

BIOL 206 - Evolutionary Genetics

Winter Term (2024-2025)

Instructor	
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Tutorial Coordinator	
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Teaching assistants	See Course OnQ page

Course Description

An introduction to the genetic mechanisms of population differentiation and evolutionary change—from molecules to species. The genetical theory of evolution is also applied to problems involving conservation, biotechnology and the evolution of disease.

Overview

The goals of Biology 206 are to provide students with a broad overview of modern evolutionary biology and how and why scientists study evolution. The course integrates the two major organizing principles of biological systems, genetics and evolution. Genes encode information influencing the phenotype from biochemistry to behaviour, while evolutionary forces shape the sequence of genes and how they are expressed. We will discuss how genetic variation is produced and stored and provides the raw material for evolution. We will introduce the major mechanisms of evolutionary change: natural selection, random evolutionary processes, and gene flow, and how these processes work together to create biodiversity. In each case, we'll explore concepts through experimental and comparative case studies. We will teach you as much about how research is done as what has been discovered. And we will show you that evolutionary biology as a field is the most profound and significant in all of science. Topics covered will include: Introduction to evolution theory, The Hardy-Weinberg principle and its assumptions, Random evolutionary processes and gene flow, Population subdivision, Types of natural selection, Causes and consequences of linkage disequilibrium, Evolution of complex (quantitative) traits, Adaptation, The evolution of sex, Sexual selection & mate choice, Social evolution, Speciation, Species interactions, Human evolution, Rapid evolution.

Course Materials

There is a required textbook for this course. You can purchase a hard-copy or digital (e-book) version from the Campus Bookstore for \$62 CAD.

Emlen & Zimmer. *Evolution: Making Sense of Life*. Third Edition. 2020. MacMillan Learning.

You do not need to purchase the access to Achieve, which is online learning service provided by the publisher. Achieve is optional, it is a very good resource, and students appreciate it for the extra practice problems and questions.

You may use a previous edition of this textbook, although page numbers from readings will not be provided for older editions. A pdf of the Table of Contents of the current edition will be provided in OnQ, so you can try to match up sections.

All other course materials will be provided online via OnQ

Weighting of Assessments

Component	Weight (%)	Date
Test 1	15%	January 31
Test 2	15%	March 7
Final exam	30%	TBD (April 7-23)
Quizzes (9 total, drop lowest)	16% (8 x 2% each)	Weekly
Tutorial Assignments	24% (6 x 4% each)	Weeks 2,3,6,7,10,11

Assessments and Activities Description

Test 1 and Test 2 – Each worth 15%. The tests will be mostly multiple choice questions with a few short answer questions. Test 1 will cover the first unit (lectures 1-10), Test 2 will cover the second unit (lectures 11-20). You will be allowed to use a calculator. Tests will be conducted during class.

Final Exam – 30% This final exam will be scheduled by FAS, during the exam period. You will have 3 hours to take the exam. The exam will be multiple choice with a few short answer questions. The final exam is cumulative, but will cover the third unit (lectures 21-30) more than the first and second. You will be allowed to use a calculator.

Quizzes – 16% There will be quizzes on OnQ that become available each Friday at 1pm, and are due by Monday at 1pm. Each quiz will consist of 5 questions, and there will be 9 quizzes over the semester. Once you begin the quiz, it must be completed within 60 minutes. You will not be allowed to move backwards through questions. Quizzes will cover lecture content, readings, and videos from the preceding week. Your lowest grade from one quiz will be dropped (i.e. 8 of the 9 quizzes will count towards your grade).

Tutorials - 24% There will be 6 tutorials over the course of the semester. During tutorials, students will be divided into groups, and will complete worksheets as a group. The group will hand in one completed assignment, that is due 2-hours after the tutorial ends (ie. there are rolling deadlines, depending on the tutorial you attend).

Lectures - Lectures will be presented live at the designated lecture times (Mon: 1:30PM-2:20PM; Wed: 12:30PM - 1:20PM; Fri: 11:30PM - 12:20PM). Slides will be posted before each lecture. Students are expected to attend lectures (content knowledge will be required for tutorials and weekly quizzes).

Absences and missing assignments:

Please refer to the Step-by-step procedures for Academic Accommodations and Considerations document on the Course Home page.

Quizzes and 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 the quizzes so extra time will not be provided and no extensions will be granted.

Your lowest quiz grade will automatically be dropped, so if you miss one quiz you do not need to apply for academic consideration. If you miss more than one quiz you must apply for academic consideration to have that quiz grade exempted. Your quiz can only be exempted if your academic

consideration spans the duration of the quiz window (e.g. if you are ill for only one day while the quiz is running you will not be eligible for an exemption). Up to 3 quizzes may be exempted, in addition to the one that will be automatically dropped. After that, the weight of any missed quizzes will be transferred to the final exam.

If you miss a test (midterm or final exam) you must apply for academic consideration to be eligible to write the deferred test at a later date. If you are also unable to write a deferred midterm, the weight of the test will be transferred to the final exam. Deferred tests may not follow the same structure as the original test, and may consist of more short answer questions.

For **tutorial assignments**, all members of your group will be penalized 10% for each day that an assignment is late, up to a maximum of 5 days, after which the assignment will not be accepted. Missing assignments will be given a 0. If you're unable to attend your scheduled tutorial, please attend the other tutorial slot run by the same TA. If you're still unable to attend a tutorial, please submit a request for academic consideration. With an approved academic consideration you will be permitted to complete the tutorial assignment on your own. Contact biol206@queensu.ca to receive a copy of the assignment. If your academic consideration is for up to 3 days, you will be required to submit your assignment within 2 days after the end of your academic consideration window. For academic considerations of 4 days or longer, please email biol206@queensu.ca to make arrangements.

Grading

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale:

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

University Operating Dates

Jan 6	Classes start
Jan 17	Last day to add courses
Jan 17	Last day to drop courses without financial
Feb 17–21	Reading Week
Feb 28	Last day to drop courses without academic penalty
Apr 4	Classes end
Apr 7-23	Exam period

Contacting the Teaching Team

The teaching team contact information is located on the Homepage of the course (see “Teaching Team”). We prefer that students use the course email BIOL206@queensu.ca and forums rather than contacting instructors directly.

For general questions about the course, please post to the Course Questions Forum, (located under Help in the navigation bar). For questions about course content (lectures, quizzes, etc) please post to the Course Content Forum (located in the Communications tab). Feel free to help answer your peers’ questions on these forums. Most questions are answered within 24 hours (Monday - Friday).

Please use your Queen’s email for inquires that are more personal in nature, or for issues such as academic accommodations or marking. If you need to have a more detailed conversation, please contact your instructor.

Etiquette

You are expected to maintain respect in your dealings with fellow students and the teaching team in any course. The following guidelines are a reference to guide your online communication in this course. Make a personal commitment to learn about, understand, and support your peers.

1. Give others the benefit of the doubt.
2. Ensure your writing is respectful and inclusive.
3. Recognize and value the experiences, abilities, and knowledge that each person brings.
4. Carefully re-read your writing before posting or sending to others.
5. It’s okay to disagree with ideas, but personal attacks will not be tolerated.

Queen's Email

The university communicates with students via Queen's email. Please check your email regularly to ensure you do not miss important information related to your course.

Copyright

Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other course materials are the intellectual property of the instructor. It is a departure from academic integrity to distribute, publicly post, sell, or otherwise disseminate an instructor’s course materials or to provide an instructor’s course materials to anyone else for distribution, posting, sale, or other means of dissemination, without the instructor’s consent. A

student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face legal consequences for infringement of intellectual property rights.

Accessibility/Accommodations

Queen's University is committed to achieving full accessibility for all students. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. The Senate Policy for Accommodations for Students with Disabilities was approved at Senate in Nov 2016.

If you are a student with a disability and think you may need academic accommodations, you are strongly encouraged to contact the Queen's Student Accessibility Services (QSAS) and register as early as possible. For more information, including important deadlines, please visit the QSAS site.

To register your academic accommodation for this course, please select the Accommodations button on the course homepage and follow the instructions.

Note that principles of universal design have been built into the quizzes and tutorial assignments so extra time will not be provided and no extensions will be granted. Individual extra time accommodations will be applied to the midterm tests and final exam.

Academic Considerations for Students in Extenuating Circumstances

Queen's University is committed to providing academic consideration to students experiencing extenuating circumstances that are beyond their control and are interfering with their ability to complete academic requirements related to a course for a short period of time. [Click here to view the Senate Policy on Academic Consideration for Students in Extenuating Circumstances.](#)

Please see the Academic Consideration Requests button on the course homepage to apply for an academic consideration in this course. Note that you will be taken to the student request portal where you will be required to provide the name and email address of the instructor/coordinator. For this course, please be sure to use the following email address: biol206@queensu.ca.

For more information about missing an assessment, please refer to the section "Assessments and Activities Description".

Academic Integrity

Academic integrity is constituted by the six core fundamental values of honesty, trust, fairness, respect, responsibility, and courage.

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1), on the Arts and Science website, and from the instructor of this course.

Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Lecture Schedule

Week	Date	Lect	Title	Readings	Quiz
1	Mon Jan 6	1	Introduction & Overview	E&Z Ch1 – 1.2, 1.3; Ch. 18 – 18.6	
	Wed Jan 8	2	Evolutionary Thinking	E&Z Ch.2 – 2.1, 2.3; Ch.4 – 4.1, 4.2,	
	Fri Jan 10	3	Phylogenies	E&Z Ch.4 – 4.3, 4.4, 4.5; Ch. 8 – 8.4, 8.5	Quiz 1
2	Mon Jan 13	4	Variation	E&Z Ch.5	
	Wed Jan 15	5	Null Hypothesis (HW)	E&Z Ch.6 – 6.1, 6.2, 6.3	
	Fri Jan 17	6	Finite Population Size	E&Z Ch.6 – 6.4, 6.5	Quiz 2
3	Mon Jan 20	7	Natural Selection, Part 1	E&Z Ch.6 – 6.6	
	Wed Jan 22	8	Natural Selection, Part 2	E&Z Ch.6 – 6.7	
	Fri Jan 24	9	Nonrandom Mating	E&Z Ch.6 – 6.8	Quiz 3
4	Mon Jan 27	10	Population Subdivision	E&Z Ch.6 – 6.9	
	Wed Jan 29		Q&A		
	Fri Jan 31		Test 1		
5	Mon Feb 3	11	Quantitative Traits, Heritability	E&Z Ch.7 – 7.0, 7.1	
	Wed Feb 5	12	Response to Selection	E&Z Ch.7 – 7.2	
	Fri Feb 7	13	Types of Selection	E&Z Ch.7 – 7.2	Quiz 4
6	Mon Feb 10	14	Phenotypic Plasticity	E&Z Ch.7 – 7.5	
	Wed Feb 12	15	History of Racism and Eugenics	See OnQ	
	Fri Feb 14	16	Linkage & Complex Traits	E&Z Ch.7 – 7.3, 7.4	Quiz 5
READING WEEK					
7	Mon Feb 24	17	Genome Evolution	E&Z Ch.8 – 8.1, 8.2, 8.3	
	Wed Feb 26	18	Molecular Evolution	E&Z Ch.8 – 8.6, 8.7	
	Fri Feb 28	19	Adaptation	E&Z Ch.9 – 9.2, 9.3, 9.4	Quiz 6
8	Mon Mar 3	20	Selection and Trade-offs	E&Z Ch.10 – 10.5, 10.6	
	Wed Mar 5		Q&A		
	Fri Mar 7		Test 2		
9	Mon Mar 10	21	Evolution of Sex	E&Z Ch.11 – 11.1	
	Wed Mar 12	22	Sexual Selection	E&Z Ch.11 – 11.2, 11.3	
	Fri Mar 14	23	Mating Systems and Sexual Conflict	E&Z Ch.11 – 11.4, 11.5, 11.6	Quiz 7
10	Mon Mar 17	24	Speciation, Part 1	E&Z Ch.13 – 13.1, 13.2, 13.3	
	Wed Mar 19	25	Speciation, Part 2	E&Z Ch.13 – 13.4, 13.5, 13.7	
	Fri Mar 21	26	Species Interactions	E&Z Ch.15 – 15.1, 15.2	Quiz 8
11	Mon Mar 24	27	Conservation genetics	See OnQ	
	Wed Mar 26	28	Social Evolution	E&Z Ch.16 – 16.6, 16.7, 16.8	
	Fri Mar 28		Human Evolution, Part 1	E&Z Ch.17	Quiz 9
12	Mon Mar 31	29	Human Evolution, Part 2	E&Z Ch.17	
	Wed Apr 2	30	Evolutionary Medicine	E&Z Ch.18	
	Fri Apr 4		Q&A		