

BISC 180Lxg: Evolution

4 units

Spring 2021

Course Description:

Evolution is the unifying principle of all biology but the importance of its study is not restricted to biologists. Understanding evolution is of paramount importance to comprehending the “why” and “how” of modern human variation and our species’ role in the biosphere. This course provides students from all disciplines with a background in evolution that will prepare them to think critically about a wide range of everyday issues including healthcare, culture, and society.

Learning Objectives:

This course will use a combination of lecture and laboratory meetings to provide students with a basic understanding of the scientific method and how it has been employed in the study of evolution. Lecture topics will range from principles of evolution and the history of scientific discovery to contemporary issues of human medicine and agriculture. Laboratories will take many forms, including experimental data collection and interpretation, field trips to local natural history collections, computer simulations of natural processes, and group discussions of current events and controversies. The course will be divided into three parts as follows, with the latter parts built upon the concepts introduced in the first part:

In the first part of the class (weeks 1-5), students will learn about the history of evolutionary theory and encounter evidence for evolution in examples of natural selection and a tour through the fossil record. By the end of this unit, students will have a broad understanding of how evolution accounts for the diversity of life on Earth. During this part of the class students will have the opportunity to observe ongoing adaption by bacteria in the laboratory and study evolution in the fossil record by visiting the Los Angeles County Museum of Natural History.

In the second part of the course (weeks 6-10), the focus will shift to human evolution. Students will learn about the evolutionary history and genetic bases underlying important aspects of human biological variation, including skin color, diet, and disease susceptibility. These topics will be paired with laboratory exercises that address the interpretation of the hominid fossil record and the acquisition of complex human behaviors.

In the third part of the class (weeks 11-15), students will explore the many ways in which the human race has modified its environment, both for better and for worse. The human practice of artificial selection will be illustrated by highlighting examples of the domestic animals and plants upon which our society is dependent. This part of the course will analyze the consequences of human practices in terms of disease and environmental contamination. In lab students will simulate the spread and containment of an emerging disease from an epidemiological perspective. Lab meetings will also be devoted to student presentations on the topic of communicating science to the public, reinforcing one of the main themes of the course: the value of understanding evolution for all individuals in all walks of life.

Lecture Time and Location: ZHS 352

MWF: 10:00-10:50 AM

Laboratory Times and Location: ZHS 460

MWF: 12–1:50 PM

Instructor: Dr. Oliver Rizk, orizk@usc.edu

Office Hours: Thursdays: 9:30-11:30 AM,
or by appointment, over Zoom

Website: <https://blackboard.usc.edu>

Required Readings: There is no textbook required for this course. Instead, weekly reading assignments will be posted to the course website (see above) in digital form. Readings will draw from historical texts such as Charles Darwin's *Origin of Species*, popular science essays by authors such as Stephen Jay Gould and Neil Shubin, and scientific journal articles from a broad variety of disciplines.

There is also no required laboratory manual. Lab worksheets describing the lab topic and protocol for each meeting will be posted to the course website (see above) in advance for students to access in preparation for each activity.

Exams: The lecture portion of this course will include two midterm examinations and a final examination. All examinations (midterm and final) may include multiple choice questions, fill-in answer, short answers, short essays, definitions, and quantitative problems. The final examination will be cumulative but also weighted towards material covered in the final third of the course.

Schedule of Lecture Topics:

Week 1

M 1/10 Introduction; Course Overview

Part 1: Evolutionary Theory and the Diversity of Life on Earth

W 1/12 Preamble to Darwin: Concepts of Change Over Time

F 1/14 The Contributions of Charles Darwin: Natural Selection

Week 2

M 1/17 **MLK Jr.'s Birthday Holiday -- NO CLASS**

W 1/19 Post-Darwinian Contributions: Genotype to Phenotype

F 1/21 Natural Selection at Work I: Stickleback Fish

Week 3

M 1/24 Natural Selection at Work II: The Vertebrate Dentition

W 1/26 Natural Selection at Work III: Antibiotic Resistance

F 1/28 Understanding the Fossil Record I: Geology and the History of the Earth

Week 4

M 1/31 Understanding the Fossil Record II: Paleontology and Fossil Discovery

W 2/2 Understanding the Fossil Record III: Transitional Species

F 2/4 The Diversity of Life on Earth I: Prokaryote Evolution

Week 5

M 2/7 The Diversity of Life on Earth II: Eukaryote Evolution and Endosymbiosis

W 2/9 The Diversity of Life on Earth III: The Extinction of the Dinosaurs and
Rise of the Mammals

F 2/11 MIDTERM EXAM #1

Part 2: Evolution of Human Biological Variation*Week 6*

M 2/14 Order Primates: Our Closest Relatives

W 2/16 Paleoanthropology I: African Origins

F 2/18 Paleoanthropology II: Modern Human Origins

Week 7

M 2/21 President's Day Holiday -- NO CLASS

W 2/23 Selection for Large Brains

F 2/25 Language Genes

Week 8

M 2/28 Human Diet I: Lactase and Aldehyde Dehydrogenase

W 3/2 Human Diet II: Meat, Grains, and Cooking

F 3/4 Coevolution with Diseases

Week 9

M 3/7 Skin Color and Vitamin D

W 3/9 The History of Race in America

F 3/11 Sexuality and Gender

Spring Break NO CLASS

3/14 – 3/18

Schedule of Lecture Topics (continued):

Week 10

M	3/21	Reproductive Health and Fertility
W	3/23	Eugenics
F	3/25	MIDTERM EXAM #2

Part 3: Artificial Selection and Human Effects on the Natural World*Week 11*

M	3/28	The Domestic Dog as a Model of Artificial Selection
W	3/30	Artificial Selection and the History of Agriculture
F	4/1	Domestication of Animals: Livestock

Week 12

M	4/4	Human-Animal Pathogen Exchange
W	4/6	Emerging Viruses
F	4/8	Vaccine Development

Week 13

M	4/11	Domestication of Plants: Corn
W	4/13	GMOs
F	4/15	Agriculture and Sustainability

Week 14

M	4/18	Habitat Destruction and Pollution
W	4/20	Bioremediation and Bioengineering
F	4/22	CRISPR and Gene Editing

Week 15

M	4/25	Controversy Over Evolution
W	4/27	The Relevance of Evolution
F	4/29	Final Exam Review

M	5/9	FINAL EXAM: 9-9:50 AM
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Grading: After each exam, grade cut-offs will be released. There is not an absolute number of points that predetermines a letter grade of A, A-, B+, B, B-, etc. The final letter grade for this course will be assigned on a curve, determined by the total number of points as given below.

The point system will total 640 points, as follows:

Midterm Exam #1	150
Midterm Exam #2	150
Final Exam	150
Lab Worksheets (10)	120
<u>Lab Presentation</u>	<u>70</u>
Total	640

Schedule of Laboratory Topics and Assignments:

<i>Week 1</i> 1/10-1/14	NO LAB
<i>Week 2</i> 1/17-1/21	NO LAB
<i>Week 3</i> 1/24-1/28	Lab 1: The Scientific Method
<i>Week 4</i> 1/31-2/4	Lab 2: <i>Life's Rocky Start</i>
<i>Week 5</i> 2/7-2/11	Lab 3: LACNHM: Dinosaurs and Mammals
<i>Week 6</i> 2/14-2/18	Lab 4: <i>Discovering Ardi</i>
<i>Week 7</i> 2/21-2/25	NO LAB
<i>Week 8</i> 2/28-3/4	Lab 5: Hominid Fossil Analysis
<i>Week 9</i> 3/7-3/11	Lab 6: <i>Race: the Power of an Illusion</i>
Spring Break 3/14-3/18	NO LAB
<i>Week 10</i> 3/21-3/25	Lab 7: <i>No Más Bebés</i>
<i>Week 11</i> 3/28-4/1	Lab 8: Artificial Selection
<i>Week 12</i> 4/4-4/8	Lab 9: Epidemiology
<i>Week 13</i> 4/11-4/15	Lab 10: How to Make a GMO
<i>Week 14</i> 4/18-4/22	Student Presentations
<i>Week 15</i> 4/25-4/29	Student Presentations

Lab Worksheets:

A 12-point lab worksheet will be handed out at the beginning of lab and collected at the start of the following week's lab. Worksheets will require students to organize, analyze, and interpret their data, as well as to answer questions about their comprehension of the conceptual material from each lab. Worksheets turned in after the due date will receive a 5-point deduction up until one month after the due date, after which no points will be awarded.

Lab Presentations:

The last two weeks of the semester will be devoted to 70-point student presentations on topics of the students' choice related to communicating evolution to the public. Detailed instructions and guidelines, including deadlines for topic submission, will be posted on Blackboard in the beginning of the semester.

Statement for Students with Disabilities:

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible, preferably by January 25, 2022. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. **Website for DSP** and contact information: (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) **ability@usc.edu**. If a student's approved accommodation is limited to extra time on examinations, the teaching staff of BSIC 180 will provide the accommodation. For any other accommodation, such as a private room, reader, or a scribe, students must make prior arrangements with the DSP office 2 weeks before the exam date.

Statement on Academic Integrity:

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. **SCampus**, the Student Guidebook, contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Emergency Preparedness/Course Continuity in a Crisis:

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies. See the university's site on **Campus Safety and Emergency Preparedness**.