

Syllabus – Biol 568 Fall 2018 – Disease ecology and evolution

Welcome:

The ecology and evolution of infectious diseases (also known as host-parasite interactions, or host-pathogen interactions) has roots that go back over a century. However, it did not begin to emerge as a discipline until around 1980, and has exploded in the current millennium. The class will cover topics such as mathematical theory and models; empirical studies of human, wildlife, insect, and plant host populations; emerging infectious diseases; effects on host behavior; host-parasite coevolution; multi-host systems; multi-pathogen systems; and anthropogenic effects on disease. The greatest depth of understanding has been achieved at the level of population interactions, specifically interactions of a single host population with a single pathogen population. The course goal is to provide a comprehensive and up-to-date understanding of the causes and consequences of infectious disease at levels from individual organisms to the globe.

Diversity statement:

The Department of Biology values the perspectives of all individuals – regardless of race, national origin, ethnicity, gender identity, gender expression, sexual orientation, religion, political views, socioeconomic status, age, physical ability, and learning ability. I strive to make this classroom and this department an inclusive space for all students.

Instructor:

Dr. Charles Mitchell
Office: Coker Hall, room 411
Office hours: by appointment
Email: mitchell@bio.unc.edu

Classroom: Genome Sciences Building, room 1378.

Time: Tuesday / Thursday 11:00am – 12:15pm.

Sakai: Will be used to share readings and announcements, and to submit assignments.

Course Copyright Information:

All course materials including your notes and assignments are covered by University Copyright Policy (<http://policies.unc.edu/files/2013/05/Copyright.pdf>), which reads "Student Works that constitute notes of classroom and laboratory lectures and exercises shall not be used for commercial purposes by the student generating such notes." What this means is that you are in violation of the law (and the honor code) if you post any course materials for use by others, or download any material from previous UNC courses for your own use, or share your notes or any other course materials with anyone not directly affiliated with this class this semester. This includes depositing materials in fraternity or sorority files, and contributing to online repositories. Sharing your notes directly with other individuals in this class this semester is fine.

Note: Except for the above, and the final exam schedule, all items in this syllabus are subject to change.

Grade:

Letter grades for the class will be based on a curve. The relatively small number of students in the class means that the statistical distribution of raw class scores varies year-to-year. Consequently, the curve of letter grades also varies year-to-year. While I cannot predict this year, in past years in Biol 568, the

mean grade has been about a “B”, which is typical for a 500-level Biology class at UNC. Your raw score will be calculated as follows:

- Student questions (in-class, weekly, completion): 5%
- Quizzes (in-class, weekly, no partial credit): 25%
- Short essays (take-home, three total): 45%
- Paper: 20%
- Presentation: 5%

Student questions. A major driver of the course content will be questions generated by you and your fellow students. You should ask at least one verbal question in class each week. This participation will be graded on completion in each week in which we have two class meetings with opportunity to ask questions. This portion of your grade will be calculated as: the number of weeks in which you asked a question, divided by the number of weeks graded. To receive credit, after you ask the question verbally, write both the question and a summary of my answer as a post to that week’s Sakai forum by midnight Thursday (preferably Tuesday, for questions asked that day).

Quizzes. Each Thursday (except for holidays and classes dedicated to student presentations), there will be a pre-class quiz. The quizzes will typically focus on that week’s (both class days’) assigned readings and/or videos. Each quiz will be: taken on Sakai, open book, timed (typically 5-10 minutes), released at least the day before, and due Thursday at 11:00am. Each question will be graded as either correct or incorrect (no partial credit). In calculating this portion of your grade, all quizzes will be weighted equally.

Short essays. For each of the three course sections (on transmission, evolution, and ecology), a take-home short essay will be assigned. The goal of each essay is to assess learning of that section.

Paper. Each student will write a paper on a topic of the student’s choosing.

- The topic should either add depth to the class by providing a more advanced exploration of a topic covered in the class, or it should add breadth to the class by covering an additional topic not otherwise covered. **Do not select a topic that you have used for a presentation, take-home exam, project, or paper in another class; this will be considered a violation of the honor code.**
- Your paper needs to fit on two pages (single-spaced, with one-inch margins, and 11-point Calibri font – make sure to check your word processor settings), excluding the list of references cited and any figures and tables, which can extend to a third page.
- Your paper needs to cite at least five references that were not class readings. Optionally, it can also cite readings from class, but these must be a minority of the references cited. All references cited should be in peer-reviewed scientific journals; these appear in the ISI Web of Science (<http://guides.lib.unc.edu/az.php?a=w>). Citations and the list of references cited should be in the following formats for the in-text citations and the list of references cited, respectively:
 - (Krebs & Myers 1974; Tamarin 1978; Gaines et al. 1991; Boonstra 1994)
 - A. B. Pedersen & T. J. Greives (2008) The interaction of parasites and resources causes crashes in a wild mouse population. *Journal of Animal Ecology*, 77, 370–377.
- Avoid plagiarism (<http://writingcenter.unc.edu/tips-and-tools/plagiarism/>).
- To facilitate unbiased grading, **DO NOT PUT YOUR NAME ON YOUR PAPER.** Identify yourself on the paper only with your PID.

- **The paper is due at 11:00 AM on Tuesday November 20, 2018.** Upload it (as a word processor file, not PDF) to the Sakai Assignment, which will time-stamp it. In addition, bring a printed, stapled copy to class that day (or the next class you attend).

Presentation. Each student will make an in-class presentation on the topic of their paper.

- Each presentation should last 10-12 minutes, followed by time for questions from your fellow students. Each presentation, including time for questions, will be allowed to last no more than 15 minutes. Prepare your presentation in PowerPoint or other program of your choosing. Your file should be no more than 5 MB in size (if it is more, then you need to reduce the resolution of your images). **Upload your file (PowerPoint or PDF) to the Sakai Assignment by 8:00AM the day of your presentation.** If you will be presenting from a website (e.g. Prezi), then the file you upload can simply contain the link. **You also must bring a backup copy to the class that day, either on your laptop or on a USB flash memory drive.**
- You are strongly encouraged to practice your presentation. In particular, it is important that your presentation lasts very close to the target of 10-12 minutes; this takes practice. However, the content of the presentation needs to be entirely your own work, following the UNC Honor Code.

Class schedule

TRANSMISSION SECTION

Tue 21 Aug: Lecture 1 – (A) Course structure. (B) Introduction to ecology and evolution of infectious disease.

Thu 23 Aug: Lecture 2 – Epidemic models.

Videos: 4 videos from the Penn State / Coursera MOOC on Epidemics.

Tue 28 Aug: Lecture 3 – Epidemic models (continued).

Videos: 4 videos from the Penn State / Coursera MOOC on Epidemics.

Thu 30 Aug: Lecture 4 – (A) Discussion of Cohen 2017 and Ferguson et al. 2016. (B) Epidemic models (continued).

Reading 1: Cohen 2017, *Science*, Where has Zika gone?

Reading 2: Ferguson et al 2016, *Science*, Countering the Zika epidemic in Latin America. (You are responsible for reading only the material that appeared in the print journal (the first 2 pages of the PDF).

Videos: 3 videos from the Penn State / Coursera MOOC on Epidemics.

Tue 4 Sept: Lecture 5 – (A) Epidemic models (continued). (B) Epidemic cycles and Critical Community Size.

Thu 6 Sept: Lecture 6 – (A) Discussion of Lessler et al. 2016. (B) Epidemic cycles and Critical Community Size (continued).

Reading: Lessler et al. 2016, *Science*, Assessing the global threat from Zika virus.

Tue 11 Sept: (A) Herd immunity. (B) Ask me anything.

Videos: 9 videos from the Penn State / Coursera MOOC on Epidemics.

Reading: Mariner et al. 2012, *Science*, Rinderpest vaccination: Appropriate technology and social innovations.

Thu 13 Sept: Cancelled due to Hurricane Florence.

Tue 18 Sept: (A) Discussion of Dobson et al. 2011. (B) Culling the herd.

Reading: Dobson et al. 2011, *Encyclopedia of Biological Invasions*, Rinderpest.

Video: 1 video from the Penn State / Coursera MOOC on Epidemics.

Thu 20 Sept: Vector and sexual transmission.

Videos: 6 videos from the Penn State / Coursera MOOC on Epidemics.

Tue 25 Sept: Transmission unification.

Reading: Parasite Ecology blog post 17 October 2013.

Videos: 2 videos from the Penn State / Coursera MOOC on Epidemics.

Thu 27 Sept: Macroparasite-host dynamics: parasite life-histories and diversity.

Video: 1 video from the Penn State / Coursera MOOC on Epidemics.

Tue 2 Oct: Macroparasite-host dynamics: population models and data.
Video: 1 video from the Penn State / Coursera MOOC on Epidemics.

EVOLUTION SECTION

Thu 4 Oct: Evolution of antibiotic resistance.
Videos: 4 videos from the Penn State / Coursera MOOC on Epidemics.

Tue 9 Oct: Evolution of virulence.
Video: 1 video from the Penn State / Coursera MOOC on Epidemics.

Thu 11 Oct: Rapid evolution.
Reading: Earn et al. 2002, *Trends in Ecology and Evolution*, Ecology and evolution of the flu (skip Box 2).
Videos: 2 videos from the Penn State / Coursera MOOC on Epidemics.

Tue 16 Oct: Cospeciation.
Reading: Holmes 2010, *Nature*, The gorilla connection.

Thu 18 Oct: FALL BREAK.

Tue 23 Oct: Host-parasite coevolution.
Readings and videos: None assigned.

Thu 25 Oct: Parasites and host behavior. **[Reminder about papers and presentations.]**
Reading: de Roode et al. 2013, *Science*, Self-medication in animals.
Videos: 2 videos from the Penn State / Coursera MOOC on Epidemics.

ECOLOGY SECTION

Tue 30 Oct: Environmental transmission.
Reading: Byrd and Sagre 2016, *Science*, Adapting Koch's postulates.
Video: 1 video from the Penn State / Coursera MOOC on Epidemics.

Thu 1 Nov: Hosts with multiple parasites.
Reading: Lafferty 2010, *Science*, Interacting parasites.

Tue 6 Nov: Cancelled due to OWASA service outage.

Thu 8 Nov: (A) Host population regulation by parasites. (B) Keeping the herd healthy: predation.
Reading for (A): NA.
Reading for (B): Ostfeld and Holt 2004, *Frontiers in Ecology and the Environment*, Are predators good for your health?, including all five figures, but excluding the panel and three sections of text:

- Panel 1
- Is zoonotic disease linked to rodent density?
- Do predators regulate rodent density?
- Does anthropogenic predator loss increase zoonotic disease risk?

Tue 13 Nov: (A) Parasites in multi-species host communities. (B) Parasites as consumers: are they really different? (C) Emerging Infectious Diseases (EIDs) I: global patterns.
Videos for (A): 2 videos from the Penn State / Coursera MOOC on Epidemics.

Reading for (B): NA.

Videos for (C): 2 videos from the Penn State / Coursera MOOC on Epidemics.

Thu 15 Nov: Emerging Infectious Diseases II: drivers

Reading: Daszak et al. 2000, *Science*, Emerging Infectious Diseases of Wildlife – Threats to Biodiversity and Human Health (including Fig. 1, but excluding Table 1 and Table 2).

Videos: 2 videos from the Penn State / Coursera MOOC on Epidemics.

Tue 20 Nov: Emerging Infectious Diseases III: ephemeral outbreaks.

Videos: 5 videos from the Penn State / Coursera MOOC on Epidemics.

Paper due on Sakai by 11:00 AM.

Thu 22 Nov: THANKSGIVING.

Tue 27 Nov: Emerging Infectious Diseases IV: sustained shifts.

Reading: Cohen et al. 2014, *Science*, Early AIDS virus may have ridden Africa's rails.

Thu 29 Nov: Presentations.

Tue 4 Dec: Presentations.

Thursday 13 December 12:00-3:00PM (final exam period) in the regular classroom:

(A) Presentations. (B) Instructor/course evaluations