USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

BISC 313: Evolution and Population Genetics

4 units
Monday, Wednesday, Friday: 11–11:50 am
Room: ZHS 163

Instructor: Sergey Nuzhdin
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Instructor: Oliver Rizk
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Teaching Assistant: TBA
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Required Texts:

Evolution, 4th Edition, by Douglas Futuyma and Mark Kirkpatrick. e-book available to rent for $60 for 180 days on RedShelf: https://www.redshelf.com/book/750516/

In addition, weekly readings will be uploaded to Blackboard and will include, but not be limited to journal articles, book chapters, short videos, and web pages.

Course Description

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.

Prerequisite(s): BISC 120/121 and BISC 220/221, the first year biology sequence

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.

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

Lecture Schedule:

Week	Day	Date	Quiz	Topics	Instructor
1	Mon	10-Jan	No quiz	Course Introduction	Rizk
	Wed	12-Jan		"Nothing makes sense… except in light of evolution"	Rizk
	Fri	14-Jan		Variation	Rizk
2	Mon	17-Jan,		*M. L. King Day – University Holiday*	
	Wed	19-Jan	Quiz 1 due	Change Over Time	Rizk
	Fri	21-Jan		Darwin And the Darwinian Method	Rizk
3	Mon	24-Jan	Quiz 2 due	Darwin And the Darwinian Method	Rizk
	Wed	26-Jan		The Genetical Theory of Natural Selection	Rizk
	Fri	28-Jan		The Modern Synthesis	Rizk
4	Mon	31-Jan	No quiz	The Origin of Life	Rizk
	Wed	2-Feb		The RNA World	Rizk
	Fri	4-Feb		**Midterm Exam 1 (100 pts., covers weeks 1–4)**	Rizk
5	Mon	7-Feb	Quiz 3 due	Phylogenetics	Rizk
	Wed	9-Feb		The Tree of Life	Rizk
	Fri	11-Feb		Diversification of Bacteria and Archaea	Rizk
6	Mon	14-Feb	Quiz 4 due	Origin and Diversification of Eukaryotes	Rizk
	Wed	16-Feb		Endosymbiosis	Rizk
	Fri	18-Feb		Coevolution	Rizk
7	Mon	21-Feb	No quiz	*President's Day – University Holiday*	
	Wed	23-Feb		The Invasion of Land by Higher Plants and Animals	Rizk
	Fri	25-Feb		Biogeography	Rizk
8	Mon	28-Feb	Quiz 5 due	Macroevolution	Rizk
	Wed	2-Mar		Human Evolution	Rizk
	Fri	4-Mar		**Midterm Exam 2 (100 pts., covers weeks 5–8)**	**Rizk**
9	Mon	7-Mar	No quiz	Natural Selection and Adaptation	Nuzhdin
	Wed	9-Mar		Natural Selection and Adaptation	Nuzhdin
	Fri	11-Mar		Genetic Drift: Evolution at Random	Nuzhdin
		March 13–20:		*Spring Break*	
10	Mon	21-Mar	Quiz 6 due	Modern Human Genetic Variation	Nuzhdin
	Wed	23-Mar		Phenotypic Evolution	Nuzhdin

Week	Day	Date	Quiz	Topics	Instructor
	Fri	25-Mar		Phenotypic Evolution	Nuzhdin
11	Mon	28-Mar	Quiz 7 due	Evolution of Gene Expression	Nuzhdin
	Wed	30-Mar		Evolution of Gene Expression	Nuzhdin
	Fri	1-Apr		Evolution of Developmental Programs	Nuzhdin
12	Mon	4-Apr	No quiz	**Midterm 3 (100 pts., covers weeks 9–11)**	**Nuzhdin**
	Wed	6-Apr		Evolution of Developmental Programs	Nuzhdin
	Fri	8-Apr		The Evolution of Life Histories	Nuzhdin
13	Mon	11-Apr	Quiz 8 due	The Evolution of Life Histories	Nuzhdin
	Wed	13-Apr		Sex and Reproductive Success	Nuzhdin
	Wed	15-Apr		Sex and Reproductive Success	Nuzhdin
14	Mon	18-Apr	Quiz 9 due	Conflict and Cooperation	Nuzhdin
	Wed	20-Apr		Conflict and Cooperation	Nuzhdin
	Wed	22-Apr		Species & Speciation	Nuzhdin
15	Fri	25-Apr	Quiz 10 due	Species & Speciation	Nuzhdin
	Wed	27-Apr		The Evolution of Interactions Among Species	Nuzhdin
	Fri	29-Apr		The Evolution of Interactions Among Species	Nuzhdin
	Wed	4-May	11 AM — 1 PM	**Final Exam (100 pts., covers weeks 12–15) Nuzhdin**	

Course Credit:

Weekly Quizzes	100 pts.
Midterms 1, 2, and 3	300 pts.
Final Exam	100 pts.
Lab	300 pts.
Total:	**800 pts.**

Additional 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.

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.

Lab Schedule:

Week	Dates	Laboratory Topic	Assignment
1:	1/12–1/13	No lab this week	
2:	1/19–1/20	Journal Club #1	Write-up (30 pts.)
3:	1/26–1/27	LANHM Field Trip	
4:	2/2–2/3	Selection Lab I	
5:	2/9–2/10	Selection Lab II	
6:	2/16–2/17	Selection Lab III	Lab Report (60 pts.)
7:	2/23–2/24	Sequence Alignment	Worksheet (20 pts.)
8:	3/2–3/3	AltaSea Field Trip	
9:	3/9–3/10	Journal Club #2	Write-up (30 pts.)
Spring Recess: March 14–18			
10:	3/23–3/24	Fruit Flies Part I	
11:	3/30–3/31	Fruit Flies Part II	Lab Report (40 pts.)
12:	4/6–4/7	Evo Sims Part I	
13:	4/13–4/14	Evo Sims Part II	Lab Report (40 pts.)
14:	4/20–4/21	AltaSea Field Trip	
15:	4/27–4/28	Journal Club #3	Write-up (30 pts.)

Lab Credit:

Participation	50 pts.
Lab reports	140 pts.
Worksheet	20 pts.
Write Ups	90 pts.
Total	**300 pts.**

Statement on Academic Conduct and Support Systems

Academic Conduct:
Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Part B, Section 11, "Behavior Violating University Standards" https://policy.usc.edu/scampus-part-b/. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems:
Student Counseling Services (SCS) - (213) 740-7711 – 24/7 on call
Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. https://engemannshc.usc.edu/counseling/

National Suicide Prevention Lifeline - 1-800-273-8255
Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. http://www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call free and confidential therapy services, workshops, and training for situations related to gender-based harm. https://engemannshc.usc.edu/rsvp/

Sexual Assault Resource Center
For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: http://sarc.usc.edu/

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086
Works with faculty, staff, visitors, applicants, and students around issues of protected class. https://equity.usc.edu/

Bias Assessment Response and Support
Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. https://studentaffairs.usc.edu/bias-assessment-response-support/

The Office of Disability Services and Programs
Provides certification for students with disabilities and helps arrange relevant accommodations. http://dsp.usc.edu

Student Support and Advocacy – (213) 821-4710
Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. https://studentaffairs.usc.edu/ssa/

Diversity at USC
Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. https://diversity.usc.edu/

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, http://emergency.usc.edu

USC Department of Public Safety – 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime.
Provides overall safety to USC community. http://dps.usc.edu