

**BISC 313: Evolution and Population Genetics**

**4 units**

**Monday, Wednesday, Friday: 11–11:50 am**

**Room: ?**

**Instructor:** Sergey Nuzhdin

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**Instructor:** Oliver Rizk

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**Teaching Assistant:** TBA

**Office Hours:** TBA

**Office Hours Location:** TBA

**Contact Info:** TBA

**Required Texts:**

There is no required textbook for the course. 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 13-Jan No quiz Course Introduction Rizk

Wed 15-Jan “Nothing makes sense… except in light of evolution” Rizk

Fri 17-Jan Variation Rizk

2 Mon 20-Jan, *M. L. King Day – University Holiday*

Wed 22-Jan Quiz 1 due Change Over Time Rizk

Fri 24-Jan Darwin And the Darwinian Method Rizk

3 Mon 27-Jan Darwin And the Darwinian Method Rizk

Wed 29-Jan Quiz 2 due The Genetical Theory of Natural Selection Rizk

Fri 31-Jan The Modern Synthesis Rizk

4 Mon 3-Feb 3 No quiz The Origin of Life Rizk

Wed 5-Feb The RNA World Rizk

 Fri 7-Feb **Midterm Exam 1(100 pts., covers weeks 1–4)** Rizk

5 Mon 10-Feb Quiz 3 due Phylogenetics Rizk

Wed 12-Feb The Tree of Life Rizk

Fri 14-Feb Diversification of Bacteria and Archaea Rizk

6 Mon 17-Feb No quiz *President’s Day – University Holiday*

Wed 19-Feb Origin and Diversification of Eukaryotes Rizk

Fri 21-Feb Endosymbiosis Rizk

7 Mon 24-Feb Quiz 4 due Coevolution Rizk

Wed 26-Feb The Invasion of Land by Higher Plants and Animals Rizk

Fri 28-Feb Biogeography Rizk

8 Mon 2-Mar Quiz 5 due Macroevolution Rizk

Wed 4-Mar Human Evolution Rizk

Fri 6-Mar **Midterm Exam 2** **(100 pts., covers weeks 5–8)** **Rizk**

9 Mon 9-Mar No quiz Natural Selection and Adaptation Nuzhdin

 Wed 11-Mar Natural Selection and Adaptation Nuzhdin

Fri 13-Mar Genetic Drift: Evolution at Random Nuzhdin

March 15–22: *Spring Break*

10 Mon 23-Mar Quiz 6 due Modern Human Genetic Variation Nuzhdin

Wed 25-Mar Phenotypic Evolution Nuzhdin

**Week Day Date Quiz Topics Instructor**

Fri 27-Feb Phenotypic Evolution Nuzhdin

11 Mon 30-Mar Quiz 7 due Evolution of Gene Expression Nuzhdin

Wed 1-Apr Evolution of Gene Expression Nuzhdin

Fri 3-Apr Evolution of Developmental Programs Nuzhdin

12 Mon 6-Apr No quiz Evolution of Developmental Programs Nuzhdin

 Wed 8-Apr **Midterm 3 (100 pts., covers weeks 9–11 + 1 lecture)** **Nuzhdin**

Fri 10-Apr The Evolution of Life Histories Nuzhdin

13 Mon 13-Apr Quiz 9 due The Evolution of Life Histories Nuzhdin

 Wed 15-Apr Sex and Reproductive Success Nuzhdin

Wed 17-Apr Sex and Reproductive Success Nuzhdin

14 Mon 20-Apr Quiz 10 due Conflict and Cooperation Nuzhdin

 Wed 22-Apr Conflict and Cooperation Nuzhdin

Wed 24-Apr Species & Speciation Nuzhdin

15 Fri 27-Apr No quiz Species & Speciation Nuzhdin

Wed 29-Apr The Evolution of Interactions Among Species Nuzhdin

Fri 1-May The Evolution of Interactions Among Species Nuzhdin

Wed 6-May 11 AM — 1 PM **Final Exam** **(100 pts., covers 1 lecture + weeks 13–15)** **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 and visits to the natural history museum.

**Lab Schedule:**

Week Dates Laboratory Topic Assignment

1: 1/9–1/11 No lab this week

2: 1/16–1/18 Journal Club #1 Write-up (30 pts.)

3: 1/23–1/25 LANHM Field Trip

4: 1/30–2/1 Selection Lab I

5: 2/6–2/8 Selection Lab II

6: 2/13–2/15 Selection Lab III Lab Report (60 pts.)

7: 2/20–2/21 Sequence Alignment Worksheet (20 pts.)

8: 2/27–3/1 LANHM Field Trip

9: 3/6–3/8 Journal Club #2 Write-up (30 pts.)

Spring Recess: March 10-17

10: 3/20–3/21 Fruit Flies Part I

11: 3/27–3/29 Fruit Flies Part II Lab Report (40 pts.)

12: 4/3–4/5 Evo Sims Part I

13: 4/10–4/12 Evo Sims Part II Lab Report (40 pts.)

14: 4/17–4/19 LANHM Field Trip

15: 4/24–4/26 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](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](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](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](http://dps.usc.edu/)