

SEMESTER AT SEA COURSE SYLLABUS

Colorado State University, Academic Partner

Voyage:	Fall 2019
Discipline:	Botany/Zoology
Course Number and Title:	BZ 418 Ecology of Infectious Diseases
Division:	Upper
Faculty Name:	Dr. Kate Huyvaert
Semester Credit Hours:	4

Prerequisites: One (1) upper division Ecology course

COURSE DESCRIPTION

Emerging infectious diseases – those diseases that we see occurring at new, higher rates or in new places – are important for their impacts on the health of humans, domestic animals, and wildlife around the world. In this course, we will examine the basic principles and theory of disease ecology including the distribution and environmental determinants of disease, disease control, and the medical detective work required to better understand when, where, why and how infectious diseases emerge and spread in and among human, veterinary, and wildlife systems. We will use a One Health approach to learn how interdisciplinary collaborations can create innovative solutions to health issues at the crossroads of people, animals, and the environment. The Semester-at-Sea voyage will allow students to study global patterns of infectious disease emergence and to witness the impacts that global environmental change is having on health and disease.

LEARNING OBJECTIVES

- 1) Learn basic concepts and methods of epidemiology and disease ecology.
- 2) Understand concepts of disease transmission and emergence.
- 3) Be conversant in the One Health approach to the health of animals, people, and the environment.

REQUIRED TEXTBOOK

AUTHOR: Marta L. Wayne and Benjamin M. Bolker
TITLE: Infectious Disease: A Very Short Introduction
PUBLISHER: Oxford University Press
ISBN #: 978-0-19-968893-7
DATE/EDITION: 2015/ 1st

Supplies: Small (e.g., 4"x6" or 4 5/8"x7") field notebook/journal

TOPICAL OUTLINE OF COURSE

Depart Amsterdam, The Netherlands – September 9

A1–September 11: Building Blocks: Defining Disease & Its Etiology

Topic: Introduction; What is disease?

Readings: Wayne & Bolker, Ch. 1

A2–September 13: Building Blocks: Defining Disease & Its Etiology

Topic: What causes disease? How do we study disease?

Readings: None

Assignment: Upcoming: Epi- Journal Entry 1

Gdansk, Poland – September 15-20

A3–September 21: Building Blocks: Disease Ecology Vocabulary

Topic: What is ecology? What is disease ecology (and why should we care)?

Readings: Keesing & Ostfeld 2012

Assignment: Epi- Journal Entry 1

A4–September 23: Building Blocks: Disease Ecology Vocabulary

Topic: Epidemiology I (Intro to epidemiology, epidemic curves, case & cause, burden of proof, false positives & true negatives)

Readings: Wayne & Bolker, Ch. 2; Messerli 2012

Assignment: DISCUSSION #1 prep

A5–September 25: Building Blocks: Disease Ecology Vocabulary

Topic: DISCUSSION #1: Disease ecology

Readings: Daszak et al. 2000; Mind maps

Assignment: DISCUSSION #1: Disease ecology; Upcoming: Epi- Journal Entry 2

Lisbon, Portugal – September 26-28 – Field Class # 1 on Day 3

Cadiz, Spain – September 29 – October 1

A6–October 3: Host Physiology and Disease

Topic: Eco-immunology, Consequences of disease for hosts (sickness, fitness effects)

Readings: Hedrick 2017

Assignment: Epi – Journal Entry 2

A7–October 5: Host-Pathogen Relationships

Topic: Virulence, host-pathogen co-evolution

Readings: Wayne & Bolker, Ch. 3

Assignment: Upcoming: Epi – Journal Entry 3

Dubrovnik, Croatia – October 6-10

A8—October 12: Host-Pathogen Relationships

Topic: DISCUSSION #2: Virulence & co-evolution

Readings: Ewald 1995

Assignment: DISCUSSION #2: Virulence & co-evolution; Epi-Journal Entry 3

A9—October 14: Host Population Dynamics

Topic: Epidemiology II (SIR Models)

Readings: Revisit Wayne & Bolker, Ch. 2

Assignment: Upcoming: Epi-Journal Entry 4

Casablanca, Morocco – October 15-20

A10—October 22: Host-Pathogen-Environment Interactions

Topic: Modes of Transmission; Vectors

Readings: Wayne & Bolker Ch. 4

Assignment: Epi-Journal Entry 4

A11—October 25: Host-Pathogen-Environment Interactions

Topic: Human-animal interfaces; zoonotic disease; emerging infectious disease

Readings: Quammen, Section 4 (pp. 165-208)

A12—October 27: EXAM 1

Topic: EXAM 1

Assignment: EXAM 1; Upcoming: Epi-Journal Entry 5

Tema, Ghana – October 28-30

Takoradi, Ghana – October 31 – November 1

A13—November 3: Host-Pathogen-Environment Interactions

Topic: Prevention, Control, and Managing Disease

Readings: Joseph et al. 2013

Assignment: Epi-Journal Entry 5

A14—November 6: Host-Pathogen-Environment Interactions

Topic: DISCUSSION #3: Emerging infectious diseases

Readings: Brower 2018

Assignment: DISCUSSION #3: Emerging infectious diseases

Community Programming – November 6 (No Class)

A15—November 8: Community & Ecosystem Relationships

Topic: Community ecology, ecosystem services, & disease

Readings: Johnson et al. 2015

Assignment: Upcoming: Epi-Journal Entry 6

Salvador, Brazil – November 10-15

A16–November 16: Community & Ecosystem Relationships

Topic: Deforestation & disease

Readings: Burkett-Cadena & Vittor 2018

Assignment: Epi-Journal Entry 6; Prep Discussion #4

A17–November 18: Community & Ecosystem Relationships

Topic: DISCUSSION #4: Biodiversity & disease

Readings: (Patil et al. 2017); Ostfeld and Keesing 2017; Wood et al. 2017

Assignment: DISCUSSION #4: Biodiversity & disease

A18–November 20: Community & Ecosystem Relationships

Topic: Urbanization & disease

Readings: Hassell et al. 2017

Community programming – November 21 (No Class)

A19–November 23: Community & Ecosystem Relationships

Topic: Climate change & disease

Readings: Wayne & Bolker, Ch. 6

Assignment: Upcoming: Epi-Journal Entry 7

Port of Spain, Trinidad and Tobago – November 24

A20–November 26: Bringing it All Together

Topic: Concepts in One Health

Readings: Cunningham et al. 2017; Wayne & Bolker, Ch. 7

Assignment: Epi-Journal Entry 7

A21–November 28: Bringing it All Together

Topic: PROJECT WORK DAY

Readings: None

Assignment: PROJECT WORK DAY

A22–December 1: Bringing it All Together

Topic: DISCUSSION #5: Globalization & Disease

Readings: Rogalski et al. 2017

Assignment: DISCUSSION #5: Globalization & Diseases; FILM REVIEW DUE

Guayaquil, Ecuador – December 2-7

A23–December 9: CLASS PROJECT PRESENTATION

Topic: CLASS PROJECT PRESENTATION

Assignment: CLASS PROJECT PRESENTATION; Upcoming: Epi-Journal Synthesis

Puntarenas, Costa Rica – December 11-15 – Field Class #2 on Day 2

A24—December 16: Bringing it All Together

Topic: Infectious diseases in the future; What role should ecology play?

Readings: Wayne & Bolker, Ch. 8; Pongsiri et al. 2009

Assignment: Epi-Journal Synthesis Essay

A25—December 19: Final Exam

Arrive San Diego, California — December 23

FIELD WORK

Semester at Sea field experiences allow for an unparalleled opportunity to compare, contrast, and synthesize the different cultures and countries encountered over the course of the voyage. In addition to the one field class, students will complete independent field assignments that span multiple countries.

Field Classes

This course has two field classes. The first field class is on **Saturday, September 28, in Lisbon, Portugal** and the second field class for this course is on **Thursday, December 12 in Puntarenas, Costa Rica.**

Field Class attendance is mandatory for all students enrolled in this course. Do not book individual travel plans or a Semester at Sea sponsored trip on the day of your field class. Field Classes constitute at least 20% of the contact hours for each course, and are developed and led by the instructor.

Field Class #1: Water is Life: Key Concepts in Epidemiology and Disease Spread

While we all know that “Water is life”, the first epidemiologist, John Snow, showed us that water can also be deadly through the transmission of deadly disease pathogens at water sources. During this first field class to the architectural marvel that is the Lisbon Aqueduct, we will consider the importance of clean water and clean ways to get water in preventing infectious diseases so that we can deepen our understanding of key concepts in epidemiology and disease transmission.

The objectives of this field class will be to:

- 1) Observe the architecture of the Lisbon Aqueduct and consider the design elements needed to obtain, deliver, and store clean water;
- 2) Reflect on the ways that water contributes to the prevention and spread of infectious disease;
- 3) Using waterborne pathogens as examples, formalize our understanding of key epidemiological and disease ecology concepts.

Field Class #2: Animals, People, and Places: One Health in Paradise

One Health is the concept that the health of animals, people, and the places we all share depends on an integrated approach that transcends any one discipline or group. During this field class, we will deepen our understanding of the ways that humans and animals can and do interact as these are the interfaces where shared disease transmission can occur through visits to Parque Nacional Braulio Carillo and the Toucan Rescue Ranch. During our visits, we will connect with different practitioners to talk about the challenges and rewards of working towards a 'One Healthier' world.

The objectives of this field class will be to:

- 1) Collect observational data on interactions among people, wildlife, and domestic animals;
- 2) Reflect on the ways that these interactions can lead to infectious disease transmission;
- 3) Formulate an understanding of the One Health concept based on observations and conversations with practitioners; and
- 4) Evaluate whether One Health is a useful concept for wildlife conservation, domestic animal health, and public health.

Independent Field Assignments

'Epi-' Field Journal

Throughout the voyage, students will receive journaling prompts about infectious disease-related issues relevant to the ports of call. Prompts will require students to reflect on their observations of infectious disease ecology and the epidemiological principles being covered in the class while visiting each port and during the Field Classes. The journal entries will culminate in a final synthesis essay assignment about their development as 'disease detectives' throughout the voyage with particular emphasis on the Field Classes. The field journal and synthesis essay will be due on December 16, 2019.

METHODS OF EVALUATION

Discussions

While discussion and conversation about the material will be expected throughout the course, we will have five formal, in-class discussions focused on papers from the scientific literature. Typically, a team of 2-3 students will be assigned to lead each discussion section. The lead students are expected to submit 3-5 discussion questions on the reading for posting on Moodle no later than the class period before the discussion. Students in the course must come to each discussion section prepared to discuss these questions and other elements of the paper. At the start of the discussion, the lead students will provide a concise overview of the paper. In the summary, leaders should: 1) review the major points of the paper, 2) highlight novel results and conclusions, 3) relate the paper to other readings or discussions in class or your own knowledge, and 4) raise questions or objections you have with the methods, results, and/or conclusions. Following the summary, the lead students should then be prepared to actively generate and facilitate discussion for the rest of the allocated time which can include debates, hands-on activities, or other exercises that are designed so that the whole class participates in learning more about the topic under

discussion. You will be assigned a grade for leading the discussion and discussion participation is expected for everyone in the class.

Film Review

Infectious diseases are featured heavily in the movies and other popular culture outlets in part because infectious diseases can be portrayed in the movies with a heavy dose of mystery and a dash of fiction. As students of infectious disease ecology, you'll view two of a selection of movies about infectious disease over the course of the voyage and write a short, critical review of each in which you sort fact from fiction using the disease investigative skills that you develop in this course. Additional details on the essay assignment will be provided in class.

Class Project

Places where many people come together (like cruise ships, schools, theaters) are ideal locations for disease transmission because people are in close contact and the size of the population is typically larger than the 'critical community size' needed to maintain active transmission. Using Glo-germ powder, liquid, or gel (<http://www.glogerm.com/>) as a stand in for an infectious pathogen, we will craft a research question and hypotheses about pathogen transmission, design tests of the predictions of the hypotheses, and collect data during the voyage together as a class. After data collection and analysis, students in the class will present their findings to the shipboard community and will write up the study for submission to a peer-reviewed scientific journal. Students in the class will serve as the research team with all members participating; we will spend time during class sessions to develop the research project and to organize data collection and analysis. Throughout the voyage, students will collect data in sessions outside of the classroom.

<u>Assignment</u>	<u>% Final Grade</u>
Discussions	20%
'Epi-'Field Journal*	20%
Exams (2@10% each)	20%
Film Review	10%
Class Project (or Perspectives Paper)	25%
Participation and Attendance	5%

*Students not participating in the field class will lose credit for the 'Epi-' field journal entries, totaling 20% of the final grade.

GRADING SCALE

The following Grading Scale is utilized for student evaluation. Pass/Fail is not an option for Semester at Sea coursework. Note that C-, D+ and D- grades are also not assigned on Semester at Sea in accordance with the grading system at Colorado State University (the SAS partner institution).

Pluses and minuses are awarded as follows on a 100% scale:

<u>Excellent</u>	<u>Good</u>	<u>Satisfactory/Poor</u>	<u>Failing</u>
97-100%: A+	87-89%: B+	77-79%: C+	Less than 60%: F
93-96%: A	83-86%: B	70-76%: C	
90-92%: A-	80-82%: B-	60-69%: D	

ATTENDANCE/ENGAGEMENT IN THE ACADEMIC PROGRAM

Attendance in all Semester at Sea classes, including the Field Class, is mandatory. Students must inform their instructors prior to any unanticipated absence and take the initiative to make up missed work in a timely fashion. Instructors must make reasonable efforts to enable students to make up work which must be accomplished under the instructor's supervision (e.g., examinations, laboratories). In the event of a conflict in regard to this policy, individuals may appeal using established CSU procedures.

LEARNING ACCOMMODATIONS

Semester at Sea provides academic accommodations for students with diagnosed learning disabilities, in accordance with ADA guidelines. Students who will need accommodations in a class, should contact ISE to discuss their individual needs. Any accommodation must be discussed in a timely manner prior to implementation.

A letter from the student's home institution verifying the accommodations received on their home campus (dated within the last three years) is required before any accommodation is provided on the ship. Students must submit this verification of accommodations to academic@isevoyages.org as soon as possible, but no later than two months prior to the voyage.

STUDENT CONDUCT CODE

The foundation of a university is truth and knowledge, each of which relies in a fundamental manner upon academic integrity and is diminished significantly by academic misconduct. Academic integrity is conceptualized as doing and taking credit for one's own work. A pervasive attitude promoting academic integrity enhances the sense of community and adds value to the educational process. All within the University are affected by the cooperative commitment to academic integrity. All Semester at Sea courses adhere to this Academic Integrity Policy and Student Conduct Code.

Depending on the nature of the assignment or exam, the faculty member may require a written declaration of the following honor pledge: "I have not given, received, or used any unauthorized assistance on this exam/assignment."

RESERVE BOOKS FOR THE LIBRARY

AUTHOR: David Quammen
TITLE: *Spillover*
PUBLISHER: W.W. Norton and Company, Inc.
ISBN #: 978-0-393-06680-7
DATE/EDITION: 2012/1st

AUTHOR: Marta L. Wayne and Benjamin M. Bolker
TITLE: *Infectious Disease: A Very Short Introduction*
PUBLISHER: Oxford University Press
ISBN #: 978-0-19-968893-7
DATE/EDITION: 2015/ 1st

AUTHOR: Pamela Nagami, MD
TITLE: *The Woman With A Worm in Her Head*
PUBLISHER: St. Martin's Press
ISBN #: 978-0-312-30601-4
DATE/EDITION: 2001/1st

AUTHOR: Richard S. Ostfeld, Felicia Keesing, and Valerie T. Eviner (editors)
TITLE: *Infectious Disease Ecology*
PUBLISHER: Princeton University Press
ISBN #: 978-0-691-12484-1 (this is hardback, paper is also fine)
DATE/EDITION: 2008/1st

FILM REQUEST

*Film is in Semester at Sea collection, CSU Libraries, August, 2018

Title of Film: And the Band Played On*
Distributor: HBO Home Video

Title of Film: Contagion*
Distributor: Warner Bros.

Title of Film: Dallas Buyers Club
Distributor: Focus Features

Title of Film: I Am Legend
Distributor: Warner Bros.

Title of Film: Outbreak
Distributor: Warner Bros.

Title of Film: The Painted Veil*
Distributor: Warner Home Video

ELECTRONIC COURSE MATERIALS

AUTHOR: Quammen, David

ARTICLE/CHAPTER TITLE:

JOURNAL/BOOK TITLE: *Spillover*

VOLUME: not applicable

DATE: 2012 / 1st edition

PAGES: Section 4, pages 165-208

ADDITIONAL COURSE MATERIALS (Works in the peer-reviewed literature):

- 1) Brower, J. L. (2018). "The Threat and Response to Infectious Diseases (Revised)." *Microb Ecol* 76(1): 19-36.
- 2) Burkett-Cadena, N. D. and A. Y. Vittor (2018). "Deforestation and vector-borne disease: Forest conversion favors important mosquito vectors of human pathogens." *Basic and Applied Ecology* 26: 101-110.
- 3) Cunningham, A. A., P. Daszak and J. L. N. Wood (2017). "One Health, emerging infectious diseases and wildlife: two decades of progress?" *Philos Trans R Soc Lond B Biol Sci* 372(1725).
- 4) Daszak, P., A. A. Cunningham and A. D. Hyatt (2000). "Emerging infectious diseases of wildlife - threats to biodiversity and human health." *Science* 287: 443-449.
- 5) Ewald, P. W. (1995). "The evolution of virulence: A unifying link between parasitology and ecology." *Journal of Parasitology* 81(5): 659-669.
- 6) Hassell, J. M., M. Begon, M. J. Ward and E. M. Fevre (2017). "Urbanization and Disease Emergence: Dynamics at the Wildlife-Livestock-Human Interface." *Trends Ecol Evol* 32(1): 55-67.
- 7) Hedrick, S. M. (2017). "Understanding Immunity through the Lens of Disease Ecology." *Trends Immunol* 38(12): 888-903.
- 8) Johnson, P. T. J., J. C. de Roode and A. Fenton (2015). "Why infectious disease research needs community ecology." *Science* 349(6252).
- 9) Joseph, M. B., J. R. Mihaljevic, A. L. Arellano, J. G. Kueneman, D. L. Preston, P. C. Cross, P. T. J. Johnson and E. Morgan (2013). "Taming wildlife disease: bridging the gap between science and management." *Journal of Applied Ecology* 50(3): 702-712.
- 10) Messerli, F. H. (2012). "Chocolate Consumption, Cognitive Function, and Nobel Laureates." *The New England Journal of Medicine*.
- 11) Ostfeld, R. S. and F. Keesing (2017). "Is biodiversity bad for your health?" *Ecosphere* 8(3).
- 12) Pongsiri, M. J., J. Roman, V. O. Ezenwa, T. L. Goldberg, H. S. Koren, S. C. Newbold, R. S. Ostfeld, S. K. Pattanayak and D. J. Salkeld (2009). "Biodiversity Loss Affects Global Disease Ecology." *BioScience* 59(11): 945-954.
- 13) Rogalski, M. A., C. D. Gowler, C. L. Shaw, R. A. Hufbauer and M. A. Duffy (2017). "Human drivers of ecological and evolutionary dynamics in emerging and disappearing infectious disease systems." *Philos Trans R Soc Lond B Biol Sci* 372(1712).
- 14) Wood, C. L., A. McInturff, H. S. Young, D. Kim and K. D. Lafferty (2017). "Human infectious disease burdens decrease with urbanization but not with biodiversity." *Philos Trans R Soc Lond B Biol Sci* 372(1722).

ADDITIONAL RESOURCES

None