

## Darwinian Medicine: Bio 0183

### **I. Instructor:**

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Office Hours: Friday 1:00-3:00, Dana 310A

### **II. The Course:**

Human diseases have both proximate (mechanistic) and ultimate (evolutionary) causes. The common medical approach has been to ignore the ultimate causes and, instead, focus on the proximate. Thus, we may understand the physiological processes but not the evolutionary significance. In this course, we will focus on the evolutionary causes of disease.

The **primary** goal of this course is to teach research skills while sharpening understanding and application of Darwinian thought. To this end, students will generate hypotheses, collect and analyze data to test these hypotheses, and present the information in both oral and manuscript form.

This course will meet in **Barnum 114** Mondays from 1:30-4:00 PM.

### **III. Prerequisites**

Biology 130: Animal Behavior.

### **IV. Attendance:**

Class attendance is critical to your success in this course. Please arrive on time and prepared. Read over each assignment carefully and note any questions you may have about the material. This is a very interactive class - class participation is required and I look forward to your input. If you need to miss a class for a University accepted reason, speak to me about it in advance (if possible).

### **V. Readings:**

**Textbook:** Neese RM & Williams GC. (1994) *Why we get sick*. Random House, New York.

**Additional Readings:** Additional readings will be handed out in class or posted on the webpage. (I will keep these to a minimum.)

### **VI. Grading:**

15-20 Page Research Paper (30%)

    First Draft (35% of paper grade)

    Final Draft (65% of paper grade)

PowerPoint Presentations (20%)

PDF Library (20%)

Weekly Email Summaries (20%)

Attendance / Participation\* / Subjective Evaluation (10 %)

\* Minimum of 4 written questions / discussion points on the week's summaries (I may ask for these to be handed in after class)

### **VII. Class Format (2 sections):**

A. Section 1: Student-led Presentations (~1:30 - 3:00)

    1. Short presentations (ideas / successes / problems / questions)

    2. Long presentation (update)

    3. Group discussion of presentation

B. Section 2: Discussion (~3:00-4:00)

1. Recap previous week (if necessary)
2. New material (see lecture schedule)

**VIII. TRUNK Assignment**

A. Must be posted by 5:00 PM on **Thursday** before Monday's lecture.

B. General Format

1. Brief synopsis of readings (you will not always have assigned readings.)
2. Issues related to your project (new ideas, new summaries, specific problems, etc.)
  - *Total length should not exceed 3 double-spaced pages*

**IX. Research Project (Proposal, 1<sup>st</sup> Draft, Final Draft, Presentation):**

A. Proposal Format (Presented Oct. 3, due by 5:00 PM Oct. 7)

1. 1-3 pages, double-spaced, 12-point Times font, and 1" margins on all sides.
2. Identify disease, symptom, or health problem of interest
3. Identify reference material relating to topic (10-15 sources)
4. List 3-5 possible approaches to studying the topic.
  - *You will present this to the group AND get feedback from us BEFORE the proposal is handed in.*

B. Manuscripts (first draft, Nov. 21; final draft, Dec. 19)

1. 15-20 pages, double-spaced, 12-point Times font, and 1" margins on all sides (references do not count toward page limit).
  - *Note: there can be considerable variation on this format.*

C. Final PowerPoint Presentation

1. 20 minutes (15 for the talk, 5 for questions)
2. Follows general paper format (intro, methods, results, and conclusions)

**X. Plagiarism:**

You must reference ideas and writings of others properly in the papers you produce for this course. Writing assignments must be your own work. Cheating of any sort will not be tolerated.

**XI. Course Homepage:**

The course has a web page. To get on the course home page, open an Internet browser and type in the address <https://trunk.tufts.edu/xsl-portal>. The page should allow you to log on using your basic student identifying information.

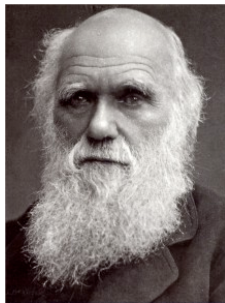


Image from <http://www.eeb.lsa.umich.edu/logo.asp>

**XII. Lecture Schedule**

<b>Week</b>	<b>Topic</b> (after chapters in Neese & Williams 1994)	<b>Readings</b>
<b><i>Background Information</i></b>		
1 (Sept. 12)	<u>Course Introduction</u> <u>Background Information (1):</u> Evolution and Natural Selection; Levels and Units of Selection. <u>Background Information (2):</u> Scientific Method; Levels of Analysis.	
<b><i>Darwinian Medicine</i></b>		
2 (Sept. 19)	<i>Guest Lecture:</i> Regina Raboin. Why disease?; Framework for Evaluating Disease	Chap. 1 & 3
3 (Sept. 26)	Fever as an Adaptive Mechanism	
4 (Oct. 3)	The ‘Red Queen’, an Evolutionary Arms race <b><i>Project Proposal (email by following Friday)</i></b>	Chap. 4
5 (Oct. 10)	Columbus Day: No Classes	
6 (Oct. 17)	Injury	Chap. 5
7 (Oct. 24)	Poisons and Toxins	Chap. 6
8 (Oct. 31)	Genetic Disease	Chap. 7
9 (Nov. 7)	Senescence	Chap. 8
10 (Nov. 14)	Human Evolution and Evolutionary Legacies	Chap. 9
11 (Nov. 21)	Diseases of Culture <b><i>First Draft of Paper Due</i></b>	Chap. 10
12 (Nov. 28)	Immunity and Allergy; Cancer	Chap. 11 & 12
13 (Dec. 5)	Sex and Reproduction	Chap. 13
14 (Dec. 12)	Mental Diseases; Darwinian Medicine and the Future	Chap. 14 & 15
(Dec. 14)	<b><i>Class Presentations</i></b> (if agreed upon)	
(Dec. 19)	<b><i>Final Paper Due</i></b>	

Course # \_\_\_\_\_ Course Title \_\_\_\_\_

Instructor \_\_\_\_\_

**This course fulfills the following expectations for educational outcomes for biology majors**

### **1. Core Competencies**

Be able to generate and to analyze data, to organize it for presentation, and to draw appropriate conclusions based on trends and/or supported by statistics, and to formulate new questions based on findings

Be able to find and understand primary literature pertinent to a given topic in biological sciences, to examine and interpret data presented in figures and tables, and to evaluate conclusions based on the data presented

Be able to understand techniques and methods described in current literature, or to investigate such methods through scholarly publications

Be able to perform standard laboratory techniques accurately and safely

Be able to access and utilize pertinent large databases

Be able to report experimental results in a standard written format and to write coherently and persuasively about conclusions from such results and their significance

Be able to communicate scientific results verbally, and to support their significance and relation to the current framework of understanding

Understand how to pursue scientific inquiry through formulating hypotheses, designing controlled experiments or studies, gathering or generating data, and analyzing and evaluating results

Be able to make connections between concepts in biology and the foundations of physical sciences and computational methods

Be mindful of ethical considerations and societal outcomes in research and in technological advancement

### **2. Knowledge base**

An understanding of the major paradigms in biology, including evolution, cell theory, genetic inheritance, the central dogma, integration of living systems, and energy flow through ecosystems

An understanding of the relationship between genotype and phenotype

An understanding of the information flow between DNA, RNA, and proteins, and a basic knowledge of the processes that govern cellular function and division.

Familiarity with the processes through which evolution occurs, and an understanding that selection acts on multiple stages in the life cycle

An understanding of the dynamic nature of organismal development from inception through growth and differentiation, aging and death

Appreciation of the morphological, physiological, ecological, and behavioral diversity of life, and the importance of that diversity

Recognition that biological processes are based on chemical and physical principles, and that biology informs medicine, community health, food production, and environmental policy