Course Syllabus

Edit

BIOL 468: Disease Ecology and Evolution (Honors)

BIOL 668: Evolutionary Medicine

Fall 2025 Combined Syllabus

About the Course

Overview

Disease Ecology and Evolution addresses those aspects of ecology and evolutionary biology most relevant to understanding the origin, dynamics and treatment of disease (both infectious and hereditary/genetic). It is particularly recommended for pre-health students, as it serves as an introduction to the science behind public health. As well as basic biology, material covered will include aspects of human behavior, as well as some mathematical models.

The course follows a ‘flipped’ model, with class time devoted to discussion as well as group and individual activities intended to reinforce the basic material.

This course is taught at an advanced level, and assumes you have learned *and retained* knowledge about fundamental evolutionary and ecological processes. Without this background, you will struggle to do well.

Content learning goals

After taking this course, students will

1. Understand the evolutionary factors driving or influencing a variety of non-infectious ailments (such as obesity, heart disease).
2. Understand the evolutionary *and* ecological factors driving or influencing infectious diseases (such as cholera, malaria, HIV or COVID-19).
3. Understand how failing to take into account evolutionary and ecological principles when addressing disease can have unfortunate consequences (e.g., antibiotic resistance, virulent ‘super-bugs’ etc.).

4. Understand the basis and evidence for ‘new germ theory’, which posits that a number of diseases traditionally thought of as non-infectious may, in fact, be caused by cryptic infectious agents.
5. Understand the multi-disciplinary teamwork required in the field public health.

Skill learning goals

After taking this course, students will

1. Be proficient at reading and extracting the important data and conclusions from scientific publications.
2. Be able to summarize the message of a scientific publication in a few sentences.
3. Be able to recognize and ‘read’ simple mathematical models of infectious disease.
4. Be able to code simple mathematical models of infectious disease and examine their behavior.

Logistics

Schedule

Class meets Tuesday and Thursday, 11:30 to 12:50, in person in FMH 313. You *must* attend class. See below for why.

Contact details

- Instructor: Gareth J. Russell
- E-mail: russell@njit.edu
- Phone: 973 596 6412 (but e-mail is much better).
- Office Hours: Thursday, 1pm–2pm (after class), or by appointment. *Let me know by the end of class if you are going to the Thursday office hour.*
- Office Hours Location: CKB 377D, in the Biology office suite.

Prerequisites (468)

Foundations of Ecology and Evolution is *required*. (General Biology, or Concepts in Biology, are not sufficient on their own.) **An upper level ecology or evolution course is *strongly recommended***. I will also assume that you know the basics of cell biology and genetics, so Foundations of Cell and Molecular Biology (or equivalent) is also recommended, as is a basic ability in algebra so that model formulations can be followed. There will be a *graded* pre-requisite test in the first two weeks of the semester.

Prerequisites (668)

There are no formal prerequisites for the Masters version of the course, but it is assumed that you have an undergraduate degree in biology or a related subject, and have the usual biology coursework, including **basic cell and molecular biology, genetics, physiology and evolution**. Helpful additions are immunology and ecology.

Textbooks

There are two *required* textbooks. They should be in the NJIT bookstore.

- *Evolutionary Medicine* **2nd edition** by Stephen C. Stearns and Ruslan Medzhitov. ISBN 9780192871985 (the cheaper paperback version). Note: the 2nd edition came out this year: it is a hardback with a **black** cover. Do not get the first edition by mistake!
- *Plague Time* by Paul Ewald. ISBN 0385721846. (Note that there are two editions of this book, with different subtitles. The only other difference is in the Foreward — the one subtitled “The New Germ Theory of Disease” with a green cover has an updated forward that mentions a few case studies that occurred after the original version. If you get the other version, don’t worry.)

The following book is not required, but it is one of the foundations of the field, and you might also find it helpful. It's not expensive: you can get it for about $10 on Amazon.

- *Why We Get Sick* by Randolph M. Nesse and George C. Williams. ISBN 0679746749.

How the class works

This is a flipped class, which means that basic information gathering happens outside of live class time. Live class time is a mixture of discussion and other activities intended to reinforce the material. You should think of class time like you would a review session before an exam, or perhaps as office hours. It is when *you* guide the discussion to get your questions answered.

The basic structure of a week

The main topics of the class are organized around weeks, but because this is a flipped course, the definition of a 'week' is this:

A week starts immediately *after* a Thursday class and runs to the end of the class the following Thursday.

Thus most of the time in a 'week' is *before* the live classes. In this time you will read the material and make notes, and in particular develop and post questions (due before Tuesday's class). You will also think about any 'prompter' questions posted by me beforehand. Tuesday's live discussion will be

based around my prompter questions, and Thursday's live discussion around *your* questions (I will copy a selection of your questions to the discussion boards: that way they will be anonymous).

So, almost every live class in each week will have a whole class discussion, and many classes will also have a small-group discussions or other activities. The remainder of the live class time will be spent in some combination of looking at case studies that illustrate the topic at hand, live coding demonstrations and reviewing any relevant news articles that have appeared in the last week. **The details will be in the daily schedule, which is a separate document.**

Grading breakdown

Graded components of the course are as follows:

Component	Grade percentage
Miscellaneous	5%
Foundations quiz	5%
Participation (in class)	5%
Posting questions	15%
Article summaries	15%
Term paper (group project)	25%
Mid-term viva exam	15%
Final viva exam	15%
TOTAL	100%

The final letter grades will be based on the standard NJIT percentage intervals. There has never been any need for a curve in this course, so don't expect one.

Notes on grade elements

Miscellaneous

These are mainly activities to consolidate your note-taking strategies, which will help you immensely in this course and beyond.

Foundations Quiz

The foundations quiz is based on the first chapter of the main textbook *plus our in-class discussions*. Much of this should be review of material covered in earlier classes (Foundations of Ecology and Evolution, Concepts in Biology, General Biology) or perhaps even high school. Getting back up to speed on this material right away will let us explore more interesting topics.

Participation (in class)

Please note that this is a flipped course, so participation in class activities is essential. A 'normal' level of participation will get you full points. If you sit and say nothing every class, you will get less than the full amount, I will let you know if you start falling into this category. If you participate enthusiastically, you could get bonus points here!

Posting questions

Every class will have preparatory reading, and you must post at least one thoughtful question (or comment) about it. You get a full score for a decent question, but might get less than that, or even zero, if your question indicates you didn't really engage with the material.

Article summaries

During the semester you will be asked to make a three posts, probably on the NJIT Biology Discord server in the #public-health channel. Each will be a short summary of a recent journal article, probably one that has triggered some news in the popular press. You be given a guide on how to write this summary: it will be graded on quality.

Term paper

A group project based on a recent development (and possible controversy) in public health.

Viva Exams

That's right: you are going to have two viva (i.e., live, on-on-one) exams. They might sound scary, but they are actually not. (Or so I am told by students in previous classes where I used them.) One will be a 'mid-term' and one will be the 'final exam.' I will explain how they will work in class, and you will get to pick a time that works for you within the space of about a week.

Online lectures

The *Evolutionary Medicine* textbook is your primary resource for most of the course content, and I expect you to read it. Please don't complain to me that it is a lot of reading — *if you are going into any kind of health career, you will soon be reading way more than this*. I will not be doing 'traditional' lecturing, either live or pre-recorded. But, if you want to listen to someone slowly give a bullet-point

summary of the *first edition* of the textbook, you are in luck: one of the authors, Stephen Stearns, **has posted such lectures online (https://www.youtube.com/playlist?list=PLh9mgdi4rNezvm7QkQ_PioadoAWqfa2L0)**. Feel free to use these to supplement — not replace — your reading. I give you fair warning though: he is a great scientist, but he is *not* a dynamic lecturer.

Other links and media

Links to external media are **now on their own page (https://njit.instructure.com/courses/58076/pages/media-resources)**, which conveniently allows some kinds of videos to be embedded. There is another **page with links to interesting articles (https://njit.instructure.com/courses/58076/pages/ecology-and-evolution-of-disease-books-and-articles)**. There may also be some non-public videos in the Media Gallery.

Current events

Keep an eye on the news and bring up any interesting stuff in class. There will be plenty! Don't forget that NJIT students can get a New York Times subscription for free. Another great source of largely unbiased global news is the BBC, and they have a great app which for now works even in the US.

Detailed class-by-class schedule

This is a **separate PDF document (https://njit.instructure.com/courses/58076/files/8455643?wrap=1)**. Note that the schedule will likely be updated as the semester goes along, especially as we are transitioning to the 2nd edition of the textbook.

Important Rules and Policies

- If you miss an exam or other major assignment due to a valid excuse, medical or other, **you need to provide valid and verifiable documentation to the Dean of Students Office (not to me), and as soon as possible**. Make-up assignments will be determined on a case-by-case basis. Note that, also as per NJIT policy, having an excused absence does not automatically mean you can do a make-up assignment: it depends on the timing, and on the nature of the original assignment.
- Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the **academic code of integrity policy (http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf)**. Please note that it is

my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office.

- ChatGPT and other generative AI tools are **absolutely not allowed** in this class. Some of you may be worried about your writing ability, and want to use an LLM to 'polish your writing'. You must not. I know that some people argue that technically proficient writing is separate from creativity and 'thinking', and that LLMs simply allow you to shift focus to the creative part. I think they are completely wrong. In fact, I would argue that technical writing is a way of organizing and clarifying your (scientific) thoughts, and so in this context is not separate from 'thinking', but rather essential to it. And I am **not alone (https://www.forkingpaths.co/p/the-death-of-the-student-essayand)** . Will I be able to tell if you are using ChatGPT? Hard to say, but in my experience it's pretty obvious (and there are also detection tools). Just know that if I catch you I will report you to the Dean of Students, and any report of misconduct will certainly be seen by NJIT's pre-heath committee and possibly by any medical or other professional schools you apply to. Just say no!