

Course Syllabus

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Course Number: ENVH 444/544 (Fall 2017, 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: T531

Instructor:

Marilyn C. Roberts, PhD

Professor, Department of Environmental & Occupational Health Sciences

Adjunct Professor, Department of Global Health and Pediatric Dentistry

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Teaching Assistant:

Mallory Little

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Office Hours: HSB E 179B, Wednesdays, 12:00-1:20 PM

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.

Prerequisites: Either EPI 320, BIOL 220 or MICROM 301 or approval by Dr. Roberts

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/ARBs 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 and undergraduate honor students (444) will be able to:

0. 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 and PBS viewings will be provided on the course website for each class session and listed below. 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-](http://www.cdc.gov/narms/pdf/2012-annual-report-narms-508c.pdf)

[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 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 communication project. **The project is due Nov 30 by Noon uploaded to the canvas site.**

1. Each student will prepare a communication document in power point or video which can include, but is not limited to, a fact sheet, an informational pamphlet, poster or a one page public service announcement.
2. Students need to identify a specific stakeholder and method of communication (fact sheet, an informational pamphlet, poster, a public service announcement or video) and submit these to the instructor for approval by Oct 12, 2017.
3. Completed assignments will be turned in online via Canvas website by noon Nov. 30, 2017. The assignment needs to be a pdf, Youtube video, or powerpoint presentation (2007 format)
4. Each student will present their communication exercise Dec 5 or Dec. 7, 2017.

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. 10, 2017 by noon and due by Nov. 21, 2017 by noon.

Exams: There will be three quizzes and one final exam for this course. The final is in room T473 on December 15, 2:30-4:30.

Student Assessment & Grading:

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 or writing on a topic)
- 20% Communication Exercise (each student will create a risk communication brochure, fact sheet, or poster) for specific stakeholders and presented the last week in class
- 20% Quizzes
- 5% Class Participation: Answers questions in class for active learning exercises and general questions during class. Attendance is required for class participation but itself is not adequate. Speaking in class will be marked but silent presence in class does not count.
- 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 or writing on a topic)
- 25% Communication Exercise (each student will create a risk communication brochure, fact sheet, or poster) for specific stakeholders and presented the last week in class
- 15% Quizzes
- 5% Class Participation: Answers questions in class for active learning exercises and general questions during class. Attendance is required for class participation but itself is not adequate. Speaking in class will be marked but silent presence in class does not count.
- 25% Final Exam
- 20% Research Paper

Basic Course Outline (see [the Modules Page](#) for links to readings, etc.):

WEEK 1	Course Overview, Introduction to ARGs/ARBs
Thursday, Sept. 28, 2017	<ul style="list-style-type: none">• Introductions and overview of student responsibilities and instructor expectations• Group warm-up activity and in-class discussion
WEEK 2	Overview of Antibiotic Resistance
Tuesday, Oct. 3, 2017	<ul style="list-style-type: none">• History of antibiotic use since 1945• Mobile elements [plasmids, transposons, integrons]• Bacterial gene exchange [conjugation, transformation, transduction]
Thursday, Oct. 5, 2017	<ul style="list-style-type: none">• Basic overview of antibiotic resistance, differences between bacteria, viruses, fungi, parasites
WEEK 3	Antibiotic Classes and Mechanisms of Resistance
Tuesday, Oct. 10, 2017	<ul style="list-style-type: none">• Linkage between antibiotic/heavy metal resistance genes and virulence• Paper topics approved by instructor (544 students and 444 honor students only) by noon
Thursday, Oct. 12, 2017	<ul style="list-style-type: none">• 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• Communication identification of stakeholder and type of document to be produced (all students) by before class Oct 12
WEEK 4	Antibiotic Resistome
Tuesday, Oct. 17, 2017	<ul style="list-style-type: none">• What is the antibiotic resistome?

Thursday, Oct. 19, 2017	<ul style="list-style-type: none"> • Sources of ARGs
WEEK 5	ARGs/ARBs: the Role of the Popular Press and ARG/ARB Costs to Society
Tuesday, Oct. 24, 2017	<ul style="list-style-type: none"> • How the popular press impacts the science • Student presentation
Thursday, Oct. 26, 2017	<ul style="list-style-type: none"> • ARGs/ARBs costs to society: Who pays? • Student presentation
WEEK 6	One Health
Tuesday, Oct. 31, 2017	<ul style="list-style-type: none"> • One Health and why it is a Global issue • In class quiz on content covered during the first 5 weeks of class
Thursday, Nov. 2, 2017	<ul style="list-style-type: none"> • <u>Guest Lecture: Dr. Mike Dodd Associate Professor Civil and Environmental Engineering UW</u> • Antibiotic Resistance in Wastewater Treatment and the Role of Chemical Oxidation and Disinfection as Mitigation Strategies
WEEK 7	The Role of Agriculture in the Spread of ARGs/ARB
Tuesday, Nov. 7, 2017	<ul style="list-style-type: none"> • The environment and its role in ARG/ARB evolution and spread • Location of ARGs/ARBs
Thursday, Nov. 9, 2017	<ul style="list-style-type: none"> • <u>Guest Lecturer:</u> Doug Call, WSU Paul G. Allen School for Global Animal Health. • Identifying the most important drivers of antibiotic resistance in food-animal production
WEEK 8	Alternative Therapies to Antibiotics
Tuesday, Nov. 14, 2017	<ul style="list-style-type: none"> • Alternative therapies, phage, probiotics
Thursday, Nov. 16, 2017	<ul style="list-style-type: none"> • Vaccines, behavior changes
WEEK 9	Protecting Yourself, Family and Pets
Tuesday, Nov. 21, 2017	<ul style="list-style-type: none"> • How do you protect yourself, family & pets from antibiotic resistant infections? • In class-quiz on content covered during the first 8 weeks of class
Thursday, Nov. 23, 2017	HOLIDAY, No Class
WEEK 10	Specific Examples and Summary of the Course
Tuesday, Nov. 28, 2017	<ul style="list-style-type: none"> • Specific examples of antibiotic resistant bacteria • The Example of VRE in US vs. EU • Ciprofloxacin resistant <i>Campylobacter</i>
Thursday, Nov. 30, 2017	<ul style="list-style-type: none"> • How do different human practices influence the evolution/ecology of ARGs/ARBs? Considering economics of antibiotic use

WEEK 11	Student Presentations
Tuesday, Dec. 5, 2017	<ul style="list-style-type: none"> • Student presentations on communication projects
Thursday, Dec. 7, 2017	<ul style="list-style-type: none"> • Student presentations on communication projects
FINALS WEEK	
Friday, Dec. 15, 2017, 2:30-4:30	<ul style="list-style-type: none"> • Final in T473

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 ([_https://ap03.alpine.washington.edu/alpine/alpine/2.0/mailto?to=uwdrs%40uw%2Eedu&pop=view/0/INBOX/250973](https://ap03.alpine.washington.edu/alpine/alpine/2.0/mailto?to=uwdrs%40uw%2Eedu&pop=view/0/INBOX/250973)) or [disability.uw.edu](http://depts.washington.edu/uwdrs/) (<http://depts.washington.edu/uwdrs/>)

















. 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.

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/policy.asp) (<http://sph.washington.edu/students/academicintegrity/policy.asp>). 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](https://www.washington.edu/cssc/) (<https://www.washington.edu/cssc/>) website.


Course Summary:

Date	Details	
Thu Sep 28, 2017	 Background Reading/Viewing for Week 1 _https://canvas.uw.edu/courses/1116969/assignments/3830595	due by 1:30pm

Tue Oct 3, 2017	 Week 1 Reading Reflections https://canvas.uw.edu/courses/1116969/assignments/3906461	due by 1pm
	 Background Reading/Viewing for Week 2 https://canvas.uw.edu/courses/1116969/assignments/3830596	due by 1:30pm
Tue Oct 10, 2017	 Week 3 Reading Reflections https://canvas.uw.edu/courses/1116969/assignments/3911231	due by 1pm
	 Background Reading/Viewing for Week 3 https://canvas.uw.edu/courses/1116969/assignments/3913814	due by 1:30pm
Thu Oct 12, 2017	 Risk Communication Stakeholder and Type of Document https://canvas.uw.edu/courses/1116969/assignments/3757890	due by 1pm
Tue Oct 17, 2017	 Week 4 Reading Reflections https://canvas.uw.edu/courses/1116969/assignments/3924608	due by 1pm
	 Background Reading/Viewing for Week 4 https://canvas.uw.edu/courses/1116969/assignments/3913825	due by 1:30pm
Wed Oct 18, 2017	 Modified Risk Communication Stakeholder Document https://canvas.uw.edu/courses/1116969/assignments/3924748	due by 5pm
Tue Oct 24, 2017	 Week 5 Article Post about ARG/ARB in the popular press https://canvas.uw.edu/courses/1116969/assignments/3757883	due by 1pm
Tue Oct 31, 2017	 Week 6 Reading Reflections https://canvas.uw.edu/courses/1116969/assignments/3929364	due by 1pm
	 Background Reading/Viewing for Week 6 https://canvas.uw.edu/courses/1116969/assignments/3913890	due by 1:30pm
Tue Nov 7, 2017	 Week 7 Reading Reflections https://canvas.uw.edu/courses/1116969/assignments/3939784	due by 1pm
Tue Nov 14, 2017	 Week 8 Reading Reflections https://canvas.uw.edu/courses/1116969/assignments/3944564	due by 1pm
Tue Nov 21, 2017	 Research Paper https://canvas.uw.edu/courses/1116969/assignments/3886988	due by 12pm
	 Week 9 Reading Reflection https://canvas.uw.edu/courses/1116969/assignments/3951247	due by 1pm
Thu Nov 30, 2017	 Risk Communication Exercise https://canvas.uw.edu/courses/1116969/assignments/3757889	due by 12pm

 [Final Exam](https://canvas.uw.edu/courses/1116969/assignments/3757884)
(<https://canvas.uw.edu/courses/1116969/assignments/3757884>)

 [Background Reading/Viewing for Week 10](https://canvas.uw.edu/courses/1116969/assignments/3925501)
(<https://canvas.uw.edu/courses/1116969/assignments/3925501>)

 [Background Reading/Viewing for Week 7](https://canvas.uw.edu/courses/1116969/assignments/3925486)
(<https://canvas.uw.edu/courses/1116969/assignments/3925486>)

 [Background Reading/Viewing for Week 8](https://canvas.uw.edu/courses/1116969/assignments/3925498)
(<https://canvas.uw.edu/courses/1116969/assignments/3925498>)

 [Lecture 1](https://canvas.uw.edu/courses/1116969/assignments/3887439) (<https://canvas.uw.edu/courses/1116969/assignments/3887439>)

 [Lecture 10](https://canvas.uw.edu/courses/1116969/assignments/3937283) (<https://canvas.uw.edu/courses/1116969/assignments/3937283>)

 [Lecture 11](https://canvas.uw.edu/courses/1116969/assignments/3941269) (<https://canvas.uw.edu/courses/1116969/assignments/3941269>)

 [Lecture 12](https://canvas.uw.edu/courses/1116969/assignments/3942811) (<https://canvas.uw.edu/courses/1116969/assignments/3942811>)

 [Lecture 13](https://canvas.uw.edu/courses/1116969/assignments/3947521) (<https://canvas.uw.edu/courses/1116969/assignments/3947521>)

 [Lecture 14](https://canvas.uw.edu/courses/1116969/assignments/3944879) (<https://canvas.uw.edu/courses/1116969/assignments/3944879>)

 [Lecture 15](https://canvas.uw.edu/courses/1116969/assignments/3952078) (<https://canvas.uw.edu/courses/1116969/assignments/3952078>)

 [Lecture 16](https://canvas.uw.edu/courses/1116969/assignments/3956324) (<https://canvas.uw.edu/courses/1116969/assignments/3956324>)

 [Lecture 17](https://canvas.uw.edu/courses/1116969/assignments/3962815) (<https://canvas.uw.edu/courses/1116969/assignments/3962815>)

 [Lecture 18](https://canvas.uw.edu/courses/1116969/assignments/3965168) (<https://canvas.uw.edu/courses/1116969/assignments/3965168>)

 [Lecture 2](https://canvas.uw.edu/courses/1116969/assignments/3906491) (<https://canvas.uw.edu/courses/1116969/assignments/3906491>)

 [Lecture 3](https://canvas.uw.edu/courses/1116969/assignments/3909936) (<https://canvas.uw.edu/courses/1116969/assignments/3909936>)

 [Lecture 4](https://canvas.uw.edu/courses/1116969/assignments/3919083) (<https://canvas.uw.edu/courses/1116969/assignments/3919083>)

 [Lecture 5](https://canvas.uw.edu/courses/1116969/assignments/3920275) (<https://canvas.uw.edu/courses/1116969/assignments/3920275>)

 [Lecture 6](https://canvas.uw.edu/courses/1116969/assignments/3924354) (<https://canvas.uw.edu/courses/1116969/assignments/3924354>)

 [Lecture 7](https://canvas.uw.edu/courses/1116969/assignments/3925472) (<https://canvas.uw.edu/courses/1116969/assignments/3925472>)

 [Lecture 8](https://canvas.uw.edu/courses/1116969/assignments/3929358) (<https://canvas.uw.edu/courses/1116969/assignments/3929358>)

 [Lecture 9](https://canvas.uw.edu/courses/1116969/assignments/3933795) (<https://canvas.uw.edu/courses/1116969/assignments/3933795>)

 [Medications for the Prevention and Treatment of Travellers' Diarrhea](https://canvas.uw.edu/courses/1116969/assignments/3928245)
(<https://canvas.uw.edu/courses/1116969/assignments/3928245>)

 [Participation](https://canvas.uw.edu/courses/1116969/assignments/3757885) (<https://canvas.uw.edu/courses/1116969/assignments/3757885>)

 [Quiz 1](https://canvas.uw.edu/courses/1116969/assignments/3757886) (<https://canvas.uw.edu/courses/1116969/assignments/3757886>)

 [Quiz 2](https://canvas.uw.edu/courses/1116969/assignments/3757887) (<https://canvas.uw.edu/courses/1116969/assignments/3757887>)

 [Quiz 3](https://canvas.uw.edu/courses/1116969/assignments/3962877) (<https://canvas.uw.edu/courses/1116969/assignments/3962877>)

