Disease Ecology & Evolution

BIOL 354

Course Instructor

Dr. Doug Woodhams, Office hours: MWF 11:00-12:00 or by appointment Integrated Sciences Complex 5760, Email: <u>dwoodhams@gmail.com</u> or douglas.woodhams@umb.edu

Meeting time and place

MWF 10:00-10:50am University Hall Y03-3370

Required Text

Schmid-Hempel, P. 2011. *Evolutionary Parasitology*.

Available online by searching under "Woodhams": http://voyager.lib.umb.edu/vwebv/e nterCourseReserve.do





Olaf Hajek, The New York Times

"The pathogen is nothing. The terrain is everything." -Louis Pasteur

Disease Ecology and Evolution



SUSCEPTIBLE HOST



Assignments

- 1) Team assignment: Diagrams of pathogens and parasites from a focal host
- 2) Team presentation 1: Choose a wildlife disease and focus on disease causation in terms of host, pathogen, and environmental factors and mode of transmission.
- 3) Exam
- 4) Epidemiological curves and disease models report
- 5) Team presentation 2 on immune defenses
- 6) Writing assignment: How is the "one health" movement changing our perspective on disease?
- 7) Take-home written exam.

As we start each unit, Dr. Woodhams will provide templates for the presentations and assignments, the rubric for grading, and more specific instructions.

Course Description

The ecology and evolution of infectious diseases encompasses interactions among hosts, pathogens and parasites, and their environments. Disease emergence, including zoonotic diseases spread from wildlife to humans, is increasing with ecological change. Thus, prediction and prevention of disease outbreaks depends on understanding not only human and veterinary medicine, but also the ecological and evolutionary framework.

Students will be given an overview of the variety and ubiquity of disease systems, and introduced to conceptual and theoretical underpinnings of disease causation, transmission, emergence, management, and host-parasite coevolution. Because the field is highly interdisciplinary, we will study basic principles of comparative and ecological immunology, parasitology, microbial ecology, epidemiology and spatial modeling, genetics and genomics, and current methodological approaches to disease ecology research in marine, freshwater, and terrestrial systems.

This course includes a strong writing component, as well as team projects and studentled discussions of primary literature. Students involved in disease-related research may choose to utilize assignments to advance their research goals.



Grading Scale

Grade	Grade points	Percentage
А	4.0	94-100
A-	3.7	90-93
B+	3.3	87-89
В	3	83-86
B-	2.7	80-82
C+	2.3	77-79
С	2	73-76
C-		70-72
D+	1.3	67-69
D		63-66
D-		60-62
F	0	Below 60

The final grade will be given as a letter based on a percentage of 200 points, 20 points for each assignment, and 40 points each for participation & exam.



http://www.frontiersinzoology.com/content/8/1/8/abstract

Assignment		.
	Points	Due date
Team diagrams: parasites of focal host	20	Friday 9/15
Team presentation 1: on a wildlife disease	20	Friday 9/22
Exam	20	Friday 10/20
Writing assignment: One Health	10+10	Friday 11/3
Team presentation 2: immune defenses	20	Friday 11/15
Epidemic curves and disease models report	20	Friday 12/1
Participation and summary: journal		
discussion	40	Mondays
Final exam: take-home written exam	40	Monday 12/18
		Wednesday
Extra credit: Book report	10	11/29
Total possible (graded out of 200):	210	



Whoever wishes to investigate medicine properly, should proceed thus: in the first place to consider the seasons of the year, and what effects each of them produces for they are not at all alike, but differ much from themselves in regard to their changes. Then the winds, the hot and the cold, especially such as are common to all countries, and then such as are peculiar to each locality. We must also consider the qualities of the waters, for as they differ from one another in taste and weight, so also do they differ much in their qualities. In the same manner, when one comes into a city to which he is a stranger, he ought to consider its situation, how it lies as to the winds and the rising of the sun; for its influence is not the same whether it lies to the north or the south, to the rising or to the setting sun.

From these things he must proceed to investigate everything else. For if one knows all these things well, or at least the greater part of them, he cannot miss knowing, when he comes into a strange city, either the diseases peculiar to the place, or the particular nature of common diseases, so that he will not be in doubt as to the treatment of the diseases, or commit mistakes, as is likely to be the case provided one had not previously considered these matters. And in particular, as the season and the year advances, he can tell what epidemic diseases will attack the city, either in summer or in winter, and what each individual will be in danger of experiencing from the change of regimen. For knowing the changes of the seasons, the risings and settings of the stars, how each of them takes place, he will be able to know beforehand what sort of a year is going to ensue.

- Airs, Waters and Places, Hippocrates



Disease Ecology and Evolution



The corpse flower, *Rafflesia arnoldii*, is a holoparasite found in the rainforests of Indonesia. The plant is non-photosyntheic and usually parasitizes the vine *Tetrastigma*. Producing the largest flower in the world, the scent of rotting flesh attracts insect pollinators, and tree shrews eat the fruit and disperse seeds.

Learning Objectives

The goals of this course are:

- 1. Introduce students to the interdisciplinary nature of the study of infectious disease.
- 2. To understand the broad ecological and evolutionary impacts on disease.
- 3. To compare human and wildlife diseases, methods of research and analysis, and applications of conservation and health management.
- 4. Students will learn to critically evaluate primary literature, and to lead discussions.
- 5. Students will develop teamwork skills to collectively solve problems.
- 6. Students will strengthen writing, presentation, and teaching skills as a means of attaining knowledge.

Technology policy

Computer programs for learning disease ecology and evolution are great. Texting, emailing, instant messaging and other activities unrelated to class are not great... and not allowed. I will confiscate devices if I must.



Entomopathogenic fungi can manipulate host behavior, are host specific and highly virulent. They are sometimes used as biocontrol agents against plant pests such as locusts.



Useful websites

http://wdin.blogspot.com/ Wildlife Disease News Digest http://eemb40.blogspot.com/ Ecology of Disease course, UC Santa Barbara http://parasiteecology.wordpress.com/ Parasite Ecology blog http://www.cdc.gov/ncezid/ National Center for Emerging and Zoonotic Infectious Diseases http://www.cdc.gov/ Center for Disease Control http://www.wildlifedisease.org Wildlife Disease Association http://microbiology.usgs.gov/wildlife_fish_health.html U.S. Geological Survey - Wildlife Disease http://www.apsnet.org/ The American Phytopathological Society http://bugs.bio.usyd.edu.au/learning/resources/Mycology2/UsesOf_Fungi/primaryProduction/fungi Diseases of Fungi

Extra Credit

Book report due: November 29, 2017





http://lnu.se/research-groups/zee-zoonotic-ecolo

Accommodations for Students with Disabilities:

The University of Massachusetts Boston is committed to providing appropriate academic accommodations for all students with disabilities. If you have a disability and feel you will need accommodations in this course, please contact:

The Ross Center for Disability Services:

Campus Center, Upper Level, Room 211 (617-287-7430).

Website: http://www.umb.edu/academics/vpass/disability/



Course Policies:

- Participation Participation includes completing all required assignments prior to class, thoughtfully participating in discussions, and taking responsibility for helping create a positive learning environment by arriving promptly, listening respectfully, and participating constructively. In particular, students are expected to participate in discussions of readings, and in-class assignments.
- Attendance -- Students are expected to attend all classes. This class is heavy on discussion, and as such, students are expected to be respectful of each others' time and effort. Sick students are expected to bring a note from a doctor. Students who are otherwise prevented from coming to class are expected to bring a note from the relevant party (e.g., if your car is towed, a the relevant ticket).
- Late Work Late work is not accepted unless there is a documented emergency or illness.
- Team Work Several team-based assignments are included in this course. Grades will incorporate individual effort, team success, and peer evaluation. Time will be provided in class for some team exercises, but students may need to meet outside of class to coordinate some assignments.

Academic Integrity and the Code of Student Conduct

Code of Conduct and Academic Integrity

It is the expressed policy of the University that every aspect of academic life, not only formal coursework situations, but all relationships and interactions connected to the educational process shall be conducted in an absolutely and uncompromisingly honest manner. The University presupposes that any submission of work for academic credit is the student's own and is in compliance with University policies, including its policies on appropriate citation and plagiarism. These policies are spelled out in the Code of Student Conduct. Students are required to adhere to the Code of Student Conduct, including requirements for academic honesty, as delineated in the University of Massachusetts Boston Graduate Catalogue and relevant program student handbook(s).

You are encouraged to visit and review the UMass website on *Correct Citation and Avoiding* <u>*Plagiarism:*</u> http://umb.libguides.com/citations

Penalties for academic misconduct in the course, including plagiarism and cheating, are strictly enforced, and the penalties are very serious. Penalties include an F in the assignment or exam, an F in the course, or suspension from the University. If you have questions about what constitutes plagiarism or other forms of academic misconduct, see Prof. Woodhams **before** completing an assignment or exam.

Ignorance of the rules does not excuse any academic conduct violation.

The University defines violations to include, but not be limited to, the following:

- Submitting as one's own an author's published or unpublished work (e.g. material from a journal, internet site, newspaper, encyclopedia), in whole, in part, or in paraphrase, without fully and properly crediting the author.
- Submitting as one's own work or materials obtained from another student, individual, or agency without full and proper attribution.
- Submitting as one's own work material that has been produced through unacknowledged or unauthorized collaboration with others.
- Submitting substantially the same work to more than one course (i.e., dual or multiple submission) without prior approval from all instructors involved.
- Using any unauthorized material during an examination, such as notes, tests, calculators, cell phones, or other electronic devices.
- Obtaining answers to examination questions from another person with or without that person's knowledge; furnishing answers to examination questions to another student; using or distributing unauthorized copies of or notes from an examination.
- Submitting as one's own an examination taken by another person; or taking an examination in another person's place.
- Interfering with an instructor's ability to evaluate accurately a student's competence or performance; misleading any person in connection with one's academic work.

Student Code of Conduct:

http://www.umb.edu/lif e_on_campus/policies/ community/code