

## **BIO 48: Disease, The Environment, and Human History**

Instructor: Mark A. McPeck

Office: 022 LSC

Time: MWF 12:50-1:55 PM, X-hour: 1:20-2:10

Office hours: 1000-1200 MWF or by arrangement

Most diseases result from either environmental challenges that individuals face or the constitution of the individuals' genomes. For example, health challenges like obesity, diabetes and allergies result from changes in the human diet, and infectious diseases like flus, Lyme disease and even bubonic plague are exacerbated by environmental changes that humans have made to our environment. Diseases as varied as dementia, various cancers, sickle cell anemia and cystic fibrosis result from past genetic changes in humans that may have actually been favored in some contexts. Moreover, humans and their pathogens continually change in response to one another. In this course, we will place various human diseases in these broader contexts to explore their sources and ultimate causes, and we will consider the implications of this exploration for how science can shape better public policy to produce better health outcomes for individual patients and the public health system more broadly.

Prerequisites: one from among Bio 12-16, or permission of instructor.

Term: 18F,19F

Textbook: Gluckman, P., A. Beedle, T. Guklijas, F. Low, and M. Hanson. 2016. Principles of Evolutionary Medicine, 2<sup>nd</sup> ed. Oxford University Press, Oxford, UK. ([textbook is available online](#) from the Dartmouth College Library)

Other readings from the primary literature will also be assigned each week.

### **Schedule:**

#### **Week I. Disease, Ecology and Evolution**

Forms of disease across the Tree of Life

Diversity of pathogens and parasites

Forms of defenses against disease

#### **Week II. Mismatched and Altered Environments**

Metabolism and resource limitation; habitat distributions and alterations

Obesity & diabetes — diet alterations, thrifty genotypes, or thrifty phenotypes?

Human environmental alterations sometimes foster diseases — Lyme disease, plague,

### **Week III. Altered Life Histories**

Life histories and life history evolution

Senescence & Dementia

Cancers of later life: colorectal, prostate cancer

### **Week IV. Uncontrolled Defense Mechanisms**

Adaptive immune response in vertebrates

Asthma, allergies & the Hygiene Hypothesis

Other autoimmune disorders

### **Week V. Human History**

Human history, migration and genetic diversity

Local adaptation and genetic drift — Lactose tolerance, hemophilia, and other genetic disorders of small and local populations

Local balancing selection — Sickle-cell anemia & G6PD deficiency adaptations to malaria parasites

### **Week VI-VII. Zoonosis**

SIR models and their dynamics

Ebola vs. measles

HIV

Flus

### **Week VII-VIII. Host-Pathogen Coevolution**

Virulence versus transmission trade-off:

Ebola vs. measles revisited

Rabbit pox and biological control measures

Microbial drug resistance and treatment policies

### **Week IX. Policy Issues and Presentations**

Student presentations of projects analyzing public policy about specific issues of the student's choosing.

### **Evaluation**

Each student's grade will be based on two midterm examinations given in the evening during the term (each constitutes 25% of the student's final grade), a final examination (30%), and a group project with two other students in the class that evaluates some public policy related to health (20%).

For the group project, students will work in groups of three to define an issue related to health policy they would like to explore. They will research this issue for what current standards and practices, evaluate those standards and practices with respect to the issues we discuss in class, and make a presentation to the class during the final week of classes on how they would recommend that these standards and practices might be improved.

### **Academic Honor Principle**

Academic honesty is essential. The following is quoted directly from the [Dartmouth College Student Handbook](#):

“Fundamental to the principle of independent learning are the requirements of honesty and integrity in the performance of academic assignments, both in the classroom and outside. Dartmouth operates on the principle of academic honor, without proctoring of examinations. Students who submit work that is not their own or who commit other acts of academic dishonesty forfeit the opportunity to continue at Dartmouth.”

The complete text of the Academic Honor Principle is in the Student Handbook. Please read it carefully. Any violations of the Honor Principle will be referred to the Committee on Standards. The answers to examination questions you submit must be completely your own work, and the exams must be completed without reference to written materials other than those provided with the exam and must be completed without communication with anyone else (the only permissible exception is that students may request clarification of any exam question from the course instructor who is present expressly for that purpose).

The public policy project is a group project that must be done with your two other group members. In this assignment, you are expected to work courteously and effectively with your colleagues to produce your analysis and create the presentation. It would in fact be academic dishonesty to claim that you contributed to this group effort when you did not. Therefore, for the group project, all members of the group are expected to contribute significantly to the overall effort.

### **Student Needs**

Students with disabilities enrolled in this course and who may need disability-related classroom accommodations are encouraged to make an appointment to see me before the end of the second week of the term. All discussions will remain confidential, although the Student Accessibility Services office may be consulted to discuss appropriate implementation of any accommodation requested.

### **Religious Observances**

Some students may wish to take part in religious observances that occur during this academic term. If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.