

## PCB3402 Disease Ecology & Evolution (Fall 2021)/ ZOO4926 Disease Ecology & Evolution

### Course Description

Disease Ecology and Evolution is an integrative course that focuses on both sides of the host-pathogen relationships. I built this course based on the One Health approach which considers that human health is closely connected to animal and ecosystem health. Thus, we rely on primary literature to discuss the latest cases of wildlife diseases, changes in host susceptibility, and theoretical approaches to study disease ecology and evolution. Although the course does not have sharp divisions into units, we focus on the first half on evolutionary topics, and then discuss topics related to ecology and the environment. Our topics for the evolution part include: evolution of defense strategies, which includes both host and pathogens; trade-off theory, red-queen dynamics. Then we transition to topics about species interactions such as: sequence and timing of infections, the mathematical concept of superspreaders, disease networks, diversity disease relationships, seasonality and disease dynamics, and microbiomes. We discuss examples from different types of infections and diseases caused by viruses, bacteria, and parasites. We integrate concepts of community ecology to understand changes in the force of infection through time and space. Disease Ecology and Evolution also offers active learning activities using the R statistical language. This course contributes to broadening the perspective of our future health practitioners and scientists studying outbreaks.

### Pre-requisites and Co-requisites

No pre-requisites or co-requisites

### Instructor

Ana V. Longo, PhD

Department of Biology

Office Location: 412 Carr Hall

Office Hours: Thursdays 10:00 am – 11:00 am by appointment only (see below).

Phone: 352.273.4982

Email: [ana.longo@ufl.edu](mailto:ana.longo@ufl.edu)

### Preferred Methods for Public and Private Communications

*Canvas mail should be used for all course-related communications. I will **NOT** answer emails from external accounts (e.g., GMAIL).*

Note: Participation in Canvas Discussions is considered a public conversation within the class.

### Course Meeting Times (Periods 2 and 3)

**Location: FLI 0109**

Tuesdays: 8:30 am – 9:20 am; 9:35 am – 10:25 am

Thursdays: 8:30 am – 9:20 am

### Office Hour Policies

Office Hours will be on Thursdays 10:00 am – 11:00 am by appointment only. I understand that these times might not work for everyone, therefore contact me to explore other options. Please use this website to schedule your meeting:

<https://outlook.office365.com/owa/calendar/UFL2@uflorida.onmicrosoft.com/bookings/>

In response to the current COVID-19 outbreak, office hours meetings will be via ZOOM by default, unless the student requests it to be in person. **Students visiting my personal office space will be required to wear a mask.** If a student does not comply to my request, we will move the meeting to an outdoor space (weather permitting).

Use this link for meetings:

<https://ufl.zoom.us/j/93264521694>

Meeting ID: 932 6452 1694

\*Requires authentication to join: UFL Participants Only.

### Course Objectives

**After successfully completing this course, students will be able to:**

1. Compare and contrast major infectious diseases in plants, animals, and humans.
2. Understand how species can persist with pathogens/parasites.
3. Analyze case studies and identify the ecological and evolutionary factors promoting disease emergence.
4. Apply concepts from ecology and evolution to mitigate disease emergence or control spread of infectious diseases.
5. Communicate infectious disease information to broad audiences, including finding reliable sources of information.

### Course Textbook (s) and/or Assigned Readings

This course does not have an assigned textbook. Reading material will be available on Canvas.

### Grading

**Learning Activities:** 20 points each x 5 = 100 points

**Quizzes:** 20 points each x 5 = 100 points

**Class Project:** 100 points

**Total:** 300 points

### Grading Scale

Total points will be rounded (for example: 94.4% = 94% = A-; 94.5 % = 95% = A).

Percent (out of 100)	Grade
≥95-100	A
≥90	A-
≥87	B+
≥85	B
≥80	B-
≥77	C+
≥75	C
≥70	C-
≥67	D+
≥65	D

≥60	D-
<60	E

Information on current UF grading policies for assigning grade points can be found in <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

### Class Attendance and Make-Up Policy

Excused absences are consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

**Late assignments will not be accepted.** A make-up quiz will be provided at the end of the semester. This score will replace one missing quiz grade or the lowest score. No extra assignments will be provided.

### Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. [Click here for guidance on how to give feedback in a professional and respectful manner.](#) Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via [ufl.bluera.com/ufl/](http://ufl.bluera.com/ufl/). [Summaries of course evaluation results are available to students here.](#)

### COVID-19 Best Practices

In response to COVID-19, the following practices are in place to maintain your learning environment, to enhance the safety of our in-classroom interactions, and to further the health and safety of ourselves, our neighbors, and our loved ones.

**If you are not vaccinated, get vaccinated.** Vaccines are readily available at no cost and have been demonstrated to be safe and effective against the COVID-19 virus. Visit this link for details on where to get your shot, including options that do not require an appointment: <https://coronavirus.uflhealth.org/vaccinations/vaccine-availability/>. Students who receive the first dose of the vaccine somewhere off-campus and/or outside of Gainesville can still receive their second dose on campus.

**You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.** Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators. Sanitizing supplies are available in the classroom if you wish to wipe down your desks prior to sitting down and at the end of the class. Hand sanitizing stations will be located in every classroom.

**If you sick, stay home and self-quarantine.** Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email [covid@shcc.ufl.edu](mailto:covid@shcc.ufl.edu)) to be evaluated for testing and to receive further instructions about

returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

Course materials will be provided to you with an excused absence, and you will be given a reasonable amount of time to make up work.

If you are withheld from campus by the Department of Health through Screen, Test & Protect you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.

Continue to regularly visit [coronavirus.UFHealth.org](https://coronavirus.UFHealth.org) and [coronavirus.ufl.edu](https://coronavirus.ufl.edu) for up-to-date information about COVID-19 and vaccination.

### Online Privacy

Our class sessions may be audio/visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat is automatically recorded, but not shared. As in all courses, **unauthorized sharing of recorded materials without instructor/student knowledge is prohibited.**

### Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, [www.dso.ufl.edu/drc/](http://www.dso.ufl.edu/drc/)) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

### Class Demeanor

Students are expected to arrive to class on time and behave in a manner that is respectful to the instructor and to fellow students. Please avoid the use of cell phones. Opinions held by other students should be respected in discussions.

### University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are

obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

### **Basic Needs, Counseling and Wellness Center**

Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact UF food pantry: <https://pantry.fieldandfork.ufl.edu> or the Dean of Students for support. If you or a friend is in distress, please contact [umatter@ufl.edu](mailto:umatter@ufl.edu) or 352-392-1575 so that a team member can reach out to the student (<https://counseling.ufl.edu/>). Sexual Assault Recovery Services (SARS) available at Student Health Care Center 352-392-1161;

University Police Department: 392-1111 or 9-1-1 for emergencies.

## Class Schedule

Week	Date	Class	Topic	Instructions	Reading Material (always confirm in Canvas)
1	Tues Aug 24	1	Welcome and Class Introduction		
	Thurs Aug 26	2	<b>Discussion:</b> Why Disease Ecology and Evolution?	Follow instructions on how to critically read a paper (Canvas).	Dobson, A. P., S. L. Pimm, L. Hannah, L. Kaufman, J. A. Ahumada, A. W. Ando, A. Bernstein, J. Busch, P. Daszak, J. Engelmann, M. F. Kinnaird, B. V. Li, T. Loch-Temzelides, T. Lovejoy, K. Nowak, P. R. Roehrdanz, and M. M. Vale. 2020. Ecology and economics for pandemic prevention. <i>Science</i> 369:379-381.
2	Tues Aug 31	3	Measuring Infection & Disease		Casadevall, A., and L. A. Pirofski. 2000. Host-pathogen interactions: basic concepts of microbial commensalism, colonization, infection, and disease. <i>Infection and Immunity</i> 68: 6511-6518.
	Thurs Sept 2	4	<b>Learning Activity 1: Infection and susceptibility data around us</b>	1. Bring examples of infection/susceptibility data. Use Google spreadsheet to record your topic so that we don't have repetitions. 2. Upload answers before Sun Sept 12, 12:00pm (20 points).	
3	Tues Sept 7	5	Immunity and Disease Ecology		Hedrick, S. M. 2017. Understanding Immunity through the Lens of Disease Ecology. <i>Trends in Immunology</i> 38:888-903.
	Thurs Sept 9	6	Evolution of defense strategies: Resistance and Tolerance		Schneider, D. S., and J. S. Ayres. 2008. Two ways to survive infection: what resistance and tolerance can teach us about treating infectious diseases. <i>Nature Reviews Immunology</i> 8:889-895.
4	Tues Sept 14	7	Red-Queen Dynamics <b>Learning Activity 2: RQD Card Game</b>	Upload answers before Sun Sept 26, 12:00pm (20 points).	Broekhurst, M. A., T. Chapman, K. C. King, J. E. Mank, S. Paterson, and G. D. D. Hurst. 2014. Runnings with the Red Queen: the role of biotic conflicts in evolution. <i>Proceedings of the Royal Society B: Biological Sciences</i> 281:20141382.
	Thurs Sept 16	8	Brief recap and Quiz	<b>Quiz #1</b>	
5	Tues Sept 21	9	Symbiont-mediated Immunity		Daisley, B.A., J.A. Chmiel, A.P. Pitek, G.J. Thompson, and G. Reid, Missing Microbes in Bees: How Systematic Depletion of Key Symbionts Erodes Immunity. <i>Trends in Microbiology</i> , 2020, 28(12): p. 1010-1021.
	Thurs Sept 23	10	Sequence and Timing of Infections		Karvonen, A., J. Jokela, and A.-L. Laine. 2019. Importance of Sequence and Timing in Parasite Coinfections. <i>Trends in Parasitology</i> 35:109-118.
6	Tues Sept 28	11	Measuring Host Specificity		Poulin, R. 2007. Chapter 3. Evolutionary Ecology of Parasites. Pages: 41-47.
	Thurs Sept 30	12	Brief recap and Quiz	<b>Quiz #2</b>	
6	Tues Oct 5	13	Disease Superspreaders		Martin, L. B., B. Addison, A. G. D. Bean, K. L. Buchanan, O. L. Crino, J. R. Eastwood, A. S. Flies et al. 2019. Extreme Competence: Keystone Hosts of Infections. <i>Trends in Ecology &amp; Evolution</i> 34:303-314.

Week	Date	Class	Topic	Instructions	Reading Material (always confirm in Canvas)
	Thurs Oct 7	14	<b>Learning Activity 3: Analyzing Networks</b>	Make account in R Studio Cloud. Upload figures/discussion before Sun Oct 17, 12:00pm (20 points).	
7	Tues Oct 12	15	Landscape Genetics and Disease Risk		Archie, E. A., G. Luikart, and V. O. Ezenwa. 2009. Infecting epidemiology with genetics: a new frontier in disease ecology. Trends in Ecology & Evolution 24:21-30.
	Thurs Oct 14	16	Macroecological Patterns of Host Competence	Instructions for Final projects will be posted	Downs, C.J., L.A. Schoenle, B.A. Han, J.F. Harrison, and L.B. Martin. Scaling of host competence. Trends in parasitology, 2019. 35(3): p. 182-192.
8	Tues Oct 19	17	Global challenges in Wildlife Diseases		TBD
	Thurs Oct 21	18	Brief Recap and Quiz	<b>Quiz #3</b>	
9	Tues Oct 26	19	Biological Invasions and Disease Emergence		Hatcher, M.J., J.T.A. Dick, and A.M. Dunn. Disease emergence and invasions. Functional Ecology, 2012. 26(6): p. 1275-1287.
	Thurs Oct 28	20	<b>Learning Activity 4: Analyzing diversity-disease data</b>	Upload figures/discussion before Sun Nov 7, 12:00pm (20 points).	
10	Tues Nov 2	21	Overview of Amphibian Diseases & Guest lecture: Sarah McGrath-Blaser on Fungal Invasions		Fisher, M.C. and T.W.J. Garner. Chytrid fungi and global amphibian declines. Nature Reviews Microbiology, 2020. 18(6): p. 332-343.
	Thurs Nov 4	22	Brief Recap and Quiz	<b>Quiz #4</b>	
11	Tues Nov 9	23	Climate Change and Infectious Diseases		Lafferty, K.D. The ecology of climate change and infectious diseases. Ecology, 2009. 90(4): p. 888-900.
	Thurs Nov 11		<b>HOLIDAY: NO CLASS: Veterans</b>		
12	Tues Nov 16	24	Seasonality and Disease Dynamics		Altizer, S., A. Dobson, P. Hosseini, P. Hudson, M. Pascual, and P. Rohani. 2006. Seasonality and the dynamics of infectious diseases. Ecology Letters 9:467-484.
	Thurs Nov 18	25	<b>Learning Activity 5: Analyzing Seasonal Data</b>	Upload figures/discussion before <b>Tue Nov 23, 5:00pm</b> (20 points).	
13	Tues Nov 23	26	Eradication of Infectious Diseases		Klepac, P., S. Funk, T.D. Hollingsworth, C.J.E. Metcalf, and K. Hampson. Six challenges in the eradication of infectious diseases. Epidemics, 2015. 10: p. 97-101.
	Thurs Nov 25		<b>THANKSGIVING BREAK</b>		

<b>Week</b>	<b>Date</b>	<b>Class</b>	<b>Topic</b>	<b>Instructions</b>	<b>Reading Material (always confirm in Canvas)</b>
<b>14</b>	Tues Nov 30	27	One Health Concept and Quiz <b>Student presentations</b>	<b>Quiz #5</b>	<a href="https://www.cdc.gov/onehealth/basics/index.html">https://www.cdc.gov/onehealth/basics/index.html</a>
	Thurs Dec 2	28	<b>Student presentations</b>		
<b>15</b>	Tues Dec 7	29	<b>Student presentations</b>	Make-up Quiz (due at 5pm)	