

# Evolution: Darwin to DNA

**Spring 2018**

Thursdays 01/18, 25 & 02/01, 08, 15

Time: 6:10–8:10pm

Location: Schermerhorn Extension classroom

ENVB N0450  
Columbia University

Instructor: Dr. Sergios-Orestis Kolokotronis

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## **COURSE OBJECTIVES**

Are Darwin's findings still relevant today? How could he have come up with the idea of evolution through natural selection if he did not know about DNA or how heredity works? And how did heredity work, again...? Now that we have decoded the human genome, what do we know – and still don't – about life?

This course will lead students on a broad exploration of evolutionary science, seeking to answer questions such as these, among many others. We will review the history of evolutionary thought and science, genetics and heredity, the main mechanisms by which evolution acts, and the tools and findings of evolutionary research, including the evolution of humans and microbial pathogens.

By the end of this course, students should be able to:

- Describe what science is, what its limitations are, and how that applies to evolutionary science
- Explain how DNA is structured and how heredity works, in their own simple terms
- Describe all of the mechanisms by which evolution acts and a real life example of each
- Define natural selection in their own words, and apply that definition to explain the evolution of a particular trait or behavior
- Relate the main events and questions in human evolution
- Use critical thinking and the best available information to frame and investigate a question related to evolution and its significance to us today

## **COURSE TEXTBOOK**

Kenneth Kardong (2007) *An Introduction to Biological Evolution*, 2<sup>nd</sup> edition. McGraw-Hill Education. ISBN-10: 0073050776, ISBN-13: 978-0073050775

## **EVALUATION**

Attendance: 10%

Participation: 10%

Weekly discussion entry: 40%

Final assignment: 40%

## INFORMATION

The course is composed of 5 sessions for which readings are provided. The evening by 8pm of the day before each class you are required to do at least the required readings and submit on CourseWorks under Discussion a short entry (no more than 200 words) on the session topic. The point of this exercise is for us to know what background you are coming in with and for you to be able to monitor any changes in your understanding of evolution as the course progresses. Chapters from the Kardong book are provided as PDF page scans.

## SCHEDULE

### Session 1\_The evolution of evolution

Class plan: What is science? Ideas in the pre-evolution era. Darwinian evolution. Natural selection.

Required readings: Charles Darwin, *The Origin of Species*, [Introduction](#) & [Struggle for Existence](#); Kardong book chapter 1; Alfred Russel Wallace's 1858 "[Ternate essay](#)"

Recommended: WNYC Radiolab podcast of Richard Dawkins "[In Defense of Darwin](#)"; Nature "[15 Evolutionary Gems](#)"

### Session 2\_Genetics

Class plan: Genetics information (DNA & RNA); DNA structure, organization, and function; the Central Dogma of Molecular Biology; Heredity; Mendel's experiments; Beyond Mendel; Genomes.

Required readings: Kardong book chapter 3; Pray (2008) [Nature Education](#); Clancy (2008) [Nature Education](#); Miko (2008) *Nature Education* on [Mendel](#) and [inheritance](#)

Recommended: [TED talk](#) by Dr. James Watson on how they discovered DNA; [Radiolab podcast](#) on inheritance

### Session 3\_Mechanisms of evolution

Class plan: Mutation; Migration; Natural Selection; Genetic Drift; Coevolution.

Required readings: Kardong book chapters 7 & 8; [Animation](#) of genetic drift

Recommended: [Radiolab podcast](#) on fox domestication; Charles Darwin, *The Origin of Species*, [Natural Selection](#)

### Session 4\_Evidence and tools of evolution

Class plan: How do scientists study evolution? What is the evidence? Biological classification; Systematics; Paleontology; Biogeography; Morphology; Genomics.

Required readings: Kardong book chapter 6; Hey (2009) *Nature Education* [on species](#); Quammen (2004) *National Geographic Magazine* "[Was Darwin Wrong?](#)"; Carl Zimmer

(2011) New York Times “[Evolution Right Under our Noses](#)”; [TED talk on cloning the mammoth](#)

Recommended: Frankham et al. (2012) *Biological Conservation* on [species concepts in conservation](#); [Radiolab podcast](#) on resurrection

### Session 5\_Overview & Applications

Class plan: Why should we be concerned with evolution? What role does Evolution play in our lives? Class will focus on the contributions of evolutionary science to human health, agriculture, renewable resources, natural products and environmental management and conservation.

Required readings: Kardong book chapter 16; Michael Specter (2007) *The New Yorker* “[Darwin’s Surprise](#)”; [Radiolab podcast](#) on creationism; [TED talk on neo-evolution](#)

Recommended: Readings on human origins: [BecomingHuman.org](#), Smithsonian “[Human Origins](#)”, visit the AMNH [Hall of Human Origins](#)