THE WAGNER FREE INSTITUTE OF SCIENCE

Winter 2017
BIOLOGICAL SCIENCES/PALEONTOLOGY SERIES
Evolution: Process and Pattern
Professor Jason Downs

This course is co-sponsored by the **University of Pennsylvania Museum of Archaeology and Anthropology,** located at 33rd and Spruce Streets, Philadelphia. The entrance for the course is at the east end of the building**.**

LECTURES ARE HELD FROM 10:30 AM TO NOON

Course Description
Evolution is the unifying concept of biology. Evolutionary biologists approach the field from two primary perspectives. One perspective focuses on the process of evolution, or how evolution works. The second focuses on the patterns of evolution. The diversity of life on Earth today is the product of evolutionary history. To understand how we arrived at the diversity observable today, we need to understand the evolutionary processes that shaped the history of life. This course will look at how we reconstruct that history and how that history can be used to address biological questions that we face in the modern world.

Lectures

1. **Saturday, January 28, 2017** - Agents of Evolution I: Mutation and Gene Flow
   Zimmer and Emlen (2012) define evolution as any change in the proportions of heritable properties in groups of organisms across generations. This constitutes more than just evolution by natural selection. This lecture examines mutation and gene flow as agents capable of enacting evolutionary change. [Chapters 8, 9]

2. **Saturday, February 4, 2017 - Agents of Evolution II: Genetic Drift and Natural Selection**
   This lecture continues the theme of the previous week and examines the final two of the four agents of evolution – genetic drift and natural selection. [Chapters 10, 11]

3. **Saturday, February 11, 2017 - Natural Selection and Adaptation**
   Natural selection operates at multiple scales of biology and this lecture will describe how selection can act upon body parts, organisms, groups, and even species. It is the only agent of evolutionary change that will result in adaptations, features that enhance reproductive success. [Chapter 11]

4. **Saturday, February 18, 2017 - Sex and Sexual Selection**
   This lecture will describe the advantages and disadvantages of sexual reproduction and will attempt to explain its prevalence in biology. Futuyma (2013) defines sexual selection as the differences in reproductive success that are attributed to differences in the ability to acquire mates. We will examine remarkable examples of sexually selected anatomy and behaviors. [Chapter 15]

5. **Saturday, February 25, 2017 - Coevolution**
   Coevolution is evolution in one species in response to evolution in another. It occurs by way of natural selection. In this lecture, we will discuss coevolution of predators and prey, parasites and hosts, species and their mimics, and competitors for a resource. [Chapter 19]

6. **Saturday, March 4, 2017** - Species and Speciation
   We will begin this lecture by arguing over the definition of a species. Speciation is the process by which new species are introduced and we will discuss the three ways in which this may occur: allopatry, parapatry, and sympatry. These three speciation processes differ in the extent of reproductive barriers in place prior to speciation. [Chapters 17, 18]

7. **Saturday, March 11, 2017** - Circumstances of the Origin of Life
   This lecture will examine Earth as a planet capable of sustaining life. We will learn about what makes Earth special among the terrestrial planets. Even if conditions are perfect for life, this does not mean that life will necessarily originate. We will additionally consider how life can begin from non-living ingredients. [Chapter 5: pp. 104-110]

8. **Saturday, March 18, 2017** - Phylogenetic Reconstruction and Phylogenetic Means of Classification
   The course concludes with an examination of how systematic biologists reconstruct the relationships among all species. We will also look at how this method of relationship reconstruction is now yielding a new system of biological names that make use of these relationships. [Chapter 2]

(SNOW DATE: Saturday, March 25, 2017)

Recommended Reading
Evolution, D. J. Futuyma, Third Edition, Sinauer Associates, ISBN 978 1605351155. (The lecture descriptions list the relevant chapters for each week)

Dr. Jason Downs is Assistant Professor of Biology at Delaware Valley University. He is also a Research Associate at the Academy of Natural Sciences in the Vertebrate Paleontology Group, where he has done active research since 2006. He was one of the team members who discovered the Tiktaalik roseae, a specimen that shed new light on the vertebrate transition to land. Dr. Downs has been teaching for the Wagner since 2012.