

ECOL/BIOL 4150L/6150L: Population Biology of Infectious Diseases Spring 2023

Lecture: Tue & Thu 11:10am-12:25pm **Lab:** Mon *or* Wed 2:00pm-3:45pm

Lecture venue: Ecology Auditorium (room 201)

Lab venue: Varies by week (see syllabus and class announcements)

Instructors:

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Teaching Assistant:

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Office hours: By appointment

Description: This course introduces students to the field of infectious disease ecology, an area of study that has developed rapidly over the past three decades and addresses some of the most significant challenges to human health and conservation. Students will learn about the incredible diversity of parasitic organisms, arguably the most abundant life forms on the planet, and examine how pathogens invade and spread through host populations. Throughout the course, an emphasis will be placed on understanding of infectious diseases dynamics at the population level, and on quantitative approaches for studying pathogen spread and impacts. Specific topics include types of pathogens and their ecological properties, epidemiology and impacts on host populations, types of transmission, evolution of resistance and virulence, drivers of the emergence of new diseases, parasites in the context of ecological communities and ecosystems, strategies for controlling outbreaks, and the role of parasites in biodiversity and conservation.

Class objectives:

1. Provide an understanding of interactions between hosts and their microbes/parasites at multiple scales of biological organization
2. Increase familiarity with quantitative approaches for studying infectious disease spread
3. Review current research and case studies in the field of infectious disease ecology
4. Enhance appreciation for the biological diversity of parasitic organisms
5. Examine the importance of parasites in biodiversity conservation and human health
6. Consider the role of ecology and evolution in predicting pathogen emergence and responding to epidemics

Format: The course format includes lectures (with embedded live quizzes), discussion of scientific papers, computer assignments with associated problem sets, and a wet lab. Students are expected to attend lectures on a regular basis, complete regular assignments, and prepare for and participate in class discussions.

Prerequisites: This course assumes familiarity with general ecology and biology, and past coursework in elementary calculus and statistics.

Attendance: Most students find the lecture topics to be interesting. As we have no formal text, lectures will not duplicate material found elsewhere. Since students will be responsible for this information on

the exams, attendance and note taking are important. Students who miss a class will still be expected to submit assignments on time. More than 5 unexcused absences from lecture or 2 unexcused absences from weekly labs may result in an automatic lowering of the final score by one letter grade. Excused absence requests should be submitted in writing prior to or immediately following an absence (these include potential exposure to Covid, feeling unwell, traveling to graduate school interviews etc.).

Labs and assignments: Laboratory attendance is mandatory, and students must arrive on time. Assignments will accompany lab activities. Unless otherwise specified, homework assignments will be due by 5pm one week following the distribution of the assignment. All lab assignments will be submitted electronically via eLC. Late assignments will be penalized 10% per weekday. For weeks where a discussion is indicated as the lab activity, students should come to the discussion section having already answered the short quiz on the reading(s), which can be found on eLC. Make-up labs will not be offered, but students can drop their two lowest lab scores at the end of the semester, which can include labs missed owing to excused absences.

Reading materials: Reading material for this course is based on journal articles and book chapters. Lectures will often refer to ideas and results from assigned readings, and exams will cover content from each of the readings. A full reading list is maintained at the end of the syllabus, and papers will be uploaded onto eLC prior to the assigned reading date.

Lecture quizzes: A short quiz will be given in all or nearly all lectures. Quizzes will consist of questions that are designed to assess student comprehension of the previous lecture and/or the assigned reading material for the current lecture. We expect approximately 30 quizzes will be given during the term. Make-up quizzes will not be offered, but students can drop their five lowest quiz scores at the end of the semester, which can include quizzes that were missed owing to class absences.

Exams: There will be two in-class exams on March 2 and on April 27. Exams will include a variety of question types: True/False, Multiple choice, and Short answer.

Participation: Students will be graded based on their participation in lecture, lab, and during the end of year symposium. Participation includes asking questions, actively listening, arriving on time to lab and lecture, and participating in occasional short in-class activities (e.g., students team up to discuss a question and individual, written responses are handed in to the instructor).

Enrollment in 6150: Students enrolled in the graduate course number will complete additional problems on assignments and exams that require synthesis of class and reading materials. For weekly computer labs and paper discussions, graduate students will have the opportunity to join 4150 students in their assigned lab section, or can choose to meet separately with other 6150 students during the regular lab time to work more independently. Graduate students will additionally deliver a short oral presentation at the time of the final class symposium on May 4.

Grade calculation :

30% Lab assignments
10% Lecture quizzes
25% First exam
25% Second exam
10% Participation, symposium and class discussions

Class symposium: On May 4 from 12:00-3:00pm (the time reserved for our final exam), we will host a class symposium in the format of a scientific conference. Attendance is mandatory for all students (or would require an excused absence). Students enrolled in 6150, in addition to students enrolled for

honors credits, will give an oral research presentation on the topic of their choosing. Students enrolled in 4150 can elect to give a poster for up to 3 percentage points bonus credit towards their final grades. Students will submit proposed titles and abstracts the week of March 14. These will be returned to students the week of March 21 with approval and comments from the instructors.

Accommodations: Please contact the instructor if you require special accommodations due to learning disabilities, religious practices, physical or medical needs, or any other reason.

Academic Honesty: (i) Academic work must meet the standards contained in “A Culture of Honesty.” Students are responsible for informing themselves about those standards before performing any academic work. The link to more detailed information about academic honesty can be found at: <https://honesty.uga.edu/Academic-Honesty-Policy> (ii) The syllabus is a general plan for the course; deviations announced to the class by the instructors may be necessary.

SCHEDULE OF TOPICS		
DATE	TOPIC	READINGS/NOTES
Module 1: The basics		
	<i>No Lab During First Week of Classes</i>	
10 Jan	Introduction (AP, AS, & TO)	“What we know about the deadliest U.S. bird flu outbreak in history ”
12 Jan	What is a parasite? I: Ubiquity & Taxonomic Diversity (AS)	Nunn & Altizer Ch. 2
	<i>No Lab Week of Martin Luther King Day</i>	
17 Jan	What is a parasite? II: Trophic strategies & Transmission Modes (AS)	Lafferty and Kuris 2002
19 Jan	Population Biology of Microparasites I: Invasion & Spread (AS)	Nunn & Altizer Ch. 4 (pp 98-114)
23/25 Jan	<i>Lab 1: Modeling distemper virus in seals</i>	<i>Computer modeling</i>
24 Jan	Population Biology of Microparasites II: Persistence & Impacts (AS)	Hochachka & Dhondt 2000
26 Jan	Population Biology of Microparasites III: Interventions & Vaccination (AS)	Ashwanden 2021, “Five Reasons Why COVID Herd Immunity is Probably Impossible”
30 Jan/ Feb 1	<i>Lab 2: Macroparasite Model Exploration</i>	<i>Computer modeling</i>
31 Jan	Population Biology of Macroparasites (AP)	Nunn & Altizer 2006, Ch. 4 (pp. 102-104; 115-122); Hudson et al. 1998
2 Feb	Population Biology of Macroparasites: Cycles in Red Grouse and Sheep (AP)	Dobson and Hudson 1992
6/8 Feb	<i>Lab 3: Discussion: Rinderpest Eradication</i>	<i>Discussion</i>
7 Feb	Population Biology of Macroparasites: Parasites	Hudson et al. 1998

	and Host Regulation (AP)	
Module 2: Host and parasite evolution		
9 Feb	Immune Defenses: Innate and Adaptive (AP)	Sompayrac 2003 Ch. 1
<i>13/15 Feb</i>	<i>Lab 4: Discussion: Parasites and Host Behavior</i>	<i>Discussion</i>
14 Feb	ABCs of MHC (SA)	Knapp 2005
16 Feb	Virulence Evolution: Biting the Hand that Feeds You? (AP)	Fraser et al. 2007
<i>20/22 Feb</i>	<i>Lab 5: Red Queen Card Game</i>	<i>Card Game</i>
21 Feb	Host Resistance: Trade-offs and Evolution (AS)	Duffy et al. 2012
23 Feb	Host-pathogen Coevolution and the Red Queen (AS)	Koskella & Lively 2009
<i>27 Feb/1 Mar</i>	<i>Lab 6: Exam Review</i>	
28 Feb	Rapid Evolution of Pathogens (AP)	Kennedy and Read 2018
2 Mar	EXAM 1	
Module 3: Ecological heterogeneity		
<i>13/15 Mar</i>	<i>Lab Catch Up</i>	
14 Mar	Parasites and Host Behavior (TO)	De Roode et al. 2013
16 Mar	STDs (AP)	Ryder et al. 2005
<i>20/22 Mar</i>	<i>Lab 7: Wet Lab Prep</i>	
21 Mar	Spatial Ecology of Pathogens: Waves, Synchrony, and Spatial Spread (AP)	Smith et al. 2002
23 Mar	Spatial Ecology of Pathogens: Metapopulations (AP)	Rohani, Earn, & Grenfell 1999
<i>27/29 Mar</i>	<i>Lab 8: Contact Networks</i>	<i>Computational analysis</i>
28 Mar	Key Hosts and Superspreaders (AP)	Vanderwaal and Ezenwa 2016
Module 4: Parasites in Communities and Ecosystems		
30 Mar	Coinfection (AS)	Ezenwa et al. 2015
<i>3/5 Apr</i>	<i>Lab 9: Wet Lab Part 1</i>	<i>Wet Lab</i>
4 Apr	Multi-host pathogens (AS)	Fenton & Pederson 2005
6 Apr	Disease-disease relationships (AS)	Keesing et al. 2006
<i>10/12 Apr</i>	<i>Lab 10: Wet Lab Part 2</i>	<i>Wet Lab</i>

11 Apr	Climate change & Infectious disease (AS)	Mordecai et al. 2013
13 Apr	Parasite Macroecology (AP)	Park et al. 2018
17/19 Apr	<i>Lab 11: Parasites and Threatened Host Species</i>	<i>Data analysis</i>
18 Apr	Parasites and biodiversity conservation (AS)	Lips et al. 2006
20 Apr	Managing Pathogen Outbreaks in Wildlife: Culling & Vaccination (AP)	Donnelly et al. 2006
24/26 Apr	<i>Lab 12: Exam Review</i>	
25 Apr	Symposium Project Work Day	
April 27	EXAM 2	
4 May	<i>12:00-3:00 pm Research symposium</i>	<i>Symposium</i>

CORONAVIRUS INFORMATION FOR STUDENTS

UGA adheres to guidance from the University System of Georgia and the recommendations from Georgia Department of Public Health (DPH) related to quarantine and isolation. Since this may be updated periodically, we encourage you to review the latest guidance [here](#). The following information is based on guidance last updated on December 29, 2021.

Face coverings:

Following guidance from the University System of Georgia, face coverings are recommended for all individuals while inside campus facilities.

How can I obtain the COVID-19 vaccine?

University Health Center is scheduling appointments for students through the UHC Patient Portal (https://patientportal.uhs.uga.edu/login_dualauthentication.aspx). Learn more here – <https://www.uhs.uga.edu/healthtopics/covid-vaccine>.

The Georgia Department of Health, pharmacy chains and local providers also offer the COVID-19 vaccine at no cost to you. To find a COVID-19 vaccination location near you, please go to: <https://georgia.gov/covid-vaccine>.

In addition, the University System of Georgia has made COVID-19 vaccines available at 15 campuses statewide and you can locate one here: <https://www.usg.edu/vaccination>

What do I do if I have COVID-19 symptoms?

Students showing COVID-19 symptoms should self-isolate and get tested. You can schedule an appointment with the University Health Center by calling 706-542-1162 (Monday-Friday, 8 a.m.-5p.m.). Please DO NOT walk-in. For emergencies and after-hours care, see <https://www.uhs.uga.edu/info/emergencies>.

What do I do if I test positive for COVID-19? (Isolation guidance)

As of December 29, 2021, when an individual receives a positive COVID-19 test: Everyone, regardless of vaccination status, should:

- Stay home for 5 days.
- If you have no symptoms or your symptoms are resolving after 5 days, you can leave your house and return to class.
- Continue to wear a mask around others for 5 additional days.

What do I do if I have been exposed to COVID-19? (Quarantine guidance)

If you have been exposed (within 6 feet for a cumulative total of 15 minutes or more over a 24-hour period – unmasked**) to someone with COVID-19 or to someone with a positive COVID-19 test and you are:

- Boosted, or have become fully vaccinated within the last 6 months (Moderna or Pfizer vaccine) or within the last 2 months (J&J vaccine)
 - You do not need to quarantine at home and may come to class.
 - You should wear a mask around others for 10 days.
 - If possible, get tested on day 5.
 - If you develop symptoms, get tested and isolate at home until test results are received, then proceed in accordance with the test results.
- Unvaccinated, or became fully vaccinated more than 6 months ago (Moderna or Pfizer vaccine) or more than 2 months ago (J&J vaccine) and have not received a booster:
 - You must quarantine at home for 5 days. After that you may return to class but continue to wear a mask around others for 5 additional days.
 - If possible, get tested on day 5.
 - If you develop symptoms, get tested and isolate at home until test results are received, then proceed in accordance with the test results.

** “Masked-to-masked” encounters are not currently considered an exposure; this type of interaction would not warrant quarantine.

If you need additional help, reach out to Student Care and Outreach (sco@uga.edu) for assistance.

Well-being, mental health, and student support

If you or someone you know needs assistance, you are encouraged to contact Student Care & Outreach in the Division of Student Affairs at 706-542-7774 or visit <https://sco.uga.edu/>. They will help you navigate any difficult circumstances you may be facing by connecting you with the appropriate resources or services. UGA has several resources to support your well-being and mental health: <https://well-being.uga.edu/>

Counseling and Psychiatric Services (CAPS) is your go-to, on-campus resource for emotional, social and behavioral-health support: <https://caps.uga.edu/>, TAO Online Support (<https://caps.uga.edu/tao/>), 24/7 support at 706-542-2273. For crisis support: <https://healthcenter.uga.edu/emergencies/>.

The University Health Center offers FREE workshops, classes, mentoring and health coaching led by licensed clinicians or health educators: <https://healthcenter.uga.edu/bewelluga/>

Monitoring conditions:

Note that the guidance referenced in this syllabus is subject to change based on recommendations from the Georgia Department of Public Health, the University System of Georgia, or the Governor’s Office. For the latest on UGA policy, you can visit coronavirus.uga.edu.

FERPA Notice

The Federal Family Educational Rights and Privacy Act (FERPA) grants students certain information privacy rights. To comply with FERPA, all communication that refers to individual students must be through a secure medium (UGAMail or eLC) or in person. Instructors are not allowed to respond to messages that refer to individual students or student progress in the course through non-UGA accounts, phone calls, or other types of electronic media. For details, please visit <https://apps.reg.uga.edu/FERPA>.

Syllabus Disclaimer

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.