Course Syllabus

Jump to Today ✎ Edit

Course Number: ENVH 444/544 (Fall 2019, 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: T739

Instructor:

Marilyn C. Roberts, PhD
Professor, Department of Environmental & Occupational Health Sciences
Adjunct Professor, Department of Global Health and Pediatric Dentistry
Office: HSB F1616D
Email: marilynr@uw.edu
Phone: 206.543.8001

TA:

Alexandria (Alex) Vingino
Email: avingi@uw.edu

Office Hours: TBD, or by appointment

Office Hours: By arrangement

Course Website: https://canvas.uw.edu/courses/1320260

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.

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 2013 (**http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf** **(http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf)**)
- CDC National Antimicrobial Resistance Monitoring System: Enteric Bacteria (NARMS), 2012 Report (**http://www.cdc.gov/narms/pdf/2012-annual-report-narms-508c.pdf** **(http://www.cdc.gov/narms/pdf/2012-annual-report-narms-508c.pdf)**)
- WHO Antibiotic Resistance global Report of Surveillance 2014 (**http://apps.who.int/iris/bitstream/10665/112642/1/9789241564748_eng.pdf?ua=1** **(http://apps.who.int/iris/bitstream/10665/112642/1/9789241564748_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 week 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, 2019.
2. Students need to identify a specific stakeholder and method of communication and submit these to the instructor for approval by Oct 8, 2019.
3. Completed assignments will be turned in online via Canvas website by noon Nov. 19, 2019. 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 or 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. 8, 2019 by noon and due by Nov. 29, 2019 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
5% - Class Participation: Answers questions in class for active learning exercises and general questions during class
35% - 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
25% - Final Exam
5% - Class Participation: Answers questions in class for active learning exercises and general questions during class
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/)** . 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/)** .

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/) . 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.

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/)
- Davies J, Davies D. 2010. Origins and evolution of antibiotic resistance. Microbiol. Mole Biol. Rev. 74:417-433 http://mmbr.asm.org/content/74/3/417.full.pdf+html (http://mmbr.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)
- 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)

Assignments Due:

- Reflections on PBS Frontline and readings, Due by 1 pm on Tue Oct 1st

Sept 26, 2019:

- Introductions and overview of student responsibilities and instructor expectations
- Group warm-up activity and in-class discussion

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)
- 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)
- 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)

Oct 1, 2019:

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

Oct 3, 2019:

- 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)**
- 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)**

Assignments Due:

- Reflections on Reading: Due by 1 pm on Tuesday October 8th
- Paper topics approved by instructor (544 students and 444 honor students only) by noon Oct 9th (544 students and 444 honor students only)
- Communication identification of stakeholder and type of document to be produced (all students) by 1 PM October 10th

Oct 8, 2019:

- Linkage between antibiotic/heavy metal resistance genes and virulence

Oct 10, 2019:

- 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 15th

Oct 15, 2019:

- What is the antibiotic resistome?

Oct 17, 2019:

- Sources of ARGs

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

Readings:

- 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 22nd. 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.
- Be prepare to discuss one of your articles in class Oct 22-24 (2 min presentation on who the audience was and what the main message of the article was)
- 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:

- Post the URLs to Canvas site by 1 pm on Tuesday October 22nd. Provide a 1 full paragraph finding on how this article could influence thinking in the general population and if this is accurate or not. Make sure you do not have the same article as others in the class.

Oct 22, 2019:

- How the popular press impacts the science
- Student presentations on popular press

Oct 24, 2019:

*Note: Dr. Roberts out of town, Alex Vingino presenting

- ARGs/ARBs costs to society: Who pays?
- Student presentations on popular press

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)

- Dolejska M, Literak I. 2019. Wildlife is overlooked in the epidemiology of medically important antibiotic-resistant bacteria. Antimicrob Agents & Chemoth 563:e01167-19 https://aac.asm.org/content/63/8/e01167-19 (links it to an external site)
- Raverty SA, Rhodes LK, Zabek E. et al. 2017. Respiratory microbiome of endangered Southern Resident Killer Whales and microbiota of surrounding sea surface microlayer in the Eastern North Pacific. Scientific Reports. 7:394 https://www.nature.com/articles/s41598-017-00457-5.pdf (links to an external site)
- Lockwood SK, Chovan JL, Gaydos JK. 2006. Aerobic bacterial isolations from harbor seals (Phoca vitulina) stranded in Washington:1992-2003. J Zoo and Wildlife Medicine 37(7). 281-291. https://bioone.org/journals/journal-of-zoo-and-wildlife-medicine/volume-37/issue-3/05-035.1/AEROBIC-BACTERIAL-ISOLATIONS-FROM-HARBOR-SEALS-PHOCA-VITULINA-STRANDED-IN/10.1638/05-035.1.full (Links to an external site)

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 October 29th on canvas late submission will be marked down

Oct. 29, 2019:

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

Oct. 31, 2019:

- One Health in Marine ecosystem, why is it an issue?
- Guest lecturer: Dr. Stefanie Normark, Marine One Health

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 (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/B7BDF4A2A40248A04D598132C5D51994B5A0C722ABFFFBAB61B94EADB42F4971078B01982F04801D617E9253F6479AE4 (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. http://archinte.jamanetwork.com/article.aspx?articleid=1738717 (Links to an external site.)

Assignments Due:

- Reflections on Reading: Due by 1 pm on Tuesday November 5th

Nov 5, 2019:

- Vaccines, behavior changes

Nov 7, 2019:

- 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)**
- 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)**
- 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-00000aab0f6c&acdnat=1503683346_257f8e056bed9d2ab5b22bbedd54e4d3 (http://ac.els-cdn.com/S0043135412008391/1-s2.0-S0043135412008391-main.pdf?_tid=453cd014-89bd-11e7-8fbf-00000aab0f6c&acdnat=1503683346_257f8e056bed9d2ab5b22bbedd54e4d3)**

Assignments Due:

- Reflections on Reading: Due by 1 pm on Tuesday November 12th

Nov 12, 2019:

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

Nov 14, 2019:

- **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 (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)**
- 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/)**
- 2012 Summary Report on Antimicrobials Sold or Distributed for Use in Food-Producing Animals **http://www.fda.gov/downloads/ForIndustry/UserFees/AnimalDrugUserFeeActADUFA/UCM416983.pdf (http://www.fda.gov/downloads/ForIndustry/UserFees/AnimalDrugUserFeeActADUFA/UCM416983.pdf)** [Look at the highlights in this report]
- 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)**
- Walsh, TR. 2010. Emerging carbapenemase: a global perspective. Internation. J Antimicrob Agents http://ac.els-cdn.com/S0924857910700042/1-s2.0-S0924857910700042-main.pdf?_tid=876e0e3a-4014-11e4-8ac4-00000aacb362&acdnat=1411141944_34d3c9f87c6513d1348c622e61d8358e (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/)**
- PBS show “The economic reason this chicken producer gave up antibiotics” http://www.pbs.org/newshour/bb/economic-reason-chicken-producer-gave-antibiotics/

Assignments Due:

- Reflections on Reading: Due by 1pm on Tuesday November 19th
  Research papers due Nov. 19th by noon for graduate students
  Communication exercise turned in by everyone Nov. 19, 2019

Nov 19, 2019:

- Guest lecturer: Scott Weisman - International spread of KPC, NDM, OXA-48

Nov 21, 2019

- ARGs/ARB: pandemic clones why do they exist?

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 http://www.aricjournal.com/content/pdf/2047-2994-2-22.pdf (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. In press http://ac.els-cdn.com/S1198743X17304275/1-s2.0-S1198743X17304275-main.pdf?_tid=7b2b3d0e-89be-11e7-a453-00000aacb361&acdnat=1503683866_0b747bc1bac8587d52e7caf18dd36fa9 (Links to an external site.)
- Durso LM, cook KL. 2018. One health and antibiotic resistance in agroecosytems. EcoHealth https://link.springer.com/content/pdf/10.1007%2Fs10393-018-1324-7.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)**
- 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

Nov 26, 2019:

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

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

Dec 3, 2019:

- 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 communication project

Dec 5, 2019: Final

- In class Final exam

Course Summary:

Date	Details