

**BIOLOGY 368-H01: ECOLOGY & EVOLUTION OF DISEASE HONORS**

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<b>OFFICE HOURS:</b>	M, W: 10:00am - 11:00am or By Appointment	<b>COURSE SCHEDULE:</b>	M, W: 8:30 - 9:55am, CKB 207

**INTRODUCTION:** *Ecology and Evolution of Disease* 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, including those in the Accelerated Programs, and 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 open to all with the necessary background (see the pre-requisites below). As an upper-level Honors course, it assumes you have learned *and retained* knowledge about fundamental evolutionary and ecological processes. Without this

background, you will struggle to do well.

**PREREQUISITES:** Foundations of Ecology and Evolution is **required**. (General Biology or Concepts in Biology is not sufficient). An upper level ecology or evolution course is **recommended**. It will also be assumed 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 mathematics so that model formulations can be followed.

**CREDITS:** 3 ■ **SCHEDULE:** Class meets Monday and Wednesday, 8:30am to 9:55am, in CKB 207 on the [NJIT campus](#). I expect you to attend class *and arrive on time even though it is an early class*.

**TEXTBOOKS:** There are two *required* textbooks. They are in the NJIT bookstore.

- *Evolutionary Medicine* by Stephen C. Stearns and Ruslan Medzhitov. ISBN 978-1-60535-260-2
- *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 Foreword — the one subtitled “The New Germ Theory of Disease” has an updated forward that mentions a few case studies that occurred after the original version. If you have the other version, don’t worry.)

The following book, which is one of the foundations of the field, you might also find helpful. You can get it for about \$10 on [amazon.com](http://amazon.com)

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**TEXTBOOKS CONT'D:**

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

**LINKS:** Links to external media are [now on their own page](#).

**GRADING & EXAMS:** There will be two exams, a mid-term and a final, and ten short writing assignments (this counts as a **writing-intensive** course for Rutgers students). The grading will be as follows:

Component	Percentage
Short writing assignments (10)	40%
Participation in class activities	10%
Online postings/Moodle discussions	5%
Mid-term Exam	15%
Final Exam	30%
<b>Total</b>	<b>100%</b>

**WRITING ASSIGNMENTS**

The idea behind the writing assignments is that you will get better at doing them, and your scores will increase. If you manage to do at least four excellent ones by the end of the semester, you will get the full 'quality' score.

Component	Total
2 points for simply doing each assignment 'adequately.'	20
A quality score for each assignment out of 5, <i>top four scores only count</i>	20
<b>Total</b>	<b>40</b>

**PARTICIPATION**

Please note that this is a flipped course, so participation in class activities is **required**. Most weeks, you will get a point for participating in both days of class (assuming there *are* two days), up to a maximum of 10 points. Missing one or both classes in a week means that you don't get the point for that week. You will see that you can miss a class or two and still get all the points.

**ONLINE POSTINGS**

Sometimes you will be asked to put something online, usually some kind of interesting case study you have found in the news or other media.

**SYLLABUS**

- **Important Note: The syllabus is different every time the course is taught!** Some the details may change even as the semester progresses. The reason is that there is usually some emergent infectious disease in the news that we can use as an overall case study. Right now it is Zika virus. Last time it was Ebola. The syllabus below provides a general outline of topics, but the specifics and timings may still change. Check back here regularly for updates.

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### SYLLABUS CONT'D

- Textbook readings are identified as "EM" (Evolutionary Medicine) and "PT" (Plague Time). Other readings are provided as PDF files — click on the name to download each one.

### Learning goals

#### 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 ecological *and* evolutionary factors driving or influencing infectious diseases (such as cholera, malaria, or HIV).
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 '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.

Be able to recognize and 'read' simple mathematical models of infectious disease.

#### COURSE OUTLINE:

##### Week 1 (Wed only): Introduction to the course.

**Content:** Class introduction and logistics. Assessment of student knowledge. Discussion of need for the course.

Discussion of writing, and writing assignments. Discussion of notes, and note-taking.

**Class activity:** Watch beginning of Dawkins lecture while making notes. In small groups, compare note-taking strategies and discuss. As a group 250 word 'abstract' summarizing lecture. Discussion of levels of explanation.

**Reading assignment (for next week):** EM Chapter 1.

##### Week 2: (Re-)introduction to Evolutionary Thinking

**Content:** Natural selection, neutral evolution, random change, mismatch, adaptation, styles of thought.

**Class activity:** Examples of bad evolutionary thinking

**Writing assignment (for Wednesday):** [Jernberg et al. 2010](#)

**Reading assignment (for next week):** EM Chapter 2

##### Week 3: What is a patient?

**Writing assignment (for Wednesday):**

**Reading assignment (for next week):** EM Chapter 3.

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**COURSE OUTLINE, CONT'D.:**

<b>Week 4: What is a disease?</b>
Writing assignment (for Wednesday): Reading assignment (for next week): EM Chapter 4
<b>Week 5: Defenses</b>
Writing assignment (for Wednesday): Reading assignment (for next week): EM Chapter 5
<b>Week 6: Pathogen Evolution</b>
Writing assignment (for Wednesday): Reading assignment (for next week): EM Chapter 6
<b>Week 7: Cancer</b>
Writing assignment (for Wednesday): Reading assignment (for next week): EM Chapter 7
<b>Week 8: Reproductive Medicine</b>
Writing assignment (for Wednesday): Reading assignment (for next week): EM Chapter 8
<b>Week 9: Mismatch</b>
Writing assignment (for Wednesday): Reading assignment (for next week): EM Chapter 9
<b>Week 10: Mental Disorders</b>
Writing assignment (for Wednesday): Reading assignment (for next week): EM Chapter 10
<b>Week 11: Individual Health vs. Population Health</b>
Class activity: Disease models Writing assignment (for Wednesday): Reading assignment (for next week): PT Chapters TBA
<b>Week 12: Germ Theory 1</b>
Writing assignment (for Wednesday): Reading assignment (for next week): PT Chapters TBA
<b>Week 13: Germ Theory 2</b>
Writing assignment (for Wednesday): Reading assignment (for next week): None
<b>Week 14: Germ Theory 2</b>
Review Final exam Date: TBA
<b>FINALS WEEK – DECEMBER 16 – 22, 2016</b>