

BIOL 439
NATURAL SELECTION AND MICROEVOLUTION
Fall 2023

Prerequisite / Co-requisite:

Essential prerequisites/co-requisite: BIOL 302/3.0 or BIOL 303/3.0) and a minimum GPA of 2.0 in the Biological Foundations List (BIOL 102/3.0; BIOL 103/3.0; BIOL 201/3.0; BIOL 202/3.0; BIOL 205/3.0; BIOL 206/3.0; BIOL 302/3.0; BIOL 303/3.0; BIOL 330/3.0; BIOL 334/3.0; BIOL 339/3.0; BIOL 341/3.0)

Course Description & Objectives:

The mechanisms of evolutionary change - from genes to societies. How natural selection interacts with genetic and population processes to make organisms adapted to their environment and to create biological diversity.

This course focuses on the core processes and mechanisms involved in adaptation and natural selection, extending to evolutionary genetics and genomics. Topics include: genetic variation, mutation and neutral evolution, selection, drift and inbreeding, quantitative genetics, molecular evolution, selection in the wild, human evolution. It will address evidence for adaptation and natural selection at the phenotypic, genetic/genomic level and at the molecular level.

Texts:

THERE IS NO REQUIRED TEXTBOOK

Useful Textbooks:

Evolutionary Analysis by Jon C. Herron and Scott Freeman. Pearson Publishers.

Evolution: Making Sense of Life by Doug Emlen & Carl Zimmer. MacMillan Learning.

Other sources:

We will be reading selected articles from the primary literature, and other readings posted in OnQ.

Assessment (may be subject to minor changes):

Midterm test	18%
Assignments (x3)	24%
Literature Discussion and Summary (x3)	18%
News Article	5%
Research Proposal	15%
Presentation	15%
Participation in class discussions	5%

Midterm test – 18%

You will have a 24-hour window to take the test. Tests will consist of a mix of short answer and long answer questions. Emphasis will be on concepts and problem solving.

Assignments (x3, 8% each) – 24%.

We will use virtual experiments to help understand and explore various aspects of the course material. The assignments will involve handing in a worksheet that will be assessed. You can ask questions about the worksheets during the tutorial sessions.

Literature Discussion and Summary (x3, 6% each) – 18%

We will discuss 3 papers from the primary literature during tutorials. The papers will be selected to match the content of the lectures. For each paper you will hand in a brief summary of the paper and be expected to participate in discussion during tutorial. More detailed expectations will be provided.

News article – 5%

You will be responsible for finding a recent (<6 month old) news article about a current issue that involves evolution. You will hand in a 1-page summary of the article and give a short 5 minute presentation.

Research Proposal – 15%

You will choose an article from the primary literature to use as a focus study. You will briefly summarize the paper, and then design a follow up study and write a research proposal. More detailed expectations will be provided.

Presentation – 15%

You will be responsible for summarizing a research concept by making a creative presentation, which you will present to the class. You will also write a research report on the topic. More detailed expectations will be provided.

Participation – 5%

You are expected to actively participate in class and tutorial discussions.

Due-dates, late, and missing assignments:

Tests have to be conducted during the window provided, unless you have an approved academic consideration. Note that principles of universal design have been built into these assignments so that extra-time considerations will only be provided in extenuating circumstances. For all other assignments, you will be penalized 10% for each day that an assignment is late. Missing assignments will be given a 0. Please contact me if you have any questions.

Grading Method

In this course, all components will be graded using numerical percentage marks. Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale:

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

Class Attendance

Your presence and participation in class contributes to the knowledge and skills that you will develop throughout this course. I expect that you attend class regularly, participate in class conversations and learning activities. These types of activities provide active engagement, promote a deeper understanding of the course content, and contribute to your success in this course.

Turnitin:

This course makes use of Turnitin, a third-party application that helps maintain standards of excellence in academic integrity. Students will be required to submit their course assignments to onQ through Turnitin. In doing so, students' work will be included as source documents in the Turnitin reference database, where they will be used solely for the purpose of detecting plagiarism.

Queen's Policy Statement on Academic Integrity

Queen's University is dedicated to creating a scholarly community free to explore a range of ideas, to build and advance knowledge, and to share the ideas and knowledge that emerge from a range of intellectual pursuits. Queen's students, faculty, administrators and staff therefore all have responsibilities for supporting and upholding the fundamental values of academic integrity. Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility and by the quality of courage. These values and qualities are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the "freedom of inquiry and exchange of ideas" essential to the intellectual life of the University.

The following statements from "The Fundamental Values of Academic Integrity" (2nd edition), developed by the International Center for Academic Integrity (ICAI), contextualize these values and qualities:

1. **Honesty** Academic communities of integrity advance the quest for truth and knowledge through intellectual and personal honesty in learning, teaching, research, and service.

2. **Trust** Academic communities of integrity both foster and rely upon climates of mutual trust. Climates of trust encourage and support the free exchange of ideas which in turn allows scholarly inquiry to reach its fullest potential.
3. **Fairness** Academic communities of integrity establish clear and transparent expectations, standards, and practices to support fairness in the interactions of students, faculty, and administrators.
4. **Respect** Academic communities of integrity value the interactive, cooperative, participatory nature of learning. They honour, value, and consider diverse opinions and ideas.

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Accommodations for Disabilities

Queen's University is committed to working with students with disabilities to remove barriers to their academic goals. Queen's Student Accessibility Services (QSAS), students with disabilities, instructors, and faculty staff work together to provide and implement academic accommodations designed to allow students with disabilities equitable access to all course material (including in-class as well as exams). If you are a student currently experiencing barriers to your academics due to disability related reasons, and you would like to understand whether academic accommodations could support the removal of those barriers, please visit the [QSAS website](#) to learn more about academic accommodations or start the registration process with QSAS by clicking *Access Ventus* button at [Ventus | Accessibility Services | Queen's \(queensu.ca\)](#) To learn more go to: <https://www.queensu.ca/ventus-support/students/visual-guide-ventus-students>

SCHEDULE (May be subject to changes)

Week	Date	Topic	Notes/Assignments
1	Sept 4 – 8	Introduction and review	
		Tutorial: None	
2	Sept 11 – 15	Selection in natural populations	
		Tutorial: Q&A	
3	Sept 18 - 22	Phenotypic selection	
		Tutorial: Q&A	Assignment 1
4	Sept 25 - 29	Genomic approaches to selection	
		Tutorial: Literature Discussion	Literature Discussion
5	Oct 2 -6	Local adaptation	
		Tutorial: Q&A	Assignment 2
	Oct 9 - 13	MID-TERM BREAK: NO CLASS	
6	Oct 16 - 20	Testing for adaptation	
		Tutorial: Q&A	Midterm
7	Oct 23- 25	Genetic correlation & trade-offs	
		Tutorial: Literature Discussion	Literature Discussion
8	Oct 30 – Nov 3	Genetic conflict	
		Tutorial: Q&A	Assignment 3
9	Nov 6 - 10	Human evolution	
		Tutorial: Q&A	Literature Discussion
10	Nov 13 - 17	Ancestry and coalescence	
		Tutorial: Q&A	
11	Nov 20 - 24	Invasives and domestication	
		Tutorial: &A	Research Proposal Topic
12	Nov 27 – Dec 1	Presentations	
		Tutorial: None	
13	Dec 4	Presentations	Research Proposal Due