

Evolution and Population Genetics, BISC 313L, Spring 2018

Instructors:

Lecture

Oliver Rizk

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Lab

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Overview:

Evolution is one of the pillars of modern biology. As evolutionary biologist Theodosius Dobzhansky put it so elegantly, in the title of his 1973 essay, “Nothing in biology makes sense except in light of evolution.” The same can be said of human biology and medicine. Pathogens, parasites, symbionts, and their victims or hosts evolve. Training in evolutionary thinking enables biologists to understand biological diversity and how organisms adapt and can help biomedical researchers and clinicians to ask useful questions about modern human health and disease that they might not otherwise pose. BISC 313 reviews the diversity of life on Earth, Darwin’s revolutionary explanation of this diversity, as the result of common descent with modification by natural selection, the population genetic mechanisms underlying our current theory of evolution, and how evolutionary thinking in the era of genomic science is advancing our understanding of biology and medicine.

The laboratory section of the course exposes students to the design and analysis of experiments in evolutionary biology and to co-curricular activities outside of the classroom, including trips to local museums, which are rich storehouses of evolutionary lessons.

Learning Objectives:

After completing the course, students will be able to:

- explain and analyze the processes of evolution
- recognize and interpret the patterns of evolution
- apply their knowledge of the processes and patterns of evolution to address biological and environmental problems ranging from the scale of individual human health to global well being
- read and comprehend primary research articles published in peer reviewed journals
- discuss contemporary topics related to evolutionary biology and serve as an authority on these subjects to their peers
- perform essential biological laboratory techniques and use the scientific method to address research questions pertaining to phenomena in the natural world

Meeting times:

Lec 13034R	11:00 AM – 11:50 AM	MWF	ZHS 163
Lab 13326R	3:30 PM – 5:20 PM	W	ZHS 460
Lab 13328R	2:00 PM – 3:50 PM	Th	ZHS 460
Lab 13327R	9:00 AM – 10:50 AM	F	ZHS 460

Prerequisites:

- BISC 120/121 and BISC 220/221, the first year biology sequence

Text: There is no required textbook for the course. Weekly readings will be uploaded to Blackboard and will include, but not be limited to content in the form of journal articles, book chapters, short videos, and web pages.

Course Credit (your final grade adds up to 1000 points):

Weekly Quizzes	100 pts.
Midterm Exam 1	200 pts.
Midterm Exam 2	200 pts.
Final Exam	200 pts.
Lab	300 pts. (30%; see breakdown on next page)

Class Structure: Lecture will center on weekly reading assignments, typically addressing one broad topic each week. Background reading assignments will be assigned on Fridays with accompanying quizzes due the following Monday that assess student preparation for the upcoming week's content. During the week, additional readings will build upon the background reading and serve as the focus of discussion during lecture. Exams will assess students' comprehension of the topics introduced in readings and lecture and their ability to apply these concepts to research questions and issues that pertain to the environment and human health.

Lecture Schedule:

<u>Week</u>	<u>Topics</u>
1: 1/8–1/12	Course Introduction; Why Study Evolution?
2: 1/15 1/17–1/19	MLK Jr.'s. Birthday: NO CLASS Variation; Change Over Time
3: 1/22–1/26	Darwin and the Darwinian Method; Natural Selection
4: 1/29–2/2	The Modern Synthesis; The Genetical Theory of Natural Selection
5: 2/5–2/9	Phenotypic Evolution, Quantitative Genetics
6: 2/12 2/14–2/16	MIDTERM #1 The Emergence of Life; The Earliest Selection and Adaptation; Prokaryotes
7: 2/19 2/21–2/23	President's Day: NO CLASS The Tree of Life; Phylogenetics
8: 2/26–3/2	Coevolution; Endosymbiosis
9: 3/5–3/9	Evolution of Gene Expression; Multicellularity
3/11-3/18	Spring Break: NO CLASS
10: 3/19-3/23	Evolution of Developmental Programs; the Cambrian Explosion
11: 3/26 3/28–3/30	MIDTERM #2 Evolution of Life Histories; Sex and Reproductive Success
12: 4/2–4/6	Species; Speciation; Macroevolution
13: 4/9–4/13	Genetic Drift; Extinction; Conservation
14: 4/16–4/20	Human Evolution; Genomic Engineering
15: 4/23–4/27	Why Teach Evolution?
5/2	FINAL EXAM: 11 AM – 1 PM

Lab:

Labs will consist of experiments that test fundamental evolutionary and population genetic concepts. Lab assignments include quizzes that test preparation prior to lab, single-week and multi-week lab report write ups of experiments, and short writing assignments for discussions of journal articles and visits to the natural history museum.

Lab Schedule:

<u>Week</u>	<u>Dates</u>	<u>Laboratory Topic</u>	<u>Assignment</u>
1:	1/10–1/12	No lab this week	
2:	1/17–1/19	Multicellularity Lab Part I	Quiz (10 pts.)
3:	1/24–1/26	Multicellularity Lab Part II	
4:	1/31–2/2	Multicellularity Lab Part III	Multi-week Lab Report (50 pts.)
5:	2/7–2/9	Sequence Alignment	Lab Report (20 pts.)
6:	2/14–2/16	LANHM Field Trip (Ornithology)	Write-up (20 pts.)
7:	2/21–2/23	Mitochondria Sequencing Part I	Quiz (10 pts.)
8:	2/28–3/2	Mitochondria Sequencing Part II	Multi-week Lab Report (50 pts.)
9:	3/7–3/9	Journal Club #1	Write-up (20 pts.)
Spring Recess March 11-18			
10:	3/21–3/23	Parasitic Wasp Part I	Quiz (10 pts.)
11:	3/28–3/30	Parasitic Wasp Part II	
12:	4/4–4/6	Parasitic Wasp Part III	Multi-week Lab Report (50 pts.)
13:	4/11–4/13	LANHM Field Trip (Mammalogy)	Write-up (20 pts.)
14:	4/18–4/20	PopG Simulation Exercise	Lab Report (20 pts.)
15:	4/25–4/27	Journal Club #2	Write-up (20 pts.)

Lab Credit:

Quizzes	30 pts.
Multi-week Lab reports	150 pts.
<u>Lab Reports (5)</u>	<u>120 pts.</u>
Total	300 pts.

Course Policies

Missed Exams. Missed exams will receive a grade of zero unless the student can document a medical or family emergency. An excused missed exam will be given a prorated score based on performance in the rest of the course. A missed final will result in an incomplete.

Regrades. To contest a grade, a student must submit the exam or assignment, along with a written explanation of why the grade was incorrect. Please note that the ENTIRE exam or assignment will be

subject to reevaluation and your score may therefore go up, go down or remain the same. Regrade requests must be submitted to the instructor within two weeks of the return of an exam or assignment.

Late assignments. Due dates are written in the schedule. Late assignments will not be accepted.

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 (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

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 Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/dept/publications/SCAMPUS/gov/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The Review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.