.php/iee/article/view/16959>). (Links to an external site.)
- Walsh, TR. 2010. Emerging carbapenemase: a global perspective. Internation. J Antimicrob Agents. <https://www.sciencedirect.com/science/article/pii/S0924857910700042> [↗]
(<https://www.sciencedirect.com/science/article/pii/S0924857910700042>). (Links to an external site.)

View :

- PBS show “How industrial farming techniques can breed superbugs”
<http://www.pbs.org/newshour/bb/industrial-farming-techniques-can-breed-superbugs/> [↗]
(<http://www.pbs.org/newshour/bb/industrial-farming-techniques-can-breed-superbugs/>).(Links to an external site.) [↗]
(<http://www.pbs.org/newshour/bb/industrial-farming-techniques-can-breed-superbugs/>).
- PBS show “The economic reason this chicken producer gave up antibiotics”
<https://www.pbs.org/newshour/show/economic-reason-chicken-producer-gave-antibiotics> [↗]
(<https://www.pbs.org/newshour/show/economic-reason-chicken-producer-gave-antibiotics>). (Links to an external site.) [↗]
(<https://www.pbs.org/newshour/show/economic-reason-chicken-producer-gave-antibiotics>).

Assignments Due:

- Reflections on Reading: Due by 1pm on Tuesday November 24th
- **Research papers due Nov. 24th by noon for graduate students**

Nov 24, 2020:

- SeaDoc and MRSA studies
- **Present risk communication project**

Nov 26, 2020

- **Holiday - No class!**

Week 10: Other ways ARGs/ARBs are transferred/Student presentation of communication projects

Readings:

- **Gedik H, Voss TA, Voss A. 2013. Money and transmission of bacteria. Antimicrob Resist Infect Control 2:22** [↗] (<https://www.sciencedirect.com/science/article/pii/S1198743X17304275>)
<https://aricjournal.biomedcentral.com/track/pdf/10.1186/2047-2994-2-22> [↗]
(<https://aricjournal.biomedcentral.com/track/pdf/10.1186/2047-2994-2-22>). (Links to an external site.) [↗]
(<https://www.sciencedirect.com/science/article/pii/S1198743X17304275>).
- Morel, Edwards, Harbarth. 2017. Preserving the “commons”: Addressing the sustainable use of antibiotics through an economic lens. Clinical Microbiology and Infection.
<https://www.clinicalmicrobiologyandinfection.com/action/showPdf?pii=S1198-743X%2817%2930427-5> [↗]
(<https://www.clinicalmicrobiologyandinfection.com/action/showPdf?pii=S1198-743X%2817%2930427-5>). (Links to an external site.)
- Durso LM, Cook KL. 2018. One health and antibiotic resistance in agroecosystems. EcoHealth
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6858902/pdf/10393_2018_Article_1324.pdf [↗]
(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6858902/pdf/10393_2018_Article_1324.pdf). (Links to an external site.)

- Berry, Wells, Durso et al. 2019. Occurrence of Escherichia coli O157:H7 in Pest Flies Captured in Leafy Greens Plots Grown Near a Beef Cattle Feedlot. J Food Prot. 2019 Aug;82(8):1300-1307 <https://www.jfoodprotection.com/doi/pdf/10.4315/0362-028X.JFP-18-601> ↗
(<https://www.jfoodprotection.com/doi/pdf/10.4315/0362-028X.JFP-18-601>)

Dec. 1, 2020:

- How do you protect yourself, family, and pets from ARB infections
- **Present risk communication project**

Dec. 3, 2020:

- ARGs/ARB: pandemic clones why do they exist?
- **Present risk communication project**

Week 11: Student Presentations/Summing up what has been learned in the quarter**Assignments Due:**

- Reflections on Reading: Due by 1pm on Tuesday December 8th




Dec 8, 2020:














- How do different human practices influence the evolution/ecology of ARGs/ARBs? Considering economics of antibiotic use
- Specific examples of antibiotic resistant bacteria
- The Example of VRE in US vs. EU
- Ciprofloxacin resistant Campylobacter
- **Present risk communication project (wrap up)**













Dec 10, 2020: Final














- **In class Final exam will be given during class from 1:30-3:20**














Course Summary:













Date	Details	
Thu Oct 1, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588058&include_contexts=course_1397858)	1:30pm to 3:30pm
Fri Oct 2, 2020	 Background Reading/Viewing for Week 1 (https://canvas.uw.edu/courses/1397858/assignments/5612658)	due by 1:30am
	 DEOHS Student Online Learning Technology Survey (https://canvas.uw.edu/courses/1397858/assignments/5693894)	due by 1pm














Date	Details
Tue Oct 6, 2020	 Week 1/2 Reading Reflections due by 1pm
	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health 1:30pm to 3:30pm
	 Background Reading/Viewing for Week 2 due by 1:30pm
Thu Oct 8, 2020	 Risk Communication Stakeholder and Type of Document due by 1pm
	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health 1:30pm to 3:30pm
Tue Oct 13, 2020	 Research paper topics due by 12pm
	 Week 3 Reading Reflections due by 1pm
	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health 1:30pm to 3:30pm
	 Background Reading/Viewing for Week 3 due by 1:30pm
Thu Oct 15, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health 1:30pm to 3:30pm
	 Quiz 1 due by 3:20pm
	 Quiz 1 due by 3:20pm
 Quiz 1 due by 3:35pm (1 student)	

















Date	Details
	<p> Quiz 1 (https://canvas.uw.edu/courses/1397858/assignments/5779217) (2 students) due by 3:50pm</p>
	<p> Quiz 1 (https://canvas.uw.edu/courses/1397858/assignments/5612688) (1 student) due by 5pm</p>
	<p> Quiz 1 (https://canvas.uw.edu/courses/1397858/assignments/5779217) (1 student) due by 6pm</p>
	<p> Quiz 1 (https://canvas.uw.edu/courses/1397858/assignments/5779217) (1 student) due by 11pm</p>
Tue Oct 20, 2020	<p> Article Post about ARG/ARB in the popular press (https://canvas.uw.edu/courses/1397858/assignments/5612657) due by 1pm</p> <p> Background Reading/Viewing for Week 4 (https://canvas.uw.edu/courses/1397858/assignments/5612662) due by 1pm</p> <p> Week 4 Reading Reflection (https://canvas.uw.edu/courses/1397858/assignments/5612696) due by 1pm</p> <p> Quiz 1 (https://canvas.uw.edu/courses/1397858/assignments/5779217) (1 student) due by 1:20pm</p> <p> ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588063&include_contexts=course_1397858) 1:30pm to 3:30pm</p>
Thu Oct 22, 2020	<p> ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588064&include_contexts=course_1397858) 1:30pm to 3:30pm</p>
Tue Oct 27, 2020	<p> ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588065&include_contexts=course_1397858) 1:30pm to 3:30pm</p> <p> Background Reading/Viewing for Week 5 (https://canvas.uw.edu/courses/1397858/assignments/5612663) due by 1:30pm</p>










Date	Details
Thu Oct 29, 2020	<p> ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588066&include_contexts=course_1397858)</p>
	<p> Background Reading/Viewing for Week 6 (https://canvas.uw.edu/courses/1397858/assignments/5612664)</p>
	<p> Week 6 Reading Reflections (https://canvas.uw.edu/courses/1397858/assignments/5612697)</p>
	<p> ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588067&include_contexts=course_1397858)</p>
	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5612689)</p>
	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5822410)</p>
Tue Nov 3, 2020	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5822410) (1 student)</p>
	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5822410) (2 students)</p>
	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5822410) (1 student)</p>
	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5822410) (2 students)</p>
	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5822410) (1 student)</p>
Wed Nov 4, 2020	<p> Quiz 2 (https://canvas.uw.edu/courses/1397858/assignments/5822410) (1 student)</p>
Thu Nov 5, 2020	<p> ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588068&include_contexts=course_1397858)</p>

Date	Details
Mon Nov 9, 2020	 Quiz 2 https://canvas.uw.edu/courses/1397858/assignments/5822410 (1 student) due by 1:15pm
	 Week 7 Reading Reflections https://canvas.uw.edu/courses/1397858/assignments/5612698 due by 1pm
Tue Nov 10, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health https://canvas.uw.edu/calendar?event_id=1588069&include_contexts=course_1397858 1:30pm to 3:30pm
	 Background Reading/Viewing for Week 7 https://canvas.uw.edu/courses/1397858/assignments/5612665 due by 1:30pm
Thu Nov 12, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health https://canvas.uw.edu/calendar?event_id=1588070&include_contexts=course_1397858 1:30pm to 3:30pm
Tue Nov 17, 2020	 Week 8 Reading Reflections https://canvas.uw.edu/courses/1397858/assignments/5612699 due by 1pm
	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health https://canvas.uw.edu/calendar?event_id=1588071&include_contexts=course_1397858 1:30pm to 3:30pm
	 Background Reading/Viewing for Week 8 https://canvas.uw.edu/courses/1397858/assignments/5612666 due by 1:30pm
	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5612690 due by 3:20pm
	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5842415 due by 3:20pm
	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5842415 (1 student) due by 3:43pm
	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5842415 (1 student) due by 4:05pm
	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5842415 (1 student) due by 5:45pm

Date	Details
	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5842415 (1 student) due by 10:15pm
Wed Nov 18, 2020	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5842415 (1 student) due by 5:30pm
	 Quiz 3 https://canvas.uw.edu/courses/1397858/assignments/5842415 (1 student) due by 12:15pm
Thu Nov 19, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health https://canvas.uw.edu/calendar?event_id=1588072&include_contexts=course_1397858 1:30pm to 3:30pm
	 Research Paper https://canvas.uw.edu/courses/1397858/assignments/5612691 due by 12pm
	 Week 9 Reflection https://canvas.uw.edu/courses/1397858/assignments/5612701 due by 1pm
Tue Nov 24, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health https://canvas.uw.edu/calendar?event_id=1588073&include_contexts=course_1397858 1:30pm to 3:30pm
	 Background Reading/Viewing for Week 9 https://canvas.uw.edu/courses/1397858/assignments/5612667 due by 1:30pm
Wed Nov 25, 2020	 Risk Communication Exercise https://canvas.uw.edu/courses/1397858/assignments/5612692 due by 1pm
Thu Nov 26, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health https://canvas.uw.edu/calendar?event_id=1588074&include_contexts=course_1397858 1:30pm to 3:30pm
Tue Dec 1, 2020	 Week 10 Reading Reflection https://canvas.uw.edu/courses/1397858/assignments/5612700 due by 1pm
	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health https://canvas.uw.edu/calendar?event_id=1588075&include_contexts=course_1397858 1:30pm to 3:30pm

Date	Details
	 Background Reading/Viewing for Week 10 (https://canvas.uw.edu/courses/1397858/assignments/5612659) due by 1:30pm
Thu Dec 3, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588076&include_contexts=course_1397858) 1:30pm to 3:30pm
Tue Dec 8, 2020	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588077&include_contexts=course_1397858) 1:30pm to 3:30pm
	 ENV H 444 A Au 20: Antibiotic Resistant Bacteria/Genes Impact On The Environment And Public Health (https://canvas.uw.edu/calendar?event_id=1588078&include_contexts=course_1397858) 1:30pm to 3:30pm
	 Final Exam (https://canvas.uw.edu/courses/1397858/assignments/5612668) due by 3:20pm
	 Final Exam (https://canvas.uw.edu/courses/1397858/assignments/5881974) due by 3:20pm
Thu Dec 10, 2020	 Final Exam (https://canvas.uw.edu/courses/1397858/assignments/5881974) (1 student) due by 4:15pm
	 Final Exam (https://canvas.uw.edu/courses/1397858/assignments/5881974) (2 students) due by 5:10pm
	 Final Exam (https://canvas.uw.edu/courses/1397858/assignments/5881974) (1 student) due by 6:50pm
	 Final Exam (https://canvas.uw.edu/courses/1397858/assignments/5881974) (1 student) due by 11:20pm
Tue Dec 15, 2020	 Final Exam (https://canvas.uw.edu/courses/1397858/assignments/5881974) (1 student) due by 4:20pm
	 Discuss article - 2 min presentation (https://canvas.uw.edu/courses/1397858/assignments/5636059)
	 Discuss article - 2 min presentation (https://canvas.uw.edu/courses/1397858/assignments/5771609)

Date	Details
	<p> Discuss article - 2 min presentation (https://canvas.uw.edu/courses/1397858/assignments/5804420)</p>
	<p> Lecture 1 (https://canvas.uw.edu/courses/1397858/assignments/5612669)</p>
	<p> Lecture 10 (https://canvas.uw.edu/courses/1397858/assignments/5612670)</p>
	<p> Lecture 11 (https://canvas.uw.edu/courses/1397858/assignments/5612671)</p>
	<p> Lecture 12 (https://canvas.uw.edu/courses/1397858/assignments/5612672)</p>
	<p> Lecture 13 (https://canvas.uw.edu/courses/1397858/assignments/5612673)</p>
	<p> Lecture 14 (https://canvas.uw.edu/courses/1397858/assignments/5612674)</p>
	<p> Lecture 15 (https://canvas.uw.edu/courses/1397858/assignments/5612675)</p>
	<p> Lecture 16 (https://canvas.uw.edu/courses/1397858/assignments/5612676)</p>
	<p> Lecture 17 (https://canvas.uw.edu/courses/1397858/assignments/5612677)</p>
	<p> Lecture 18 (https://canvas.uw.edu/courses/1397858/assignments/5612678)</p>
	<p> Lecture 19 (https://canvas.uw.edu/courses/1397858/assignments/5612679)</p>
	<p> Lecture 2 (https://canvas.uw.edu/courses/1397858/assignments/5612680)</p>
	<p> Lecture 3 (https://canvas.uw.edu/courses/1397858/assignments/5612681)</p>
	<p> Lecture 4 (https://canvas.uw.edu/courses/1397858/assignments/5612682)</p>
	<p> Lecture 5 (https://canvas.uw.edu/courses/1397858/assignments/5612683)</p>

Date	Details
	<p> Lecture 6 (https://canvas.uw.edu/courses/1397858/assignments/5612684)</p>
	<p> Lecture 7 (https://canvas.uw.edu/courses/1397858/assignments/5612685)</p>
	<p> Lecture 8 (https://canvas.uw.edu/courses/1397858/assignments/5612686)</p>
	<p> Lecture 9 (https://canvas.uw.edu/courses/1397858/assignments/5612687)</p>
	<p> Present risk communication projects (https://canvas.uw.edu/courses/1397858/assignments/5636145)</p>
	<p> Present risk communication projects (https://canvas.uw.edu/courses/1397858/assignments/5771603)</p>
	<p> Present risk communication projects (https://canvas.uw.edu/courses/1397858/assignments/5771604)</p>
	<p> Present risk communication projects (https://canvas.uw.edu/courses/1397858/assignments/5771605)</p>
	<p> Syllabus Quiz (https://canvas.uw.edu/courses/1397858/assignments/5770040)</p>