

Biology 15: Genetic Variation and Evolution

Winter 2022

Mon, Wed, Fri 11:30-12:35; X-hour, Tue 12:15-13:05 EST

LSC 105

Instructor

Olga Zhaxybayeva (aka Professor Z.)

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Office Hours: On Zoom, to be announced weekly via Canvas

Experiential Learning Facilitator

Craig Layne (*Craig.D.Layne@Dartmouth.edu*)

Office Hours: LSC 102, by appointment

Teaching Assistants

Kaitlin McDonald (*Kaitlin.M.McDonald.GR@dartmouth.edu*)

Mia Phillips (*Mia.E.Phillips.GR@dartmouth.edu*)

Office Hours: To be announced weekly via Canvas

Course Description

The overall goal of the course is to understand relevance of evolution to all of biology and to real-world problems. To achieve this goal, we will study fundamental processes and mechanisms of evolution on a population level that give rise to variation and diversity of living organisms. We will examine the source and distribution of phenotypic and genotypic variation in nature; the forces that act on genetic variation (mutation, migration, selection, chance); the evolution of complex traits determined by multiple genes and environmental conditions; and the genetic basis of adaptation.

Throughout the course, we will exemplify the topics with data on natural populations, emphasizing humans and their microbial commensals and pathogens, including SARS-CoV2. For in-depth understanding of the material, the course is structured to consist of pre-class videos and quizzes, in class mini-lectures and discussions, in-class problem-solving sessions, and several hands-on and data analysis activities that include experimental evolution, observational data analyses and computer-based evolutionary inferences.

Learning Objectives

At the end of the class you will be able to:

- Reconstruct evolutionary relationships among organisms using phenotypic and molecular data.
- Recognize evolutionary forces acting on natural populations, and evaluate their impact.
- Interpret biological phenomena in an evolutionary context.

Additionally, via activities in this course, you will...

- Become a creative problem solver
- Learn how to model a process
- Learn how to design and carry out an experiment, and analyze results
- Learn to summarize and communicate your scientific findings

Reading Materials

Textbook:

Bergstrom and Dugatkin, *Evolution*, Second edition, W.W.Norton &Co., 2016

- E-book: <https://digital.wwnorton.com/evolution2> (\$55)
- One paper copy is available in Berry-Baker library reserves for 2-hr loan.

Occasional extra materials for specific class periods will be made available via *Canvas* or Berry-Baker library reserves.

Other Course Materials

As term progresses, the following types of materials will be shared with you via *Canvas* (<http://canvas.dartmouth.edu>):

- Pre-lecture videos and associated PowerPoint slides
- Pre-lecture quizzes
- PowerPoint slides and notes for material covered during class periods
- Problem sets and answer keys
- Panopto class recordings
- Data analysis assignments and grading rubrics
- Suggestions for further reading

Some in-class exercises will be provided via **Google Docs** on **Dartmouth's Google Drive**. To access the Dartmouth's Google Suite, use your NetID, password and Duo authentication.

We will also use InQuizitive for graded interactive quizzes. The resource comes with the e-book purchase and is integrated with Canvas. InQuizitive is also available for purchase separately from e-book for \$20 (<https://digital.wwnorton.com/evolution2>)

Meeting Places

The regular class periods will be in person, with Zoom as a back-up in case of emergencies or closures. All class periods will be recorded and the videos will be made available via Panopto on *Canvas* (see **Consent to Recording** section below.)

The Professor Z.'s office hours will take place on Zoom during the times that will be communicated weekly via “Announcements” section of *Canvas*. Craig’s office hours will be by appointment. TAs’ office hours will be announced on *Canvas*.

Dedicated Zoom link for the class is available via *Canvas*. Please use Dartmouth’s Zoom account, as this meeting place is limited to Dartmouth users only.

COVID-19 Information

Attendance: For the health and safety of our class community, please **do not attend class when you are sick (with any potentially contagious respiratory illness, COVID-19 or not), or when you have been instructed by Student Health Services to stay home.** You will be able to view recordings of class in *Canvas* if you are unable to attend.

Safety: In accordance with [current College policy](#), **all members of the Dartmouth community are required to wear a suitable face covering when indoors, regardless of vaccination status.** The only exception to the mask requirement is for students with an approved disability-related accommodation. If you do not have an accommodation and refuse to comply with masking or other safety protocols, I am obligated to assure that the COVID-19 health and safety standards are followed, and you will be asked to leave the classroom. If you refuse to comply with masking or other safety protocols, and to ensure the health and safety of our community, I am obligated to report you to the Dean’s office for disciplinary action under Dartmouth’s [Standards of Conduct](#). Additional COVID-19 protocols may emerge. Pay attention to emails from the senior administrators at the College. I will communicate any changes and their resulting implications for our class.

Food and Drink: **Eating and drinking is not permitted in the classroom.** If you need to take a quick drink during class, please step outside the classroom to do so.

What to do If you develop Symptoms or were Exposed: **Students who have symptoms or have been identified as a close contact** should wear a face covering, limit close contact with others, and contact the [Dartmouth College Health Service](#) for instructions (603-646-9400).

Course Topics Broad Overview

(Class-by-class details are posted to Canvas)

- What is evolution. How evolution works.
- Inference of evolutionary histories of genes and organisms.
- Mutation as a source of genetic variation. Human genetic variation.
- Inheritance of traits.
- Evolutionary forces that shape genetic composition of populations: Modeling dynamics of allele frequencies in a population.

- Evolution of complex traits that are determined by multiple genes and are influenced by environment.
- Adaptation. Detection of adaptation.
- Implications of evolution for human health. Human-pathogen co-evolution.
- Use of human genomic data for tracking human migration, inferring selection, and associating genes with traits and diseases.

Expectations

Here is what we expect from you:

- (1) to critically read and watch the assigned material **before** class,
- (2) to reflect on the assigned material via ungraded **pre-lecture** quizzes,
- (3) to enthusiastically participate in class discussions and problem-solving sessions,
- (4) to diligently prepare for all exams,
- (5) to complete InQuizitive and data analyses assignments thoughtfully and timely.

Cell Phones: Please be sure your cell phone is muted before class starts. We will use PollEverywhere polls, for which you can use your phone. Otherwise, please refrain from texting, checking email or social media, watching videos, etc. These activities will distract you (and, more importantly, students who sit next to you) from participating fully during class and therefore will interfere with learning.

Laptops: You are welcome to use laptops for taking notes. We will also occasionally use computers for in-class exercises. We will prompt you to bring the laptops to those class periods. As with cell phones, please do not use laptop for activities unrelated to class.

You can expect your professor, experiential learning facilitator, and TAs to:

- (1) Bring expertise into the classroom.
- (2) Stimulate interest in the course material.
- (3) Provide consultations during the hands-on activities and be available to answer questions.
- (4) Return graded assignments promptly.

Evaluation

Exam #1	23% (Jan 25, 1:15PM – Jan 26, 11:00AM, 2hrs on Gradescope)
Exam #2	23% (Feb 15, 1:15PM – Feb 16, 11:00AM, 2hrs on Gradescope)
Final Exam	24% (3hrs, TBA)

Data Analysis Assignments 20%

- Tetrapod Evolution and Phylogeny – 4% (due Jan 24)
- Spirit Bear Evolution (2 quizzes) – 5% (due Feb 2 and Feb 8)
- Experimental Evolution – 5% (due Feb 18)
- Selection in Goldenrod Galls – 6% (due Mar 1)

InQuizitive quizzes 5% (multiple quizzes released throughout the term)

Participation **5%**

- Ungraded pre-lecture quizzes and surveys (posted regularly to Canvas)
- Active participation in the in-class discussions and problem solving

Academic Honor

The Dartmouth Honor Principle applies to **all work you submit for a grade in this course**. That is, the exams and graded activities you turn in must be your own. Any copying of another person's work or from the Internet, in whole or in part, is a violation of the Honor Principle.

However, we will be working in groups during class on various non-graded problem-solving activities. During these activities, you are *encouraged* to ask each other questions, share ideas and brainstorm solutions.

The detailed description of the Dartmouth Honor Principle is available at <https://students.dartmouth.edu/community-standards/policy/academic-honor-principle>.

Your Needs and Wellness

Students requesting disability-related accommodations and services for this course are required to register with Student Accessibility Services (SAS; [Getting Started with SAS webpage](#); student.accessibility.services@dartmouth.edu; 1-603-646-9900) and to request that an accommodation email be sent to me in advance of the need for an accommodation. Then, you should schedule a follow-up meeting with me to determine relevant details such as what role SAS or its [Testing Center](#) may play in accommodation implementation. This process works best for everyone when completed as early in the quarter as possible. If you have questions about whether you are eligible for accommodations or have concerns about the implementation of your accommodations, you should contact the SAS office. All inquiries and discussions will remain confidential.

If you have a religious observance that conflicts with your participation in the course, please meet with me before the end of the second week of the term to discuss appropriate accommodations.

The academic environment at Dartmouth is challenging, our terms are intensive, and classes are not the only demanding part of your life. There are a number of resources available to you on campus to support your wellness, including your undergraduate dean (<http://www.dartmouth.edu/~upperde/>), Counseling and Human Development (<http://www.dartmouth.edu/~chd/>), and the Student Wellness Center (<http://www.dartmouth.edu/~healthed/>). I want you to be aware of these resources and encourage you to use them as needed.

Title IX

At Dartmouth, we value integrity, responsibility, and respect for the rights and interests of others, all central to our Principles of Community. We are dedicated to establishing

and maintaining a safe and inclusive campus where all have equal access to the educational and employment opportunities Dartmouth offers. We strive to promote an environment of sexual respect, safety, and well-being. In its policies and standards, Dartmouth demonstrates unequivocally that sexual assault, gender-based harassment, domestic violence, dating violence, and stalking are not tolerated in our community.

The Sexual Respect Website (<https://sexual-respect.dartmouth.edu>) at Dartmouth provides a wealth of information on your rights with regard to sexual respect and resources that are available to all in our community. Please note that, as faculty members, we are obligated to share disclosures regarding conduct under Title IX with Dartmouth's Title IX Coordinator. Confidential resources are also available, and include licensed medical or counseling professionals (e.g., a licensed psychologist), staff members of organizations recognized as rape crisis centers under state law (such as WISE), and ordained clergy (see <https://sexual-respect.dartmouth.edu/reporting-support/all-resources/confidential-resources>). Should you have any questions, please feel free to contact Dartmouth's Title IX Coordinator (Kristi.Clemens@Dartmouth.edu) (and deputies if appropriate).

Consent to Recording

(1) Consent to recording of course

- a) By enrolling in this course, you affirm your understanding that this course and associated **group** meetings involving students and the instructor, may be recorded within any digital platform used to offer instruction for this course;
- b) You further affirm that the instructor owns the copyright to their instructional materials, of which these recordings constitute a part, and distribution of any of these recordings in whole or in part without prior written consent of the instructor may be subject to discipline by Dartmouth up to and including expulsion;
- c) You authorize Dartmouth and anyone acting on behalf of Dartmouth to record your participation and appearance in any medium, and to use your name, likeness, and voice in connection with such recording; and
- d) You authorize Dartmouth and anyone acting on behalf of Dartmouth to use, reproduce, or distribute such recording without restrictions or limitation for any educational purpose deemed appropriate by Dartmouth and anyone acting on behalf of Dartmouth.

(2) Requirement of consent to one-on-one recordings

By enrolling in this course, you affirm that you will not under any circumstance make a recording in any medium of any one-on-one meeting with the instructor without obtaining the prior written consent of all those participating, and you understand that if you violate this prohibition, you will be subject to discipline by Dartmouth up to and including expulsion, as well as any other civil or criminal penalties under applicable law.