BISC 579 Ecology & Evolution of Infectious Disease (EEID) Syllabus

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Office Hours: By appt.
Lecture: 408 Shoemaker Hall; Tu, Th 1:00 – 2:15 pm

Course Description: On a most basic level, this is a class primarily based around problem solving and critical thinking. We will focus on problems related to the ecological and evolutionary processes that drive the transmission of pathogens between hosts; the impact of disease on host populations; and what causes the emergence of an infectious disease. The course content includes a theoretical framework and discussion of wildlife and human diseases.

In this course we will examine and discuss current concepts and trends in infectious disease biology, assessing our basic understanding of human, animal, and (time permitting) plant diseases and their impacts on one another. When new concepts are introduced and a broad view is needed as an introduction, we will be reading selected book chapters and review papers. We will then deepen our understanding of the concepts by reading primary literature, which will be discussed in depth during class time. Articles from the primary and secondary literature have been selected for various reasons, including everything from studies that beautifully illustrate the implementation of the concepts you are learning to studies that present major disagreements amongst researchers in terms of methodology and interpretation.

In recent years there has been an unprecedented rise in the global incidence and severity of infectious diseases in human, animal, and plant populations across nearly all of the world’s terrestrial, aquatic, and marine ecosystems. At the same time, the ways in which we approach the prevention and management of diseases have changed little in the past 50-100 years. It is becoming increasingly clear that the intensification of diseases around the world is, in part, due to human activities, which have brought about habitat transformation, biological invasions, environmental contamination, climate change, and ensuing losses of biodiversity. Although disease outbreaks have historically been studied in relative isolation, the ecological complexities of disease development and spread have been clearly illustrated by such famous examples as the plague, smallpox, and flu epidemics, the Irish potato famine, and more recently, the swine flu epidemic, amphibian chytridiomycosis, white nose disease of bats, Tasmanian devil facial tumor disease, bee colony collapse disease, various forest declines, SARS, Lyme disease, West Nile virus and now Zika virus.

Course Goals/Learning Objectives:

- An appreciation for the complexity of disease, including the number of disciplines that are involved in a thorough understanding of any given disease (e.g., ecology, evolution,
epidemiology, clinical medicine, economics, politics, agriculture, wildlife management, public health,…).

- The ability to integrate ecological and evolutionary concepts and theory in ways that inform disease models/predictions/control.
- Basic knowledge of parasite diversity and host defensive repertoires.
- Ability to skillfully read and synthesize primary literature.
- Ability to effectively convey the natural history and current literature pertaining to an infectious disease in an oral presentation
- Graduate students: Ability to review the historical and current literature regarding a specific infectious disease in the context of disease ecology in a research paper format

<table>
<thead>
<tr>
<th>Grades (Undergraduates): Journals 10%; Quizzes 15%; Homework Assignments 10%; Midterm 25%; Discussion Activities 20%; Presentation 20%</th>
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<tr>
<td>Grades (Graduates): Journals 5%; Quizzes 10%; Homework Assignments 10%; Midterm 20%; Discussion Activities: 20%; Presentation 15%; Research Paper: 20%.</td>
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Course Readings: There is no book, but the assigned readings are absolutely essential to success in this course. We will read a mix of book chapters, review papers, and primary literature to facilitate learning and discussion in this course. Therefore, readings should be completed prior to coming to class. There is a lot of reading. Putting the time in to not only read the assigned papers, but think about them as you do so is absolutely essential to the success of the course and for your ability to participate in informed debate during discussions. Assigned readings are listed in this syllabus, and pdfs of each will be posted on Blackboard at least one full week before they are due.

Journals: You are required to write about your thoughts and reflections of the week’s major ideas, activities, discussion, and remaining questions or controversies that came up either in or outside of class. These journals are mainly for you to review and reinforce what you learned each week. They have the added benefit of providing feedback to the instructor about the effectiveness of the classroom activities and readings for teaching you the desired concepts and skills. Entries are to be submitted online through the course Blackboard page before noon each Friday (not including Thanksgiving break). A few sentences will be adequate, but a longer discussion is welcome as well.

Quizzes: There will be a 5 minute quiz at the beginning of each class on the readings for that day. There will be questions on the in papers in columns I and II (see below), with questions on papers in column II providing extra credit for undergraduates. 4 things to get from each reading: 1) main question of paper, 2) type of study, 3) major finding, 4) major flaw(s). Quizzes are written so that you can’t get answer from title/abstract, but it is obvious from reading paper.

Homework: You will turn in 2 homework assignments, each worth 5% of your overall grade. Due dates are given on the course schedule below.

Midterm Exam: The midterm exam will be open note and open book, and will consist of short essays questions. It will be made available on Blackboard the morning of Thursday October 5th.
and is due by Friday October 6th at 5pm. Plan to spend the equivalent of the entire class period taking the test; feel free to spend more time writing your answers as necessary. You will email your answers to me no later than 5pm on Oct. 6th or points will be deducted.

Exam questions will include problem-solving and discussion style responses. They will cover material presented in lectures, discussions and papers and will encourage the integration of information from these sources. All answers to exam questions must be in the student’s own words – exams should be taken independently (no collaborations or study buddies while taking the exam).

**Presentation:** A powerpoint presentation will be required for all class participants and all students are required to attend each presentation and ask relevant questions following the presentations. The final presentation will consist of a 15-min overview of an infectious disease not covered in detail in class or assigned readings. Presentations of each disease must be placed within the most relevant conceptual framework(s) discussed over the course of the semester and must include information regarding host and pathogen natural history as well as current research regarding the disease. Specific topics will be chosen mid-semester in consultation with me.

**Research Paper:** Graduate students enrolled in the course will also write an approximately 8-page paper associated with their presentation topic, to be turned in before 4pm on December 6th. These papers must be double-spaced and 12 point font. This paper will address some aspect of the topic that the student finds of particular interest (especially something related to their thesis or dissertation if possible). Papers must have a minimum of 10 references drawn from the primary or secondary literature (no websites and no “gray” literature unless discussed with me first). Note that references must be cited appropriately; see the citations in this syllabus for examples of appropriate citation styles.

**Attendance:** Attendance at lectures and discussion is mandatory and attendance will be taken.

**Note:** If there is a topic you would like included in the readings and discussion, please contact me. There is at least one “open” class day with no official topic assigned as of yet. This is done intentionally so that students (especially graduate students) with a particular interest may provide input regarding their needs from the class.

**Weekly Schedule**

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<tr>
<th>Wk</th>
<th>Day</th>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td></td>
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<td>Syllabus, course expectations; Evolutionary thinking; What is disease ecology, and what is it good for?</td>
<td>1-3</td>
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<tr>
<td>1</td>
<td>Tue</td>
<td>Aug 22</td>
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<tr>
<td>1</td>
<td>Thu</td>
<td>Aug 24</td>
<td>Ecological theory and disease</td>
<td>4-5</td>
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<td>2</td>
<td>Tue</td>
<td>Sep 5</td>
<td>Fundamental theory: SIR models, R0, Frequency and density dependent transmission</td>
<td>6,7,8,9</td>
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<td>2</td>
<td>Thu</td>
<td>Sep 7</td>
<td>Diversity and natural history of parasites &amp; pathogens</td>
<td>10</td>
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<tr>
<td>Date</td>
<td>Day</td>
<td>Reading</td>
<td>Chapter(s)</td>
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<tr>
<td>Sep 12</td>
<td>Tue</td>
<td>Class discussion of readings</td>
<td></td>
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<tr>
<td>Sep 14</td>
<td>Thu</td>
<td>Host defenses</td>
<td>11</td>
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<tr>
<td>Sep 19</td>
<td>Tue</td>
<td>Class discussion of readings (with Dr. Sarah Knutie, U of Connecticut)</td>
<td>TBA, TBA</td>
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<tr>
<td>Sep 21</td>
<td>Thu</td>
<td>Directly transmitted human pathogens</td>
<td>12, 13</td>
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<td>Sep 26</td>
<td>Tue</td>
<td>Disease impacts on populations and ecosystems</td>
<td>15, 16</td>
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<tr>
<td>Sep 28</td>
<td>Thu</td>
<td>Class discussion of readings</td>
<td>12-17</td>
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<tr>
<td>Oct 3</td>
<td>Tue</td>
<td>Livestock, wildlife, zoonotic pathogens</td>
<td>18, 19</td>
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<tr>
<td>Oct 5</td>
<td>Thu</td>
<td>Take home midterm exam – no class</td>
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<td>Oct 10</td>
<td>Tue</td>
<td>Disease control: Vaccination, Behavioral changes, culling</td>
<td>20, 21</td>
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<td>Oct 12</td>
<td>Thu</td>
<td>Building a model from data: Cholera</td>
<td>23, 24</td>
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<tr>
<td>Oct 17</td>
<td>Tue</td>
<td>Homework due; Class discussion of cholera model</td>
<td>23, 24</td>
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<td>Oct 19</td>
<td>Thu</td>
<td>Pathogen interactions via the immune system, and parasite caused changes in host behavior</td>
<td>25, 26</td>
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<td>Oct 24</td>
<td>Tue</td>
<td>Evolution of virulence: hosts, pathogens, vectors</td>
<td>27, 28</td>
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<tr>
<td>Oct 26</td>
<td>Thu</td>
<td>Class discussion of readings – Myxoma virus</td>
<td>30, 31</td>
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<td>Oct 31</td>
<td>Tue</td>
<td>Herd immunity</td>
<td>33</td>
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<td>Nov 2</td>
<td>Thu</td>
<td>Parasites, immunity, and sexual selection</td>
<td>34, 35</td>
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<td>Nov 7</td>
<td>Tu</td>
<td>Malaria I – Class discussion of readings</td>
<td>36, 37</td>
<td></td>
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<tr>
<td>Nov 9</td>
<td>Th</td>
<td>Malaria II – Homework due; Class discussion of readings</td>
<td>38, 39</td>
<td></td>
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<tr>
<td>Nov 14</td>
<td>Tu</td>
<td>Seasonality, climate change and transmission dynamics</td>
<td>40, 41</td>
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<td>Nov 16</td>
<td>Th</td>
<td>TBA</td>
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<tr>
<td>Nov 28</td>
<td>Tu</td>
<td>Presentations</td>
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<tr>
<td>Nov 30</td>
<td>Th</td>
<td>Presentations</td>
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<tr>
<td>Dec 7</td>
<td>Th</td>
<td>Final Exam time</td>
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Readings


22 Galvani, A. P., Reluga, T. C., and Chapman, G. B., Long-standing influenza vaccination policy is in accord with individual self-interest but not with the utilitarian optimum *Proceedings of the National Academy of Sciences of the United States of America* 104 (13), 5692 (2007).


32 Peng, C., Haller, S., Rahman, M., McFadden, G., and Rothenburg, S., Myxoma virus M156 is a specific inhibitor of rabbit PKR but contains a loss-of-function mutation in Australian virus


**Make up work:**

- Make up quizzes and exams are NOT given. The only exception would be if you were admitted to the hospital.
- If you have a documented school function (marching band, game) or research-related function (conference, workshop), you will need to provide documentation in advance.
- Quizzes are given at the beginning of class. If you come late (after the class has finished taking the quiz) you will not be allowed to take the quiz.

**Students with disabilities:**

- University policy provides for reasonable accommodations to be made for students with verified disabilities on an individualized and flexible basis as specified under Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 (ADA).
- SDS provides classroom accommodations to all students on campus who disclose a disability, request accommodations, and who meet eligibility criteria. We do not have specialized programs for specific types of disabilities.

- It is the responsibility of any student with a disability who requests a reasonable accommodation to contact the Office of Student Disability Services (915-7128). SDS will then contact the instructor through the student by means of an Instructor Notification of Classroom Accommodations form.

**Cheating:**
- Is, of course, unacceptable. This absolutely includes plagiarism. Any assignment including plagiarized material will automatically be given 0 points, and extreme cases of cheating and/or plagiarizing will result in failure of the course.

**Disclaimer:**

The instructor retains the right to modify this syllabus during the semester. Students will be notified of modifications during class.