

Biology 15: Genetic Variation and Evolution

Winter 2013

M, W, F, 11:15-12:20; X-hour, T 12:00-12:50

105 Life Sciences Center

Olga Zhaxybayeva

026 Life Sciences Center

Phone: 646-8616*Email:* olgazh@dartmouth.edu*Office Hours:* Monday 12:30-2, Tuesday 1-2, X-hour (when not used), or by appointment**Course Description**

In this course students will be introduced to the major evolutionary processes that occur on a population level. We will concentrate on the mechanisms of evolutionary change and how they are modeled using practices from population and quantitative genetics. We will also consider the nature and limits of various forms of selection, problems of classification and phylogenetic inference, as well as the roles of random drift in molecular evolution. Through in-class discussions and problem-solving sessions, students will explore dynamics of various natural populations, including variation within human population and its implications to heritable and infectious diseases.

Students are expected to (1) carefully read the assigned material *before* class, (2) enthusiastically participate in class discussions and problem-solving sessions, and (3) diligently prepare for all exams and labs.

Every class period will start with ~ 20-30 min. of lecture that would summarize the most important concepts of the topic. For the remainder of the class, the students will work in assigned small groups on problems, which will be handed out. Some of the problems will involve using web-based tools, therefore the students are required to bring their laptops to each class period.

Teaching Assistants:

Jessica Trout-Haney

Beth Reinke

Christine Urbanowicz

Laboratories:**Laboratory Coordinator:** Craig Layne

We will be offering laboratory sections on Monday, Tuesday, and Wednesday afternoons, 2-6pm, 104 LSC. You can sign up for lab sections on the first day of class, January 7th.

Texts:

- Douglas Futuyma, *Evolution*, Second Edition, Sinauer, 2009.
- William Patten, *Directions for Taking Evolution*. The Dartmouth Press, 1924-5.
- Charles Darwin, *On the Origin of Species* (1859), Ch. 3.
- C. A. Driscoll, et al., "The near eastern origin of cat domestication," *Science* 317 (2007) 519-523.
- S. J. Gould and R. C. Lewontin, "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme," *Proceedings of the Royal Society of London, Series B*, 205, NO. 1161 (1979), PP. 581-598.
- Sewall Wright, "The Roles of Mutation, Inbreeding, Crossbreeding and Selection in Evolution", *Proceedings of the Sixth Annual Congress of Genetics* 1 (1932) 356-366.
- Motoo Kimura, "Evolutionary Rate at the Molecular Level," *Nature* 217 (1968), 624-626.
- Jack King and Thomas Jukes, "Non-Darwinian Evolution," *Science* 164 (1969), 788-798.
- Kevin deQueiroz, "Species Concepts and Species Delimitation," *Systematic Biology* 56 (2007), 879-886.
- G. Sander Van Doorn, et al., "On the Origin of Species by Natural and Sexual Selection," *Science* 326 (2009), 1704-1707.

Evaluation

Exam #1	25%
Exam #2	25%
Final	30%
Lab	20%

The Social Contract at Dartmouth:

When you decided to attend Dartmouth, you agreed to join an academic community and to dedicate yourself to the "pursuit of intellectual and personal growth." In doing so you agreed to follow the Standards of Conduct described in the Student Handbook. One of these standards is that you must not "intentionally disrupt, interfere with, or obstruct teaching." I interpret this standard to mean that it is your responsibility not to deliberately interfere with the learning of any Dartmouth student. Because cellphone and laptop use have the potential to interrupt teaching and learning in this classroom, I have set the following policies:

Cell Phones: Cell phone use during class is not allowed. Please be sure all cell phones are turned off or disabled before class starts.

Laptops: You are expected to use portable computing devices of any sort to directly further your education in this course. Please refrain from checking email, browsing the internet, visiting chat rooms, and anything else that is not directly relevant to this course. While you may be willing to accept the consequences of giving less than your full attention to a class meeting, your computer screen is not private in this classroom and can distract other students who do want to fully engage with this course.

Academic Honor: The Dartmouth Honor Principle (<http://www.dartmouth.edu/~reg/regulations/undergrad/acad-honor.html>) applies to all work you submit for a grade in this course. That is, the lab reports you turn in must be your own unless the assignment has been explicitly identified as a group activity by the

professor. All computer output that **that you turn in should be created, typed, documented, and generated by you.** In lab, you may consult freely with others while designing analyses, running analyses, and drawing conclusions, but you should generate your own output, including the write-up, and **answer laboratory's questions on your own.** Any copying of another person's lab report, in whole or in part, is a violation of the Honor Principle.

Student Needs: Students with disabilities enrolled in this course and who may need disability-related classroom accommodations are encouraged to make an appointment to see me before the end of the second week of the term. All discussions will remain confidential, although the Student Accessibility Services office may be consulted to discuss appropriate implementation of any accommodation requested.
Student Accessibility Services (<http://www.dartmouth.edu/~accessibility/facstaff/>)

Schedule (subject to change; additional X-hours may be used for problem solving sessions and post-exam reviews):

	Date	Topic	Reading
M	1/7	Introduction and Historical Overview	Patten
W	1/9	Darwin's Dangerous Idea	Chapter 1, Darwin
F	1/11	Phylogenetic Inference	Chapter 2
M	1/14	Phylogenetic Inference. Systematics	Chapter 2
W	1/16	Trees of Life	Chapter 2
F	1/18	Phylogenetics in Practice: History of Cat Domestication	Driscoll <i>et al.</i>
M	1/21	*** No Class ***	
T	1/22	Patterns and Trends	Chapters 3 and 6
W	1/23	Sources of Genetic Variation	Chapter 8
F	1/25	Exam 1	
M	1/28	Population Genetics: Hardy-Weinberg Equilibrium, Inbreeding	Chapter 9
W	1/30	Population Genetics: Multiple Loci and Linkage Disequilibrium	Chapter 9
F	2/1	Population Genetics: Migration and Population Structure	Chapter 9, Wright
M	2/4	Genetic Drift	Chapter 10
W	2/6	Adaptation and Natural Selection, Discussion of Adaptationism	Chapter 11, Gould and Lewontin
F	2/8	*** No Class ***	
M	2/11	Modeling Selection	Chapter 12
T	2/12	Levels of Selection	Chapter 11
W	2/13	Quantitative Traits	Chapter 13
F	2/15	Quantitative Genetics	Chapter 13
M	2/18	Exam 2	
W	2/20	Molecular Evolution: Modeling Sequence Divergence	Chapter 20
F	2/22	Molecular Evolution: Inference of Selection	Chapter 20

M	2/25	Molecular Evolution: Neutral Theory. Genome Evolution	Chapters 10 and 20, Kimura, King and Jukes
W	2/27	Conflict and Cooperation	Chapter 16
F	3/1	Sexual Selection. Evolution of Sex	Chapter 15
M	3/4	Species	Chapter 17, deQueiroz
W	3/6	Speciation	Chapter 18, Van Doorn
F	3/8	The Problem of Design. Review	Chapters 1 and 23

BIOLOGY 15 LABORATORY SCHEDULE

Week of	Activity	Assessment Item	% of Score
7 January	No Lab		
14 January	Evolution in Darwin's Finches: Models Using the Grant's Data	Hypothesis Testing	2
21 January	Phylogeny: Morphological And Molecular Trees	Worksheet	2
28 January	Selection in Goldenrod Galls: Gall and Inhabitants Measures	Scientific Report	5
4 February	Heritability in Fruit Flies: Crosses	Scientific Report	5
	More Goldenrod galls: Analyses and Results		
11 February	Evolutionary Genetics Modeling: Dominance, Allele Frequency and Fitness	Problem Set	3
	More Fruit Flies: Parent Length and Weight Measures		
18 February	More Modeling: Quantitative Genetics		
	More Fruit Flies: Offspring Length and Weight Measures		
25 February	More Flies: Analyses and Results		
4 March	Exaptative Immunity: Reports about the CCR5Δ32 Allele	Popular Press Article	3

Details about lab assessment items, including due dates, will be discussed in lab.