

# **ENV H 452/542: Environmental & Occupational Health Microbiology II: Detection and Control of Environmentally Transmitted Pathogens**

Winter Quarter, 2009  
Monday, Wednesday, and Friday, 11:30-12:20  
Room T-635

**INSTRUCTORS:** Gwy-Am Shin  
Assistant Professor  
Department of Environmental and Occupational Health Sciences  
Office: 4225 Roosevelt Way NE, Suite 2339  
Phone: (206) 543-9026  
Email: [gwyam@u.washington.edu](mailto:gwyam@u.washington.edu)

John Scott Meschke  
Assistant Professor  
Department of Environmental and Occupational Health Sciences  
Office: 4225 Roosevelt Way NE, Suite 2338  
Phone: (206) 221-5470  
Email: [jmeschke@u.washington.edu](mailto:jmeschke@u.washington.edu)

**OFFICE HOURS:** By Appointment

**COURSE DESCRIPTION:** This course will review environmental detection and control of pathogenic organisms. The first half of the course will cover methods of sample collection, processing and target detection. The second half of the course will examine methods of decontamination and disinfection, as well as other engineered controls of environmentally transmitted pathogens. This course will be of use for public health and health care professionals, microbiologists, civil and environmental engineers, environmental scientists and bio-defense specialists.

**COURSE OBJECTIVES:** At the conclusion of this class, students should be able to:

1. identify various routes of pathogen transmission through environment
2. describe the methods of sample collection and processing from various environmental media
3. categorize the various methods to detect environmentally transmitted pathogens
4. explain the advantages and disadvantages of the detection methods
5. identify several major measures to control and prevent environmentally transmitted pathogens
6. distinguish between sterilization, disinfection, and preservation methods
7. identify different classes of disinfectants and explain disinfection kinetics
8. describe several methods to decontaminate infectious wastes and acceptable biosafety practices in the laboratory

9. recognize the importance of clinical hygiene and institutional infection control practices
10. recognize the importance and magnitude of emerging antimicrobial resistance

**TEXTS AND REFERENCES:** The recommended text for this course is Environmental Microbiology (Maier, Pepper, and Gerba, Academic Press). Additional Readings and course materials will be available through the course webpage or handed out in class. The following texts are recommended references for more in-depth detail on course topics (more will be given during the duration of the course):

Books-

Manual of Environmental Microbiology, 2<sup>nd</sup> edition, ASM Press  
Disinfection, Sterilization and Preservation, 5<sup>th</sup> edition, LWW  
Metcalf and Eddy's Wastewater Engineering: Treatment and Reuse, McGraw-Hill  
Water Quality and Treatment, 5<sup>th</sup> edition, AWWA  
Bioaerosols Handbook, Lewis  
Food Microbiology, Doyle  
Any Basic Microbiology Text (e.g. Madigan, Martinko and Parker; Prescott, Harley and Klein; etc.)

Journals-

Journal of Applied Microbiology  
Letters in Applied Microbiology  
Journal of Applied and Environmental Microbiology  
Journal of American Water Works Association  
Journal of Food Protection  
International Journal of Food Microbiology  
Water Science and Technology  
Water Research  
Emerging Infectious Disease

**READINGS:** Students will typically be assigned readings for each class session. These readings will typically be 20-25 pages in length (though combined readings may be assigned for multiple sessions exceeding this length). Readings will commonly be chapters from the recommended text or other reference texts, but may include website or journal articles.

**CLASS PARTICIPATION:** Although class attendance is not expressly required, students will be expected to participate in classroom discussion and in-class group learning activities. Students will not have the opportunity to earn class participation credit for course periods during which they are absent.

**COURSE FORMAT:** Class periods will be lecture and discussion sessions. Lecture sessions will typically consist of 5 minutes of review questions, 30-40 minutes of lecture material, and 5-10 follow-up questions. Discussion sessions will be student led and mediated by one of the instructors. Students will be divided into 3 groups for student-led discussion sessions. For each session one group will be in charge of selecting a series of articles on the listed topic and preparing a list of discussion questions/topics. During the sessions the leading group will lead/facilitate the discussion for the course session. These are intended to be discussions not lectures. Articles and discussion questions/topics should be submitted to mediating instructor one week prior to discussion session to insure adequate time for distribution to the class.

**GRADING OPPORTUNITIES:** For the sake of this class, letter and numerical grades will typically be distributed according to the university grading scale between the following standards:

A(4.0)= Excellent and exceptional work (typically >90% of available points)

D (1.0) = Deficient work (typically <66% of available points)

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

**Graduate student points will be available according to the following % breakdown:**

Curriculum Vitae (5%): Each student will be required to provide a 1-2 page CV describing the student's background and interests. CVs will be due by the third class period.

Homework (10%): Students will have the opportunity to complete 2 homework assignments, each worth 5 % of the overall grade. Once graded homeworks are returned, students will have one week to provide an explanation of why any incorrect answers were wrong and provide the correct answers as an opportunity to recover up to ½ of missed points. Homework assignments will be due as indicated on the course outline. Late assignments will be penalized 10% of point value for each class period that they are late.

Midterm Exam (25%): Midterm exam will consist primarily of short answer questions, but may include multiple choice, and fill-in the blank questions as well. Exams will be conducted during a scheduled course period. Exam will be open book and open note. Once graded exams are returned, students will have one week to provide an explanation of why any incorrect answers were wrong and provide the correct answers as an opportunity to recover up to ½ of missed points. Early or make-up exams will only be offered in case of emergencies or prior arrangement with instructor. Format for early and make-up exams is left to the discretion of instructor.

Class Participation (5%): Class participation credit will be awarded for participation in classroom discussions, asking of questions that further the instruction, email response to instructor-posed questions, and peer reviews of manuscripts.

Oral Exam (15%): Students will be required to make an appointment with the instructor on March 4th, 6<sup>th</sup>, or 9th. Exams will consist of a relaxed discussion (~15 minutes) during which instructor will evaluate students grasp of course content.

Review Paper (15%): Graduate students will be expected to write and submit a detailed review paper on a particular topic relevant to this course. Students will work

in pairs and must have topics approved by instructors. Papers are expected to be as long as necessary to cover the topic, but should not exceed 25 pages of text double spaced (not including references). Research topics should be approved by January 19th. A progress check in the form of a reference check is due by February 4th. First drafts of the Manuscript are due on February 16th. Peer reviews are due February 23th and final drafts are due on March 11th. Formatting should in accordance with ASM journal guidelines.

**Final Exam (25%):** Final Exam will be offered on **March 18th from 2:30 pm-4:20 pm**. Final exam will be comprehensive and will consist of multiple choice, matching, short answer and problem solving questions. Exam will be open book and open note.

**Undergraduate student points will be available according to the following % breakdown:**

**Curriculum Vitae (5%):** Each student will be required to provide a 1-2 page CV describing the student's background and interests. CVs will be due by the third class period.

**Homework (20%):** Students will have the opportunity to complete 2 homework assignments. Once graded homeworks are returned, students will have one week to provide an explanation of why any incorrect answers were wrong and provide the correct answers as an opportunity to recover up to ½ of missed points. Homework assignments will be due as indicated on the course outline. Late assignments will be penalized 10% of point value for each class period that they are late.

**Midterm Exam (30%):** Midterm exam will consist primarily of short answer questions, but may include multiple choice, and fill-in the blank questions as well. Exams will be conducted during a scheduled course period. Exam will be open book and open note. Once graded exams are returned, students will have one week to provide an explanation of why any incorrect answers were wrong and provide the correct answers as an opportunity to recover up to ½ of missed points. Early or make-up exams will only be offered in case of emergencies or prior arrangement with instructor. Format for early and make-up exams is left to the discretion of instructor.

**Class Participation (5%):** Class participation credit will be awarded for participation in classroom discussions, asking of questions that further the instruction, email response to instructor-posed questions, and peer reviews of graduate student manuscripts.

**Oral Exam (10%):** Students will be required to make an appointment with the instructor on March 4th, 6<sup>th</sup>, or 9th. Exams will consist of a relaxed discussion (~15 minutes) during which instructor will evaluate students grasp of course content.

**Final Exam (30%):** Final Exam will be offered on **March 18<sup>th</sup>, 2:30 pm – 4:20 pm**. Final exam will be comprehensive and will consist of multiple choice, matching, short answer and problem solving questions. Exam will be open book and open note.

**ACADEMIC ACCOMODATIONS:** To request academic accommodations due to disability, please contact Disabled Student Services, 448 Schmitz, (206) 543-8924 (V/TTY). If you have a letter from Disabled Student Services indicating that you have a disability that requires academic accommodations, please present the letter to me so we can discuss the accommodations you might need in this class.

COURSE OUTLINE:

<b>Date</b>	<b>Topic</b>	<b>Instructor</b>	<b>Due</b>
5-Jan	Introduction/Sampling of Environmental Media	Meschke	
7-Jan	Concentration and Purification of Airborne Microbes and Biotoxins	Meschke	
9-Jan	Sampling of Food and Fomitic Surfaces for Pathogens	Meschke	CVs
12-Jan	Concentration and Purification of Waterborne Pathogens	Shin	
14-Jan	Microscopy/Immunoassays	Meschke	
16-Jan	Culture/Biochemical Assays	Meschke	
19-Jan	Holiday-MNK Day-No class		
21-Jan	Molecular Methods of Detection I	Shin	Research Topics
23-Jan	Molecular Methods of Detection II	Meschke	
26-Jan	<i>Student Led Discussion on Sampling</i>	Meschke	HW1
28-Jan	<i>Student Led Discussion on Detection</i>	Shin	
30-Jan	Handwashing/Antisepsis/PPE	Meschke	
2-Feb	Water and Wastewater Treatment	Shin	
4-Feb	<i>Student Led Discussion on Host Control</i>	Shin	Reference Check
6-Feb	HVAC Controls/Filtration of Air/BSCs	Meschke	
9-Feb	Midterm Exam	Meschke	
11-Feb	Control and Prevention of Foodborne Disease	Meschke	
13-Feb	Antimicrobial Use and Resistance/Vaccination	Roberts	
16-Feb	Holiday-President's Day-No class		
18-Feb	<i>Student Led Discussion on Containment and Removal</i>	Shin	First Draft Paper
20-Feb	Principle of Disinfection, sterilization and Preservation	Shin	
23-Feb	Disinfection Classes (Chemical and Physical)	Shin	Reviews of Paper
25-Feb	Kinetics of Disinfection	Shin	
27-Mar	Media-Specific Disinfection (Air and Surface)	Meschke	
2-Mar	Decontamination of Infectious Wastes	Meschke	HW2
4-Mar	<i>Student Led Discussion on Disinfection</i>	Shin	Oral Exam
6-Mar	<i>Student Led Discussion on Control of Microbial Exposures in the Workplace</i>	Meschke	Oral Exam
9-Mar	Laboratory Design/Biosafety Practices	Meschke	Oral Exam
11-Mar	<i>Student Led Discussion on Clinical Hygiene/Institutional Infection Control</i>	Shin	Final Draft
13-Mar	Review	Shin/Meschke	

References:

Date	Topic	Reference	Chapters
5-Jan	Introduction/Sampling of Environmental Media	Handouts	
7-Jan	Concentration and Purification of Airborne Microbes and Biotoxins	Handouts	
9-Jan	Sampling of Food and Fomitic Surfaces for Pathogens	Handouts	
12-Jan	Concentration and Purification of Waterborne Pathogens	Handouts	
14-Jan	Microscopy/Immunoassays	E. M*	8, 9
16-Jan	Culture/Biochemical Assays	E. M*	10,11
19-Jan	Holiday-MNK Day-No class		
21-Jan	Molecular Methods of Detection I	E. M*	13
23-Jan	Molecular Methods of Detection II	Handouts	
26-Jan	<i>Student Led Discussion on Sampling</i>	Papers****	
28-Jan	<i>Student Led Discussion on Detection</i>	Papers****	
30-Jan	Handwashing/Antisepsis/PPE	Handouts	
2-Feb	Water and Wastewater Treatment	E. M*	21,22
4-Feb	<i>Student Led Discussion on Host Control</i>	Papers****	
6-Feb	HVAC Controls/Filtration of Air/BSCs	Handouts	
9-Feb	Midterm Exam		
11-Feb	Control and Prevention of Foodborne Disease	Handouts	
13-Feb	Antimicrobial Use and Resistance/Vaccination	Handouts	
16-Feb	Holiday-President's Day-No class		
18-Feb	<i>Student Led Discussion on Containment and Removal</i>	Papers****	
20-Feb	Principle of Disinfection, sterilization and Preservation	D.S.P**	3, 4
23-Feb	Disinfection Classes (Chemical and Physical)	D.S.P**	8,13,14,36,37
25-Feb	Kinetics of Disinfection	W. E***	12
27-Feb	Media-Specific Disinfection (Air and Surface)	Handouts	
2-Mar	Decontamination of Infectious Wastes	Handouts	
4-Mar	<i>Student Led Discussion on Disinfection</i>	Papers****	
6-Mar	<i>Student Led Discussion on Control of Microbial Exposures in the Workplace</i>	Papers****	
9-Mar	Laboratory Design/Biosafety Practices	E. M*	5
11-Mar	<i>Student Led Discussion on Clinical Hygiene/Institutional Infection Control</i>	Papers****	
13-Mar	<i>Review</i>		

\* Environmental Microbiology.

\*\* Disinfection, Sterilization, and Preservation

\*\*\* Wastewater Engineering.

\*\*\*\* Student chosen papers

## COURSE RULES

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