

**Evolution, Disease, and Medicine**  
Tuesdays and Fridays

**11:216:110**  
10:55am-12:15pm

**Fall 2018**  
RAB 001

**Instructors:** Mansha Seth-Pasricha  
mansha@sebs.rutgers.edu  
(lectures)

Siobain Duffy  
siobain@sebs.rutgers.edu  
(assists with discussion days)

**Office Hours:**  
Foran 316B  
Fridays 12:30-2

Foran 316B  
Tuesdays 1-2:30

*Email inquiries should be addressed to both instructors*

**Course Website:**

<https://sakai.rutgers.edu/portal/site/9090d4a9-0ac0-41da-849a-147e0ded8839>  
Resources, announcements and **changes to this syllabus** will be posted on this Sakai page, so please let us know if you do not have access or do not receive announcements. Sakai uses your Rutgers email address, so make sure you have checked that.

Lecture materials will be posted on the sakai site the day after the lecture.

**Course content:** This course is designed to introduce students to the theory of evolution and its real-world applications to the practice of medicine. Concepts of evolutionary fitness, co-evolution, competition, natural selection, bottleneck effects, adaptation, exaptation and historical constraint will be introduced and discussed in the context of disease and disease treatment. The course will cover infectious and non-infectious diseases.

**Learning Goals:**

1. Students will be able to define and discuss concepts of evolutionary fitness as survival and reproduction, heritability with variation as the mechanism for adaptation, and both selection and non-selection-based mechanisms of evolution.
2. Students will be able to analyze disease and disease-related healthcare concepts from human medicine as evolutionary pressures.
3. Students will be able to logically evaluate medical treatment strategies within the context of evolved responses and altered selective pressures.

**Prerequisites:** None

**Texts:**

Why We Get Sick: The New Science of Darwinian Medicine  
Randolph M. Nesse, George Christopher Williams (1996) Knopf Doubleday

Any edition is acceptable. They are widely available in electronic, used, and new forms.

Readings listed in the syllabus are to be completed **before** the lecture for which they are assigned. Additional resources are listed for many lectures, these are suggested readings/activities to be done **before** the lecture.

**Evaluation and Grading:**

Four exams, each worth 25%, lowest dropped

Four in-class discussions, participation worth up to 6.25% (total of 25%)

Total: 100%

*No make-up exams will be given; you can miss one without suffering any consequences.*

The exams are not explicitly cumulative, but the later topics build on those discussed earlier. The fourth exam will be given during the final exam period but will be of similar length as the other, in-class exams.

Each discussion day's grade is based on presence (attendance), participation (speaking up in the discussion groups), and perspective (appropriate and logical contributions to the discussion). Continual participation where one only asks for clarification (e.g, "what are we talking about again?") is not sufficient.

**Scholarly Conduct:** As with all courses at Rutgers, cheating and plagiarism are strictly forbidden (see <http://academicintegrity.rutgers.edu/>). You are personally responsible for adhering to the entire policy. Don't cheat! Violations of Rutgers' policy will result in a grade of 0% for that exam and will be reported to the Student Conduct Office.

**This syllabus is not a contract.** It is the planned course outline. Items may be added, subtracted, or changed at the discretion of the professors. The on-line version of the syllabus takes precedence over any printed copies.

T 9/4 Introduction to the course

### **Module 1: Disease and Human Evolution**

- F 9/7 Survival of the *Fitter*  
WWGS 13-25  
<http://learn.genetics.utah.edu/content/selection/misconceptions/>  
<http://learn.genetics.utah.edu/content/selection/recipe/>
- T 9/11 Walk Like a (Hu)man  
<http://humanorigins.si.edu/evidence/human-family-tree>
- F 9/14 I Would Walk 500 (million) Miles  
<https://genographic.nationalgeographic.com/human-journey/>  
<http://www.actionbioscience.org/evolution/johanson.html>
- T 9/18 The Problem with Culture  
<http://learn.genetics.utah.edu/content/selection/artificial/>
- F 9/21 Why is my Cholesterol So High?  
WWGS 143 - 157 (Diseases of Civilization)
- T 9/25 Discussion Day
- F 9/28 Exam 1

### **Module 2: Evolution and non-infectious disease**

- T 10/2 It's in our DNA: DNA, RNA, Genes, Cell Division, Mutations, Genetics  
<http://learn.genetics.utah.edu/content/basics/>  
A basic textbook chapter for reference (Molecular Biology of the Cell):  
<http://www.ncbi.nlm.nih.gov/books/NBK26887/>
- F 10/5 Why Good Things Happen to Bad People  
WWGS 13-25 (Natural Selection), 91-106 (Genes and Disease), 123-142  
(Life History evolution)
- T 10/9 Why We Get Old and Fat?  
WWGS 107-122 (Aging), 143-157 (Diseases of Civilization)
- F 10/12 Why We Overreact?  
WWGS 158-170 (Allergy), 207-221 (Mental Disorders)
- T 10/16 Cancer  
WWGS 171-181
- F 10/19 Discussion Day
- T 10/23 Exam 2

### **Module 3: Evolution and infectious disease**

- F 10/26 DNA/RNA re-cap, Signs and Symptoms of Infectious Diseases  
WWGS 26-48
- T 10/30 Alice in Wonderland?

- WWGS 49-65 (An Arms Race Without End)
- F 11/2 We the Living? Viruses: HIV, Ebola, Zika
- T 11/6 This Sucks!! Vector Borne Diseases  
 WHO Global Brief on Vector Borne Disease:  
[http://apps.who.int/iris/bitstream/10665/111008/1/WHO\\_DCO\\_WHD\\_2014.1\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/111008/1/WHO_DCO_WHD_2014.1_eng.pdf)  
 CDC Division of Vector Borne Disease: <http://www.cdc.gov/ncezid/dvbd/>
- F 11/9 Is it all about Penguins? Climate Change and Emerging Infectious Disease  
 Climate Change and Infectious Disease: Is the Future Here?  
<http://ehp.niehs.nih.gov/119-a394/>  
<http://www.who.int/globalchange/environment/en/chapter6.pdf>  
*Vibrio parahaemolyticus*  
<https://www.cdc.gov/vibrio/>  
<https://www.cdc.gov/vibrio/investigations/vibriop-09-13/index.html>
- T 11/13 Discussion Day
- F 11/16 Exam 3

#### **Module 4: Applications of evolutionary medicine**

- W 11/21 Evolutionary history of human physiology
- T 11/27 The future of global public health
- F 11/30 The Human Microbiome  
 Our Bodies Best Buddies, Elisabeth Bik  
<https://microbiomedigest.com/our-bodies-best-buddies/>  
<http://learn.genetics.utah.edu/content/microbiome/ecosystem/>  
<http://learn.genetics.utah.edu/content/microbiome/simulator/>
- T 12/4 Precision Medicine  
 Dr. Watson's base pairs, Maynard Olsen  
<http://www.nature.com/nature/journal/v452/n7189/full/452819a.html>  
<http://learn.genetics.utah.edu/content/precision/intro/>  
<http://learn.genetics.utah.edu/content/precision/action/>  
<https://www.whitehouse.gov/precision-medicine>
- F 12/7 Race based medicine  
<http://www.npr.org/sections/health-shots/2016/02/05/465616472/is-it-time-to-stop-using-race-in-medical-research>  
<http://www.wsj.com/articles/david-altshuler-and-henry-louis-gates-race-in-the-age-of-genomics-1402094811>  
<http://www.reproductivefacts.org/>
- T 12/11 Discussion Day
- Exam 4 during assigned common hour exam period (not explicitly cumulative, on 4<sup>th</sup> module)