

ANTH 175: EVOLUTIONARY MEDICINE
Fall Quarter 2014 (CRN: 10332)
Lillis 282 Monday/Wednesday 4:00-5:20 pm

4 Credit Hours; Satisfies an SC Group Requirement

Instructor: Dr. Josh Snodgrass (website: <http://www.pinniped.net/snodgrass.html>)

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Course Description: Application of evolutionary thinking to the study of human health and disease

Format: Lecture and required weekly laboratory sections.

Course Content: This course provides an introduction to evolutionary (or Darwinian) medicine, a relatively new field that recognizes that evolutionary processes and human evolutionary history shape health among contemporary human populations. The field of evolutionary medicine emphasizes ultimate explanations, such as how natural selection and other evolutionary forces shape our susceptibility to disease; this perspective complements that of biomedicine, which generally focuses on identifying the immediate mechanisms that give rise to diseases and malfunctions. The evolutionary medicine approach has provided insights into why diseases occur at all and additionally has produced valuable insights on treatment strategies. This course will examine a variety of diseases using an evolutionary perspective, including infectious diseases, mental disorders and cancers, and focus attention on the role of diet and psychosocial stress in the development and progression of cardiovascular disease, obesity, and diabetes.

Expanded Course Description: This is a science group satisfying course that is designed to be a comprehensive introduction to evolutionary, or Darwinian, medicine. In brief, evolutionary medicine is the application of evolutionary thinking, including evolutionary processes and human evolutionary history, to understanding health and disease among contemporary human populations. This course uses a scientific approach, drawing on the methods, theories, and bodies of knowledge from various scientific disciplines, including evolutionary biology, genetics, neuroscience, physiology, nutritional sciences, and medicine.

This course has four main sections:

Section 1 introduces students to the scientific method and evolutionary theory, and builds the foundation for the understanding the evolutionary medicine approach. Particular attention is directed towards the adaptation concept and life history theory. This section of the course also provides an introduction to human evolutionary history, concentrating on key events in hominin evolution (e.g., bipedalism and brain evolution), and to modern human biological variation.

Section 2 focuses on the basic principles of evolutionary medicine, and emphasizes differences between proximate and ultimate explanations. This section of the course also provides a basic introduction to epidemiology (the study of patterns of human disease and their causes) and a brief discussion of contemporary global health issues.

Section 3 uses the evolutionary medicine approach to examine infectious diseases. This section of the course provides an introduction to human defenses to infectious organisms, and describes major cultural transitions in human history that altered exposure to infectious disease. This section also focuses on emerging infectious diseases.

Section 4 applies the evolutionary medicine approach to chronic diseases, including cancers and osteoporosis. This section of the course emphasizes cardiovascular diseases (heart disease and stroke), obesity, and diabetes and uses a biocultural framework to examine the role of diet and psychosocial stress in the development and progression of these conditions.

LEARNING OBJECTIVES

After successful completion of this course, students will have an understanding of the following key issues:

- The basic principles of evolutionary biology and human genetics
- The major trends in hominin evolution and how humans have adapted biologically to their environments
- The distinction between proximate and ultimate explanations for human biology and disease
- The general pattern of health change throughout human prehistory and history, and across populations
- How the biocultural approach to health can provide a window onto such issues as obesity, cardiovascular disease, type 2 diabetes, birth complications, HIV/AIDS, autoimmune diseases, and allergy
- The explanatory framework that the environmental mismatch approach uses to explain chronic disease, infectious conditions, and mental disorders in contemporary human populations

Accommodations: Appropriate accommodations will be provided for students with documented disabilities. If you anticipate needing accommodations in this course, please make arrangements to meet with me soon.

Expectations and Grading: Attendance at lectures and participation in lab sections are expected. Course readings are essential to passing exams, completing lab assignments, and participating in lab section activities. Your grade in the course will reflect performance on midterm and finals, four quizzes, 5 lab write-ups, and one response paper.

Quiz 1 (online; end of week 2)	5%
Quiz 2 (online; end of week 3)	5%
Midterm Exam (in class; 10/27)	25%
Quiz 3 (online; end of week 7)	5%
Quiz 4 (online; end of week 8)	5%
Final Exam (in class; 12/9)	25%
Response Paper (choose 1 of the 3 options)	10%
Lab Exercises (5 short lab write-ups @ 4% each)	20%

Grades will be assigned as follows: A = 90-100%, B = 80-89%, C = 70-69%, D = 60-69%, F < 60% (with minus and plus grades assigned at appropriate cutoffs).

The grading system used in this course is as follows:

- A** – Outstanding performance relative to that required to meet course requirements; demonstrates a mastery of course content at the highest level.
- B** – Performance that is significantly above that required to meet course requirements; demonstrates a mastery of course content at a high level.
- C** – Performance that meets the course requirements in every respect; demonstrates an adequate understanding of course content.
- D** – Performance that is at the minimal level necessary to pass the course but does not fully meet the course requirements; demonstrates a marginal understanding of course content.
- F** – Performance in the course, for whatever reason, is unacceptable and does not meet the course requirements; demonstrates an inadequate understanding of the course content.

Required Readings: Assorted articles and book chapters (see below)

Blackboard: The blackboard site for this class will be your main source for course information, documents, and announcements. Make sure that you check your Blackboard-linked e-mail account every day.

The midterm and final exams will cover lectures, readings, videos, and lab section material. Exams will include multiple choice, matching, and short answer (2-3 sentences) sections. **The final exam will be cumulative**, but will emphasize material from the second half of the course. Exams and assignments must be taken/turned in at the scheduled time—**under no circumstances will make-up exams or assignment extensions be given without a documented excuse** (e.g., signed note from your doctor). If you will not be able to take an exam or turn in an assignment, you **must** notify me in advance (preferably by e-mail).

During the term, each student will write one short (3-4 page, double spaced) **response paper** on an article or movie provided by the instructor. This response paper will provide an opportunity for discussion and critical analysis of current topics related to evolutionary medicine and global health. Reaction papers are only 3-4 pages long so writing should be concise and focused around a couple of main points. **Response paper choices (Choose only one):**

1) Global health partners? HIV/AIDS, academia, and the rise of global health. Based on article, “Unequal ‘partners’: AIDS, academia, and the rise of global health” by Johanna T. Crane. **DUE: 10/17 @ 8 pm.**

2) Ebola: Can we stop it or have we already lost? Based on the following articles: A) Jon Cohen’s “How to stop Ebola: Could survivors safely care for the infected?” (*Slate*, Sept. 23, 2014); B) Adam Nossiter’s “Lockdown begins in Sierra Leone to battle Ebola” (*The New York Times*, Sept. 19, 2014); and, C) Nicolas Kristof’s “The Ebola fiasco” (*The New York Times*, Sept. 24, 2014). **DUE by 10/31 @ 8 pm.**

3) HIV/AIDS: Identifying and Surviving a Plague. Based on one (or both, if you wish) of the following movies: *And the Band Played On* (1993, HBO Films) OR *How to Survive a Plague* (2012, MPI Media). **DUE by 11/14 @ 8 pm.**

SCHEDULE:

Week	Dates	Topics	Required Reading
1	9/29 10/1	Course Overview and Requirements Anthropology, Science, & Evolution: Anthropology; Scientific Method; Early Evolutionary Studies <u>Lab 1: Intro; Scientific Method; Basic & Applied Science</u> ** (Lab write-up due in lab the following week)	1) Shubin 2009 2) Gibbons 2009 1) Jurmain et al. 2011 (Ch2) <u>Lab readings</u> 1) Firestein 2012 2) Bering 2012
2	10/6 10/8	Evolutionary Biology, Part 1: Natural Selection & Adaptation; How Evolution Works; Biological Basis of Life Evolutionary Biology, Part 2: Modern Synthesis; Adaptation; Evolution and Development; <u>Video Segment: Evolution—Darwin’s Dangerous Idea</u> <u>Lab 2: Video: Ghost in Your Genes</u> **Quiz on the Scientific Method & Evolutionary Biology (Online—to be taken anytime 10/11 - 10/13; Covers everything from Weeks 1-2)**	1) Jurmain et al. 2011 (Ch3) 1) Stanford et al. 2008 (Ch5) 2) Gluckman & Hanson 2006 (Ch2)

SCHEDULE:

Week	Dates	Topics	Required Reading
3	10/13 10/15	<p>Evolutionary Biology, Part 3: Human Evolutionary History</p> <p>Evolutionary Biology, Part 4: Modern Human Origins; Human Adaptation and Adaptability</p> <p><u>Lab 3: Evolutionary Theory</u> **(Lab write-up due in lab the following week)</p> <p>Response Paper #1 (DUE by 10/17 @ 8 pm) Global health partners? HIV/AIDS, academia, and the rise of global health</p> <p>**Quiz on Evolutionary Biology & Human Evolution (Online—to be taken anytime 10/18 - 10/20; Covers everything from Weeks 1-3)**</p>	<p>1) Gluckman et al. 2009 (Ch6)</p> <p>1) Jurmain et al. 2011 (Ch12)</p> <p><u>Lab reading</u> 1) Johnson 2011</p>
4	10/20 10/22	<p>Basics of Evolutionary Medicine: Proximate vs. Ultimate Explanations; The Biocultural Perspective</p> <p>Evolutionary Medicine Case Study: Cold Adaptation & Chronic Disease—Dr. Snodgrass’ Research in Siberia</p> <p><u>Lab 4: Anthropometry (Body size, proportions, and composition) & biomarkers/disease markers</u> **(Lab write-up due in lab the following week)</p>	<p>1) Zuk 2007 (Ch1) 2) Randall 2012</p> <p>1) Leonard et al. 2009</p>
5	10/27 10/29	<p>**Midterm Exam (In Class—Covers everything from Weeks 1-4)**</p> <p>Epidemiology & The Big Picture of Global Health: Trends & Historical Patterns; Epidemiological Transitions; Health Disparities; <i>Video Segment: Trends in Life Expectancy</i></p> <p>Response Paper #2 (DUE by 10/31 @ 8 pm—Happy Halloween!) Ebola: Can we stop it or have we already lost?</p> <p><u>Lab 5: Food Production; Skeletal Health/Paleopathology</u> **(Lab write-up due in lab the following week)</p>	<p>1) Relethford 2010 (Ch17) (<u>not</u> covered on midterm)</p>
6	11/3 11/5	<p>Allergy & Autoimmune Disease: Changing Worlds & the Price of Victory over Infectious/Parasitic Disease</p> <p><i>Video—Rx for Survival: A Global Health Challenge – Disease Warriors</i> (Dr. Snodgrass in Washington DC at the Gerontological Society of America conference)</p> <p><u>Lab 6: Video—Typhoid Mary: The Most Dangerous Woman in America</u></p>	<p>1) Zuk 2007 (Ch2) 2) O’Rourke 2013</p> <p>1) Seymour n.d. (Smallpox) 2) Gottlieb n.d. (Vitamin A)</p>

SCHEDULE (Cont'd):

Week	Dates	Topics	Required Reading
7	11/10 11/12	<p>Emerging Infectious Diseases: Invulnerability Turns to Fear & Pessimism; The Third Epidemiological Transition</p> <p>An Evolutionary Perspective on HIV/AIDS: Molecular Anthropology & HIV/SIV</p> <p>Response Paper #3 (DUE by 11/14 @ 8 pm) HIV/AIDS: Identifying and Surviving a Plague.</p> <p>Lab 7: Discussion: Current Issues in Public Health (Public Health vs. Individual Rights: Vaccination & Quarantine)</p> <p>**Quiz on material since the midterm (Online—to be taken anytime 11/15 - 11/17; Covers everything but emphasizes Weeks 5-7)**</p>	<p>1) Zuk 2007 (Ch10)</p> <p>1) Fischer & Madden 2011</p> <p>Lab Readings: Couzin-Frankel 2009 Specter 2011 Wilson 2007 Kaiser 2013 (Read at least 2)</p>
8	11/17 11/19	<p>Sexually-Transmitted Diseases: Humans in Comparative Perspective; Sex Differences in Health; Video segment: <i>Evolution: Why Sex?</i></p> <p>Chronic Diseases, Part 1: The Human Diet in Evolutionary Perspective; The Nutrition Transition</p> <p>Lab 8: Physical Activity & Diet ** (Lab write-up due in lab the following week)</p> <p>**Quiz on material since the midterm (Online—to be taken anytime 11/22 – 11/24; Covers everything but emphasizes Weeks 5-8) **</p>	<p>1) Zuk 2007 (Ch5) 2) Zuk 2007 (Ch6)</p> <p>1) Leonard 2002 2) Cordain et al. 2005</p>
9	11/24 11/26	<p>Chronic Diseases, Part 2: Obesity; The Obesogenic Environment; Diet & Physical Activity</p> <p>Chronic Diseases, Part 3: Cardiovascular Disease & Type 2 Diabetes; Diabetes?</p> <p>No Labs—Thanksgiving Holiday!</p>	<p>1) Gluckman & Hanson 2012 2) Bellisari 2013</p> <p>1) Chen et al. 2012</p>
10	12/1 12/3	<p>Chronic Diseases, Part 4: The Effects of Chronic Stress on Disease Risk; Stress and Poverty</p> <p>Chronic Disease (cont'd): Catch-Up on Obesity, CVD, Diabetes, and Stress; How to Live a Long and Healthy Life</p> <p>Lab 10: Video: Stress: Portrait of a Killer</p>	<p>1) Sapolsky 2005 2) Tough 2011</p>
	12/9	<p>**Final Exam, Tuesday, December 9, 2:45-4:45 (In Class—Cumulative but emphasizes material from weeks 5-10)**</p>	

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Required Readings

Week 1 Readings

- Shubin NH. 2009. This old body. *Scientific American* 300, Issue 1 (January): 64-67.
- Gibbons A. 2009. What's for dinner? Researchers seek our ancestors' answers. *Science* 326: 1478-1479.
- Jurmain R et al. 2011. The development of evolutionary theory (Chapter 2). In: Essentials of Physical Anthropology, Cengage. pp. 24-47.

Lab readings for week 1

- **Firestein S. 2012. What science wants to know. *Scientific American* (April).**
- **Bering J. 2012. How are they hanging? This is why they are. In: Why is the Penis Shaped Like That?...And other Reflections on Being Human. *Scientific American/FSG*, pp. 3-10.**

Week 2 Readings

- Jurmain R et al. 2011. The biological basis of life (Chapter 3). In: Essentials of Physical Anthropology, Cengage. pp. 48-69.
- Stanford C et al. 2008. The forces of evolution and the formation of species (Chapter 5). Pearson. pp. 89-98 (you do not need to read pp. 99-111).
- Gluckman P, Hanson M. 2006. Where have we come from? (Chapter 2). In: Mismatch: The Lifestyle Diseases Timebomb. Oxford University Press. pp. 49-73.

Week 3 Readings

- Gluckman P et al. 2009. Human evolution and the origins of human diversity (Chapter 6). In: Principles of Evolutionary Medicine. Oxford University Press. pp. 123-150.
- Jurmain R et al. 2011. Human Variation and Adaptation (Chapter 12). In: Essentials of Physical Anthropology, Cengage. pp. 302-335.

Lab reading for week 3

- **Johnson EM. 2011. Stressing motherhood: How biology and social inequality foster maternal infanticide. *The Primate Diaries Blog, Scientific American*; 7/22/11.**

Week 4 Readings

- Zuk M. 2007. Why doctors need Darwin (Chapter 1). In: Riddled with Life: Friendly Worms, Ladybug Sex, and the Parasites that Make Us Who We Are. Harcourt Press. pp. 13-37.
- Randall DK. 2012. The evolutionary mistake that chokes millions of people in their sleep every night. *Slate*; 8/13/12.
- Leonard WR, Snodgrass JJ, Sorensen MV. 2009. Health consequences of social and ecological adversity among indigenous Siberian populations: Biocultural and evolutionary interactions. In: C. Panter-Brick & A. Fuentes (eds.) Health, Risk, and Adversity: A New Synthesis from Biological Anthropology. Berghahn Books. pp. 26-51.

Week 5 Reading

- Relethford JH. 2010. The biological impact of agriculture and civilization (Chapter 17). In: The Human Species: An Introduction to Biological Anthropology. McGraw-Hill. pp. 430-458.

Week 6 Readings

- Zuk M. 2007. Friendly worms and the price of victory (Chapter 2). In: Riddled with Life: Friendly Worms, Ladybug Sex, and the Parasites that Make Us Who We Are. Harcourt Press. pp. 38-63.
- O'Rourke M. 2013. What's wrong with me? I had an autoimmune disease then the disease had me. *The New Yorker* (8/26/13), pp. 32-37.

- Seymour J. n.d. Case study: Eradicating smallpox. Center for Global Development (<http://www.cgdev.org/page/case-1-eradicating-smallpox>).
- Gottlieb J. n.d. Case study: Reducing child mortality through vitamin A in Nepal. Center for Global Development (<http://www.cgdev.org/page/case-4-reducing-child-mortality-through-vitamin-nepal>).

Week 7 Readings

- Zuk M. 2007. Bad, but not weird: The real emerging diseases (Chapter 10). In: Riddled with Life: Friendly Worms, Ladybug Sex, and the Parasites that Make Us Who We Are. Harcourt Press. pp. 237-265.
- Fischer A, Madden D. 2011. DNA to Darwin Case Study: The origins and evolution of HIV. National Centre for Biotechnology Education, University of Reading, UK.

Lab readings for week 7 (Read at least two):

- Couzin-Frankel J. 2009. Science gold mine, ethical minefield. *Science* 324: 166-168.
- Specter M. 2011. Resistant: Why a century-old battle over vaccination continues to rage. *The New Yorker* (May 30).
- Wilson B. 2007. Air traveler with drug-resistant TB quarantined. *NPR* (May 30).
- Kaiser J. 2013. Researchers to explore promise, risks of sequencing newborns' DNA. *Science* 341: 1163.

Week 8 Readings

- Zuk M. 2007. When sex makes you sick (Chapter 5). In: Riddled with Life: Friendly Worms, Ladybug Sex, and the Parasites that Make Us Who We Are. Harcourt Press. pp. 99-122.
- Zuk M. 2007. The sicker sex (Chapter 6). In: Riddled with Life: Friendly Worms, Ladybug Sex, and the Parasites that Make Us Who We Are. Harcourt Press. pp. 123-141.
- Leonard WR. 2002. Food for thought: Dietary change was a driving force in human evolution. *Scientific American* (December): 74-83.
- Cordain L et al. 2005. Origins and evolution of the Western diet: health implications for the 21st century. *American Journal of Clinical Nutrition* 81:341-354.

Week 9 Readings

- Gluckman P & Hanson M. 2012. The origins of obesity (Chapter 3). In: Fat, Fate, and Disease: Why Exercise and Diet aren't Enough. Oxford University Press. pp. 40-55.
- Bellisari A. 2013. The obesogenic environment (Chapter 4). In: The Obesity Epidemic in North America: Connecting Biology and Culture. Waveland Press. pp. 41-61.
- Chen L et al. 2012. The worldwide epidemiology of type 2 diabetes mellitus—Present and future perspectives. *Nature Reviews Endocrinology* 8: 228-236.

Week 10 Readings

- Sapolsky R. 2005. Sick of poverty. *Scientific American* (Dec.): 93-99.
- Tough P. 2011. The poverty clinic: Can a stressful childhood make you a sick adult? *The New Yorker* (March 21): 25-32.