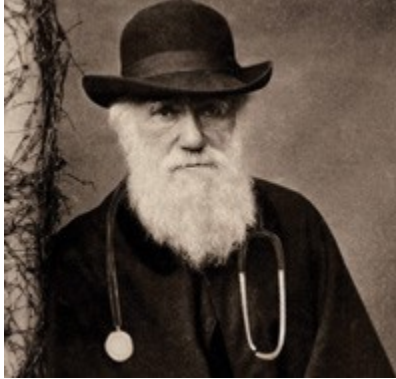


## HEB 1424: EVOLUTIONARY MEDICINE

*Spring Semester 2017*

Thursday 1:00-4:00, Peabody Museum 52H



**Professor:** Dr. Lara Durgavich; Peabody Museum 53A; ldurgavich@fas.harvard.edu

**Office Hours:**

### COURSE DESCRIPTION

This course applies a Darwinian perspective to explore the ultimate causes of human disease, and uses the tenets of evolutionary theory to explain variability in the health of individuals and populations. In addition, we will examine the role that environmental conditions, economic factors, and sociocultural practices play in shaping modern patterns of human health and disease. Topics will include human-pathogen coevolution, diet and nutrition, reproductive health, mental illness, and senescence.

### REQUIRED READING

Trevathan W, Smith EO, McKenna J (2008) *Evolutionary Medicine and Health: New Perspectives*. Oxford University Press.

Additional readings are available as PDF files on the course website.

### COURSE REQUIREMENTS

There will be an in-class midterm exam and a non-cumulative take-home final exam given in this course. You will also complete two writing assignments during the semester (details TBA). Finally, because it is a vital component of a successful seminar course, class participation will factor significantly into your semester grade. Each of you will be expected to lead one class discussion during the semester, and to regularly participate in weekly discussions of the reading

materials. Your weekly participation will be evaluated as follows (score out of 3 points per class):

0 = not present

1 = present, but not engaged in discussion and exercises

2 = engaged in discussion and exercises, but comments are only somewhat relevant to, or indicate a superficial understanding of, the reading

3 = actively engaged in discussion and exercises; comments are insightful and indicate clear understanding of readings

Please note that you are expected to attend all class meetings. Make-up exams will not be given without an appropriate written excuse (e.g., medical emergency, jury duty...). No extra credit will be given during the course.

### GRADING

Participation	20% (Weekly participation 15%; Discussion leading 5%)
Writing assignment 1	20% <b>Due March 10</b>
Midterm Exam:	20% <b>March 2</b>
Writing assignment 2:	20% <b>Due April 21</b>
Final Exam	20% Due date TBA

### Late Work Policy:

5% will automatically be deducted from the grade for written work that is turned in within 24 hours after the due date. 15% will automatically be deducted for work that is turned in within 48 hours. 25% will automatically be deducted for work that is turned in within 72 hours. Written work will not be accepted more than 72 hours after the due date.

### ACADEMIC INTEGRITY

All students are required to adhere to the Harvard College Honor Code. To review the honor code, visit <http://honor.fas.harvard.edu>.

Additional information about the Academic Integrity Policy of this course, including details about collaboration, is available on the course website.

Information about properly citing sources is available at the following address:  
<http://usingsources.fas.harvard.edu/icb/icb.do>

## SCHEDULE

Reading assignments should be completed for the day they are listed.

EMH = Evolutionary Medicine and Health text

### **January 26: Introduction: What is Darwinian medicine?**

1. Nesse (2008) The importance of evolution for medicine. EMH.

Optional background reading to review key concepts:

1. Forbes and Kimmel (2010) Evolution is change in the inherited traits of a population through successive generations. *Available online at Scitable.*
2. Carlin (2011) Mutations are the raw materials of evolution. *Available online at Scitable.*
3. Sabeti (2008) Natural selection: Uncovering mechanisms of evolutionary adaptation to infectious disease. *Available online at Scitable.*

### **February 2: Evolution of virulence; Infectious disease in human evolution**

1. Ewald (1993) The evolution of virulence
2. Ebert and Hamilton (1996) Sex against virulence: the coevolution of parasitic diseases
3. Dobson and Carper (1996) Infectious diseases and human population history
4. Knell (2004) Syphilis in Renaissance Europe: rapid evolution of an introduced sexually transmitted disease?
5. Callaway (2011) Fighting for a cause
6. Gross (2006) The results are in: bacterial parasite strives for balance in host infection.

### **February 9: Emerging infectious disease and antimicrobial resistance**

1. Rogalski et al. (2016) Human drivers of ecological and evolutionary dynamics in emerging and disappearing infectious disease systems
2. Galvani and Novembre (2005) The evolutionary history of the CCR5-Δ32 HIV-resistance mutation
3. Lessler et al. (2016) Assessing the global threat from Zika virus
4. Xue (2014) Superbug: An epidemic begins
5. Zhang (2017) Resistance to the antibiotic of last resort is silently spreading
6. Antonovics et al. (2007) Evolution by any other name: Antibiotic resistance and avoidance of the E-word
7. Glaser (2004) The ubiquitous Triclosan

## **February 16: Increasing chronic disease mortality**

1. Weil (2008) From ancient seas to modern disease: evolution and congestive heart failure. EMH.
2. David and Zimmerman (2010) Cancer: an old disease, a new disease or something in between?
- 2b. Faltas (2010) Cancer is an ancient disease: the case for better paleoepidemiological and molecular studies.
- 2c. David and Zimmerman (2010) Cancer is an ancient disease?

## **February 23: Dietary adaptation; Nutritional disease; Metabolic syndrome**

1. Turner et al. (2008) Human evolution, diet, and nutrition: When the body meets the buffet. EMH.
2. Lieberman (2008) Diabesity and Darwinian medicine: The evolution of an epidemic. EMH.
3. Speakman (2006) Thrifty genes for obesity and the metabolic syndrome: Time to call off the search?
4. Pontzer (2017) The Exercise Paradox
4. Tsai and Coyle (2009) The microbiome and obesity: is obesity linked to our gut flora?

## **March 2: MIDTERM EXAM**

## **March 9: Development and disease; Hygiene hypothesis**

1. Kuzawa (2008) The developmental origins of adult health: intergenerational inertia in adaptation and disease. EMH.
2. Gluckman et al. (2009) Epigenetic mechanisms that underpin metabolic and cardiovascular diseases.
3. Thornburg and Marshall (2015) The placenta is the center of the chronic disease universe
4. von Mutius (2007) Allergies, infections, and the hygiene hypothesis: The epidemiological evidence.
5. Zaccane et al. (2006) Parasitic worms and inflammatory diseases.
6. Praprotnik et al. (2008) The curiously suspicious: Infectious disease may ameliorate an ongoing autoimmune destruction in systemic lupus erythematosus patients.

## **March 16 – NO CLASS; SPRING RECESS**

## **March 23: Human reproduction, fertility, and infertility**

1. Nuñez-de la Mora and Bentley (2008) Early life effects on reproductive function. EMH.

2. Sievert (2008) Should women menstruate? An evolutionary perspective on menstrual-suppressing oral contraceptives. EMH.
3. Smith et al. (2012) Effects of *BRCA1* and *BRCA2* mutations on female fertility
4. Russell et al. (2016) Sudden infant death syndrome.

### **March 30: Cancer; Senescence**

1. Aktipis and Nesse (2012) Evolutionary foundations for cancer biology
2. Parikh (2017) Why we need to redefine the “cure” for cancer
3. Kirkwood and Austad (2000) Why do we age?
4. Pringle (2013) Long live the humans.

Optional background reading to review key concepts:

1. “Cell division and cancer.” *Available online at Scitable.*
2. Shefferson (2010) Why are life histories so variable? *Available online at Scitable.*

### **April 6: Stress, anxiety, and psychiatric disorders**

1. Sullivan and Hagen (2002) Psychotropic substance-seeking: evolutionary pathology or adaptation?
2. Nesse (2000) Is depression an adaptation?
3. Stein and Nesse (2011) Threat detection, precautionary responses, and anxiety disorders.
4. Pearlson and Folley (2008) Schizophrenia, psychiatric genetics, and Darwinian psychiatry: An evolutionary framework.

### **April 13: Economic factors and Sociocultural practices**

1. Lindenbaum (2001) Kuru, prions, and human affairs: Thinking about epidemics.
2. Farmer (1996) Social inequalities and emerging infectious diseases.

### **April 20: Personalized medicine and Applied Evolution**

1. Crews and Gerber (2008) Genes, geographic ancestry, and disease susceptibility: Applications of evolutionary medicine to clinical settings. EMH.
2. Carroll et al (2014) Applying evolutionary biology to address global challenges
3. Vale et al (2016) Beyond killing: can we find new ways to manage infection?
4. Sawadogo et al (2017) Targeting male mosquito swarms to control malarial vector density
5. Cornetta and Gunther Brown (2013) Perspective: balancing personalized medicine and personalized care