



THE OHIO STATE UNIVERSITY

COLLEGE OF PUBLIC HEALTH

PUBHEHS 5335
Ecology of Infectious Diseases
3 credit hours – Spring, 2020

Instructor: Dr. Laura Pomeroy
Email: pomeroy.26@osu.edu
Office location: 380G Cunz Hall
Phone number: 614.292.2942
Office hours: Wednesdays 12:00 noon to 1:00 pm (and by appointment)

Class Time: Tuesdays and Thursdays; 12:45 pm to 2:05 pm

Course description: Ecology of infectious diseases is a scientific field that studies the relationships between pathogens, humans, other animal species, and the environment. This course provides an introduction to the ecology of infectious diseases suitable for undergraduate students, graduate students, and professional students. We will investigate infectious disease transmission and control in single- and multi-host systems and for vector-borne diseases. We will also cover variation in time and place, emerging diseases, and reemerging vaccine-preventable diseases. Case studies will focus on infectious diseases that affect humans, livestock, and wildlife and will include measles, rabies, hantavirus, West Nile virus, and Lyme disease.

Class Format: This course will include lectures, in-class exercises, reading assignments, case study assignments, a final oral presentation, and a final written report.

Prerequisites: Biology 1101, 1113, or equivalent course; or permission of instructor.

Course Objectives: Upon successful completion of the course, students will be able to:

1. Describe general concepts in the field of Ecology of Infectious Diseases, including population-level transmission, disease control, environmental effects, variation through time, and variation by location.
2. Recognize differences in transmission and control among single-host, multi-host, and vector-borne infectious disease systems.
3. Distinguish effects of host population dynamics and environmental factors on infectious disease transmission and control.
4. Examine a population-level model of infectious disease transmission and control.
5. Critique case studies of pathogens affecting wildlife, livestock, and human populations.
6. Investigate a current problem in infectious disease ecology using the scientific method, data, and findings from primary sources or journal articles.

Foundational Public Health Knowledge (for MHA, MPH, MS and PhD Degrees in CPH):

- Explain the role of quantitative & qualitative methods and sciences in describing and assessing a population's health (3)
- List major causes and trends of morbidity & mortality in the US or other community relevant to the school or program (4)
- Discuss the science of primary, secondary and tertiary prevention in population health, including health promotion, screening, etc. (5)
- Explain the critical importance of evidence in advancing public health knowledge (6)
- Explain effects of environmental factors on a population's health (7)
- Explain biological and genetic factors that affect a population's health (8)
- Explain how globalization affects global burdens of disease (11)
- Explain an ecological perspective on the connections among human health, animal health and ecosystem health (e.g., One Health) (12)

Foundational Competencies (for MPH Degrees in CPH):

- Interpret results of data analysis for public health research, policy or practice (4)
- Discuss multiple dimensions of the policy-making process, including the roles of ethics and evidence (12)
- Communicate audience-appropriate public health content, both in writing and through oral presentation (19)
- Apply systems thinking tools to a public health issue (22)

Foundational Domains (for BSPH degree in CPH):

- The basic concepts, methods and tools of public health data collection, use and analysis and why evidence-based approaches are an essential part of public health practice (2)
- The concepts of population health, and the basic processes, approaches and interventions that identify and address the major health-related needs and concerns of populations (3)
- The underlying science of human health and disease, including opportunities for promoting and protecting health across the life course (4)
- The socioeconomic, behavioral, biological, environmental and other factors that impact human health and contribute to health disparities (5)
- Basic concepts of public health-specific communication, including technical and professional writing and the use of mass media and electronic technology (9)

Foundational Competencies (for BSPH degree in CPH):

- The ability to communicate public health information, in both oral and written forms, through a variety of media and to diverse audiences (1)
- The ability to locate, use, evaluate and synthesize public health information (2)

Cross-Cutting Concepts/Experiences (for BSPH degree in CPH):

- Community dynamics (2)
- Critical thinking and creativity (3)
- Ethical decision making as related to self and society (5)
- Independent work and a personal work ethic (6)
- Professionalism (9)
- Research methods (10)
- Systems thinking (11)

Specialization Competencies (for BSPH degree in Environmental Public Health in CPH):

- Apply principles of math, chemistry, biology to applied science of environmental public health (1)
- Summarize management, technical measures and approaches to reduce and prevent environmentally related human diseases (3)

Text/Readings

There is no required textbook. The readings will consist of journal articles and technical websites that will be provided through Carmen.

Assignments

There are seven types of graded assignments for this course.

- A. Weekly comprehension quizzes will be administered through Carmen. Students should complete the weekly readings and attend both class sessions before taking the quiz. Quizzes will be available after class each Tuesday and remain available for the remainder of the semester. Students can refer to any class materials (readings, lecture notes, etc.) while taking the quiz. Students are required to take each quiz once but can re-take the quiz as many times as desired. The grade assigned will be the highest grade earned on any quiz attempt. There will be 12 quizzes that each contain 5 to 10 multiple choice or short answer questions.
- B. There will be seven assignments. Two will introduce students to disease ecology. They are:
- a one-page list of definitions for field-specific terms (due 1/23)
 - a three-slide presentation on accessibility, strengths, and weaknesses of a specific surveillance data source assigned in class (due 1/30)

Five assignments are lab-style write-ups of exercises conducted in class. Students will address a list of questions using short answers, graphs, etc. and the final document for each assignment will be approximately two pages in length. These three assignments are:

- a write up of the SIR model exercise (due 2/6)
- a write up of the NEON small mammal trapping data analysis (due 2/13)
- a write up of the NEON rodent-borne pathogen data analysis (due 2/20)
- a write up of the NEON communities biodiversity analysis (due 2/27)
- a write up of the NEON tick-borne pathogen data analysis (due 3/5)

Additional details will be provided for each assignment during the course. All assignments will be submitted through Carmen. I encourage students to discuss the assignments with each other. However, please note that these are individual assignments, and the final submission must be the work of the individual submitting the assignment. Plagiarism will not be tolerated!

- C. Graduate students will work together to write a research-based journal article. Students will investigate the rodent-hantavirus system and use NEON data and primary peer-reviewed literature to conduct an in-depth case study on that system. The goal of this project is to answer a question about the disease or its control. Graduate students will each submit their own draft sections and we will work together in class to combine them into a single document. Each graduate student should submit a one-page (single-spaced) draft introduction section, due 3/26. Each graduate student should also submit a one-page (single-spaced) draft methods section, due 4/2. Finally, graduate students should submit a one-page (single-spaced) results section, due 4/9. All draft sections will be submitted through Carmen. In class, we will review, edit, and combine the individually written sections. The final project will be presented orally and as a group during the last class session (4/16). Additional details will be provided during the course.
- D. Undergraduate students are required to attend group project presentations during the final class session and complete a peer-review for each group presentation. Undergraduate students will complete the peer-reviews by completing a paper survey during class.
- E. If undergraduate students choose, they may write a two-page review of a peer-reviewed journal article describing novel research in infectious disease ecology. The grade earned on this assignment can substitute for the lowest grade earned on one of the seven assignments (B).

Students can use the in-class group work sessions during the last third of the course to work on this assignment and consult with Dr. Pomeroy. Additional details will be provided during the course. This assignment will be submitted through Carmen and is due the last day of class.

Graduate and professional students are required complete assignments A – C as described above. They may not complete assignments D nor E.

Undergraduate students are required to complete assignments A – B and D as described above. They may not complete assignment C. Undergraduates have the option to complete assignment E. If assignment E is completed, the grade earned can be substituted for the lowest grade earned on a single writing assignment (B).

Grading

Table 1. Grade distribution for graduate and professional students

Assignment Type	Number of assignments	Points per assignment	Points for this assignment type	Percentage of final grade
Quizzes (A)	12	10	120	12%
Assignments (B)	7	60	420	42%
Draft manuscript sections (C)	3	66	198	19.8%
Final project presentation (C)	1	262	262	26.2%
Total			1000	100%

Table 2. Grade distribution for undergraduate students

Assignment Type	Number of assignments	Points per assignment	Points for this assignment type	Percentage of final grade
Quizzes (A)	12	10	120	12%
Assignments (B)	7	100	700	70%
Presentation peer-reviews (D)	1	180	180	18%
Total			1000	100%

Grading Scale:

A = 93.0 - 100

A- = 90.0 - 92.9

B+ = 87.0 - 89.9

B = 83.0 - 86.9

B- = 80.0 - 82.9

C+ = 77.0 - 79.9

C = 73.0 - 76.9

C- = 70.0 - 72.9

D+ = 67.0 - 69.9

D = 60.0 - 66.9

E = Below 60

Exams

There are no exams in this course.

Carmen

There will be a Carmen site for this course where all readings, lecture materials, and assignments will be posted. Students should submit all assignments on this site.

Class Policies

All students are expected to be present for each class. Please contact the instructor in advance if you cannot be present on a particular day. Attendance is required for the final presentations.

Office of Student Life: Disability Services

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office of Student Life: Disability Services at 614-292-3307 in Room 098 Baker Hall 113 W. 12th Ave. to coordinate reasonable accommodations for students with documented disabilities (<https://slds.osu.edu/>).

Mental Health Services

As a student, you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting ccs.osu.edu or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at 614-292-5766 and 24-hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Academic integrity

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University, the College of Public Health, and the Committee on Academic Misconduct (COAM) expect that all students have read and understood the University's *Code of Student Conduct* and the School's *Student Handbook*, and that all students will complete all academic and scholarly assignments with fairness and honesty. The *Code of Student Conduct* and other information on academic integrity and academic misconduct can be found at the COAM web pages (<https://oaa.osu.edu/academic-integrity-and-misconduct>). Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct*, the *Student Handbook*, and in the syllabi for their courses may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Please note that the use of material from the Internet without appropriate acknowledgement and complete citation is plagiarism just as it would be if the source were printed material. Further examples are found in the *Student Handbook*. Ignorance of the *Code of Student Conduct* and the *Student Handbook* is never considered an "excuse" for academic misconduct.

If I suspect a student of academic misconduct in a course, I am obligated by University Rules to report these suspicions to the University's Committee on Academic Misconduct. If COAM determines that the student has violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in the course and suspension or dismissal from the University. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Course Outline

Week	Week topics	Session	Session topics	Readings to be completed before class	Assignments (Due Dates)
1	Introduction & overview	Tue 1/7	Introduction and course overview		Quiz #1 (1/14)
		Thu 1/9	Host-pathogen dynamics: PANDEMIC! game	Disease ecology by Kilpatrick & Altizer (2010)	
2	Pathogens & transmission	Tue 1/14	Viruses, bacteria, parasites, and transmission	Are viruses alive?	Quiz #2 (1/21)
		Thu 1/16	Epidemics, endemics, and seasonality	The calendar of epidemics by Martinez (2018)	Definitions write-up (1/23)
3	Data	Tue 1/21	Sources and types of infectious disease data	Infectious disease surveillance by Simonsen et al (2016)	Quiz #3 (1/28)
		Thu 1/23	Case study: CDC reportable diseases	Readers' guide to CDC data	Disease data slides (1/30)
4	Immunity	Tue 1/28	Disease control and herd immunity	Rethinking herd immunity	Quiz #4 (2/4)
		Thu 1/30	Systems thinking tool: SIR models	Chapter 1 from Keeling and Rohani (2008)	SIR model write-up (2/6)
5	Ecological concepts	Tue 2/4	Populations, communities, and ecosystems	A mouse is a mouse? Guess again.	Quiz #5 (2/11)
		Thu 2/6	Case study: NEON small mammal trapping data	Small mammals	Mammals write-up (2/13)
6	Host heterogeneity	Tue 2/11	Cross-species transmission	Assembling evidence for identifying reservoirs of infection	Quiz #6 (2/18)
		Thu 2/13	Case study: NEON rodent-borne pathogen data	Rodent pathogen data user guide	Pathogens write-up (2/20)
7	Biodiversity	Tue 2/18	Dilution or amplification debate	Biodiversity and transmission in small mammals	Quiz #7 (2/25)
		Thu 2/20	Case study: quantifying NEON communities	Small mammal data user guide	Biodiversity write-up (2/27)
8	Environment	Tue 2/25	Mosquito-borne and tick-borne pathogens	Environmental factors and Zika	Quiz #8 (3/3)
		Thu 2/27	Case study: NEON tick-borne pathogen data	"Of mice and mast" by Ostfeld et al. (1996)	Tick pathogens write-up (3/5)
9	Current issues	Tue 3/3	Emerging diseases: Ebola, Zika, and influenza	Ebola in Congo	
		Thu 3/5	Reemerging vaccine-preventable diseases	Questions raised about pertussis reemergence	
10	Spring Break	Tue 3/10	No class		
		Thu 3/12	No class		
11	Project Intro	Tue 3/17	Introduction	<i>* forthcoming *</i>	Quiz #9 (3/24)
		Thu 3/19	In-class group work session		*Draft introduction (3/26)
12	Project Methods	Tue 3/24	Methods	<i>* forthcoming *</i>	Quiz #10 (3/31)
		Thu 3/26	In-class group work session		*Draft methods (4/2)
13	Project Results	Tue 3/31	Results	<i>* forthcoming *</i>	Quiz #11 (4/7)
		Thu 4/2	In-class group work session		*Draft results (4/9)
14	Project Discussion	Tue 4/7	Discussion	<i>* forthcoming *</i>	Quiz #12 (4/14)
		Thu 4/9	In-class group work session		*Group presentation (4/16)
15	Project Presentation	Tue 4/14	In-class group work session		
		Thu 4/16	Student presentations		*Presentations; ^reviews

* only grad/prof students complete these assignments

^ only undergrads complete this assignment

Alignment of Course Objectives, Foundational Knowledge, Competencies, Domains, and Cross-Cutting Concepts

Week	Topic	Assessments	Course Learning Objectives	Foundational Public Health Knowledge (MHA, MPH, MS, PhD)	Foundational Competencies (MPH)	Foundational Domains (BSPH)	Foundational Competencies (BSPH)	Cross-cutting Concepts (BSPH)	Specialization Competencies (BSPH-EHS)
1	Introduction & overview	Quiz	1	4,8,11,12	19	2,3,4,5	1,2	9,11	1
2	Pathogens & transmission	Definitions, quiz	1,2,3,5	3,4,6,8	4	3,4,5	1,2	3,6,11	1
3	Data	Data presentation, quiz	1,2,3,5	3,5,6,8	4,19	2,3,4,5,9	1,2	3,6,9,10,11	1
4	Immunity	SIR model write-up, quiz	1,2,3,4,5	3,5,6,7,8,12	4,12,19,22	2,3,4,5,9	1,2	3,6,10,11	1,3
5	Ecological concepts	Mammals data write-up, quiz	1,2,3	3,6,8	4,12,19	2,3,4,5	1,2	2,3,6,10,11	1
6	Host heterogeneity	Mammal pathogen write-up, quiz	1,2,3,5	3,6,7,8,12	4,19	2,3,4,5	1,2	2,3,6,10,11	1
7	Biodiversity	Biodiversity write-up, quiz	1,2,3,5	3,6,7,8,12	4,19	2,3,4,5	1,2	2,3,6,10,11	1
8	Environment	Tick pathogens write-up, quiz	1,2,3,5	3,6,7,8,12	4,12	2,3,4,5	1,2	2,3,10,11	1
9	Current Issues	Quiz	2,3,5	3,6,7,8,11,12	4,12,19	3,4,5	1,2	5,6,11	1,3
11-14	Group projects	Project ideas, methods proposal, weekly quizzes	1,2,3,4,5,6	3,4,5,6,7,8,12	4,12,19	2,3,4,5,9	1,2	2,3,6,9,10,11	1
15	Presentations	Presentations, final project write-up, peer-reviews	1,2,3,4,5,6	3,4,5,6,7,8,12	4,12,19	2,3,4,5,9	1,2	2,3,6,9,10,11	1