BIOL*4120 Evolutionary Ecology

Winter 2023
Section(s): 01

Department of Integrative Biology
Credit Weight: 0.50
Version 1.00 - January 06, 2023

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1 Course Details

1.1 Calendar Description

This course is an examination of common ecological circumstances faced by plants and animals and the morphological, behavioral and life history characteristics that have evolved in response. Particular emphasis will be placed on evolutionary processes and on adaptive aspects of thermoregulation, foraging strategies, spatial distribution, social and reproductive strategies. The course will emphasize both the theoretical basis and the empirical evidence for ecological adaptation.

Pre-Requisites: BIOL*2060, BIOL*2400

1.2 Course Description

- This course reviews the basic tools to study hypotheses about evolutionary adaptation. It will not be a broad survey of the field, but will instead focus on a few subject areas that we will discuss in detail using tools and approaches of evolutionary ecology.
- Basic understandings of Ecology and of Evolution are assumed and will not be taught. Students are also expected to have some basic experience in statistics in order to complete quantitative assignments and understand some analyses of assigned papers.
- Note on Prerequisites: BIOL*2060 (Ecology) or BIOL*3110 (Population ecology – discontinued) or other Ecology course with instructor consent), BIOL*2400 (Evolution) or BIOL*3400 or ZOO*3300 (Evolution - discontinued).

1.3 Timetable

- All lectures are delivered in person: MCKN 117: 11:30 - 12:20 M, W, F
- All seminars are delivered in person (covid permitting)

Tutorial Section 1: 12:30 - 1:20 PM, Fridays, SSC 1306 (Jan-Feb), then SSC 2306 (Feb-Apr)
Tutorial Section 2: 1:30 - 2:20 PM, Fridays, SSC 1306 (Jan-Feb), then SSC 2306 (Feb-Apr)
Tutorial Section 3: 2:30 - 3:20 PM, Fridays, SSC 1306 (Jan-Feb), then SSC 2306 (Feb-Apr)
Tutorial Section 4: 3:30 - 4:20 PM, Fridays, SSC 1306 (Jan-Feb), then SSC 2306 (Feb-Apr)

- Excluding winter break and holidays around Easter

1.4 Final Exam

There is no final exam. Instead a final poster presentation of an individual literature research project will be submitted through PEAR.

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2 Instructional Support

2.1 Instructional Support Team

Instructor:	Beren Robinson Ph.D.
Email:	berenrob@uoguelph.ca
Office:	SSC2455
Office Hours:	Office hours: Students with personal issues should contact Dr. Robinson directly by email.

2.2 Teaching Assistants

Teaching Assistant (GTA):	TBA TBA
Office Hours:	TBD

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3 Learning Resources

Lecture material will be drawn from the primary literature and supplied through the CourseLink website.

Various good evolution textbooks and websites will help you with terms and basic evolutionary concepts (see first 3 below for example)

For more specific treatments of evolutionary ecology, the final 3 references below are recommended especially for students considering graduate school.

3.1 Recommended Resources

Evolution: Making sense of Life (any edition) (Textbook)
Douglas Emlen and Carl Zimmer 3rd edition Aug 1 2019 (or earlier/later) is the current textbook being used in BIOL*2400 "Evolution" Pearson **(**ISBN13: 9781319079864) .

Evolution (Textbook)
Douglas J. Futuyma and Mark Kirkpatrick Publication Date - 4th Edition April 2017 Sinauer Associates, Inc. (ISBN: 9781605356051)

Evolutionary Analysis (Textbook)
Jon C. Herron and Scott Freeman 5th Edition Aug 12 2013 Pearson (ISBN-13: 978-0321616678)

Useful basic evolution websites (Software)
See links provided on Courselink > Content > Useful Evolutionary Ecology Links

Evolutionary Ecology: Concepts and Case Studies (Readings)
Fox, C.W., D.A. Roff and D.J. Fairbairn (eds). 2001. Oxford University Press, Oxford, UK. (ISBN-13: 978-0195131550)

Eco-Evolutionary Dynamics (Textbook)
Andrew P. Hendry 2017. Princeton University Press, Princeton, NJ (ISBN-13: 978-0691145433)

A Primer in Ecological Genetics (Textbook)
Jeffrey K. Conner and Daniel L. Hartl. 2004. Sinauer Assoc. Inc., MA (ISBN-13: 978-0878932023).

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4 Learning Outcomes

By the end of this course, students should be able to address the following goals and perform the following skills.

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Evolution: Apply evolutionary principles to new problems in biology and everyday life; use evolutionary principles to develop novel hypotheses based on observation; explain a study to document selection-driven evolutionary change in a population.
2. Selection: Measure directional and nonlinear (stabilizing/disruptive) selection differentials; Define and understand how to measure selection gradients; Think critically about genic, individual and group selection; have a general sense of the strength of selection in the wild.
3. Fitness: Explain what fitness is and the variety of ways in which it can be measured; Appreciate challenges of measuring fitness in nature.

4. Heritability: Understand concepts of repeatability, heritability and polygenic inheritance at a more conceptual level; Understand at a basic level genetic covariances, genetic constraints and correlated responses to selection; Appreciate patterns in heritability estimates among types of traits.
5. Phenotypic evolution: Understand how to assess whether observed phenotypic changes/differences are genetically based.
6. Comparative method: Appreciate why it is important to consider evolutionary history in comparisons among species (and higher taxa), and have a basic idea of how this can be done.
7. Consider various other features of organisms such as phenotypic plasticity and life history traits in an evolutionary context, and explain using examples such concepts as evolutionary conflict between species, individuals and genes.
8. Quantify phenotypic variation in a sample in collaboration with others and use basic statistical methods to evaluate selection acting on the population.
9. Practice effective critical thinking during written and oral communication in tutorial discussions focused on analysing primary scientific literature and creating a final research poster evaluating the strength of evidence on applied evolution by natural selection.

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5 Teaching and Learning Activities

- This course has on campus lecture and seminar components delivered at the University of Guelph.
- Lecture content material will be delivered live M, W, F. Online recorded lectures will also be available from prior years. Here I introduce and discuss theoretical concepts and specific methods in evolutionary ecology.
- Friday tutorial sections will apply concepts through practical exercises and the discussion, critique and presentations of the primary literature.

5.1 General Lecture and Tutorial Schedule

Week	**Lecture #s / Tests**	**Tutorial / Assignments**
Week 1 - Jan 9 Intro. to General Adaptation problem	1 A - D	**Assignment 1:** Introduction, Hypotheses & predictions

Week 2 - Jan 16 Measuring selection	2 A - F	**Assignment 1:** Hypotheses and Predictions of Trait change **Assignment 2:** Presentation date Sign up deadline
Week 3 - Jan 23 Trait-performance relationships	3 A - C	**Assignment 1:** Analyze – Interpret selection
Week 4 - Jan 30 Natural vs Sexual vs Correlational Selection	4 A - C	**Assignment 1 Final Report: Feb 3** **Assignment 2.1:** Paper Presentation - TBA
Week 5 - Feb 6 Intro. Adaptive Evolution	5 A - E	**Assignment 2.2:** TBA
Week 6 - Feb 13 Heritability, Quantitative Genetics, Evolutionary Rate **Intro. to assignment 3: Poster**.	6 A - D **Unit test 1 - Natural selection - Feb 10-12 (online)**	**Assignment 2.3:** TBA
Week 7 - **Feb 20: Winter Break (No classes)**	**Winter Break (No classes)**	Feb 24 - **Winter Break (No classes)**
Week 8 - Selection on genotypes	7 A - B 8 A - B	**Assignment 2.4:** TBA
Week 9 - Evolution of aging and senescence	9 A - E	**Assignment 2.5:** TBA

	Unit test 2 - Adaptive Evolutionary Response - Mar 10-12 (online)	
Week 10 - Evolutionary conflicts	10 A - C	**Assignment 2.6:** TBA Assignment 3 - Draft - Mar 15 - PEAR
Week 11 - Coevolution	11 A - C	**Assignment 2.7:** TBA Assignment 3 - Reviews - Mar 22 - PEAR
Week 12 - Final Synthesis		**Assignment 2.8:** TBA Assignment 3 - Due - Apr. 10 - PEAR

5.2 Important Dates

- Jan 9: Classes start
- Jan 13: Assignment 1 Introduction
- Jan 20: Deadline to sign up for paper presentation schedule (Assignment 2)
- Feb 3: Assignment 1 report due; First oral presentation of paper (Assignment 2) *see note below
- Feb 10-12: Unit test 1 - Natural Selection (online)
- Feb 20-24: **Winter break (No Classes)**
- Mar 10: 40th day of classes
- Mar 10-12: Unit test 2 - Adaptive Evolutionary Responses (online)
- Mar 15: Assignment 3 Draft 1 due - PEAR
- Mar 22: Assignment 3 peer reviews due - PEAR
- April 10: Final assignment 3 poster due - PEAR
- *Note: Assignment 2 (paper oral presentation <u>and</u> participatory questions) are <u>always</u> due prior to your scheduled Friday tutorial throughout Feb 3 - Mar 31. Submit participatory questions through the online Quiz tool in Courselink.

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Assignment 1: Practical Lab - Measuring selection	20
Assignment 2: Paper Oral Presentation & Discussion	20
Assignment 2: 3 Questions Per Discussion Paper	5
Unit Test 1	10
Unit Test 2	10
Assignment 3: Draft poster	5
Assignment 3: Peeer review	5
Assignment 3: Applied evolution poster presentation	25
Total	100

6.2 Assessment Details

Assignment 1: Practical Lab - Measuring Selection (20%)
Due: Fri, Feb 3
Learning Outcome: 1, 2, 3, 5, 8, 9
Friday seminars in the first 3 weeks of course are dedicated to developing hypotheses and predictions on morphological traits; using statistical models to test these effects; writing a summary final report of findings.

Assignment 2 Seminar Presentation & Discussion (20%)
Date: Fri. every week: Feb. 3 - Mar 31, In class seminar
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 9
Group presentation summarizing and critiquing an assigned scientific paper; leading seminar discussion.

Assignmnent 2 - Preparation for discussion, 3 Questions (5%)
Date: Friday of week: Feb. 3 - Mar 31
Learning Outcome: 9
Submit 3 questions about the weekly assignment 2 papers through the quiz tool on Courselink demonstrating that you have read the assigned paper.

Unit test 1 (10%)
Date: Fri, Feb 10, 9:00 AM - Sun, Feb 12, 11:59 PM, Online
Learning Outcome: 1, 2, 3
The online unit test will assess cover our review of basic material about natural selection, Lectures 1 - 4.

Unit Test 2 (10%)

Date: Fri, Mar 10 - Sun, Mar 12, 11:59 PM, Online
Learning Outcome: 1, 2, 3, 4, 5, 6, 7
This online unit test will focus more on adaptive evolutionary responses to selection. Questions may include material from the first 4 assignment 2 papers.

Assignment 3 - Draft - Literature research on Applied Evolution (5%)
Due: Wed, Mar 15, 11:59 PM, PEAR
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9
Submit a draft research poster to PEAR for peer review. Your grade will be the mean of 3 peer reviews.

Assignment 3 - Peer reviews - Literature research on applied evolution (5%)
Due: Wed, Mar 22, 11:59 PM, PEAR
Learning Outcome: 1, 2, 9
Submit your reviews of 3 student (peer) poster drafts. Evaluation based on utility of your peer reviews as assessed by an instructor.

Assignment 3 - Final poster presentation applied evolution (25%)
Due: Mon, Apr 10, 11:59 PM, PEAR
Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8, 9
Submit final poster presentation of your individual research project on applied evolution.

6.3 Assignments

There are three assignments. Additional details and resources will be presented in class and available on the Courselink website. Assignments are to be performed and reported as your individual work.

Assignment 1: Practical lab (In class Friday labs in January)

- Developing adaptive hypotheses and predictions; Quantifying phenotypic variation in a real population; estimating selection on traits; writing a summary report.

Assignment 2: Oral presentation and discussion of assigned research paper (in class Friday labs remainder of term)

- Sign into a student group to present an oral summary and lead a discussion of one of the eight primary research papers in your tutorial section over the term.
- Students will form groups of 3-4 and sign up for either the summary or critique part of the presentation. See materials for paper analysis and presentation on CourseLink.
- After oral presentation, members of each presenting group will lead student discussion of the research paper.
- Non-presenting students submit 3 written questions for each week's assigned paper to demonstrate that they have read it and are coming prepared to discuss the paper. Submit questions through the Quiz tool. In addition to 5% of your grade, reading and

understanding the papers will help you answer questions about the papers on Unit Test 2.

Assignment 3: Individual literature research project on applied evolution.

- Perform a review of the primary scientific literature in order to analyze a potential example of human induced evolution in any natural system of your choice.
- Design and create a scientific poster presenting your analysis of the evidence that human activities may be generating selection and driving trait evolution in a natural population.
- You do not need to demonstrate that a trait is adaptive, but rather you will use methods introduced in this course to critically evaluate an adaptive hypothesis using published data.
- Your goal is to find and evaluate data to test an adaptive hypothesis that humans are a source of selection (intentionally or unintentionally) that may/may not drive the evolution of specified traits (targets of selection) in any natural population.

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7 Course Statements

7.1 Class Atmosphere

- Success depends on:
  - Your organizational and time-management skills. 80% of the grade involves activities related to the 3 assignments. To perform well on these will require you to be organized and on top of tasks.
  - Your focus on and willingness to learn rather than to be focused on grades. When you focus on learning, grades will follow. The same is not true when you focus on grades.
- Learning strategy 1: Strive for general knowledge rather than detailed knowledge. All examples are given to demonstrate a big idea. Try to first capture the big idea and then consider how the examples inform that idea. Make sure that you can sketch or write out the big ideas. I frequently use diagrams to describe the major components of an idea with words and arrows and how the different parts influence each other.
- Learning strategy 2: Psychological research demonstrates that motor activity always enhances learning. So, make a habit to always write out or diagram out your notes rather than just reading them over and over again. Being able to express ideas in your way is a good test of your knowledge.

- Learning strategy 3: Stay on top of the material every day. Instead of spending all of a day on one class, try to always have an hour or so of time with each of your courses every day. This has many benefits that include breaks and changes in topics which keeps the brain fresher.
- The success of this course depends on mutual respect among students and instructors. It also depends on everyone's participation. Participating makes the course more interesting for all. But, always strive to choose your words carefully especially in peer reviewing to be respectful in your communication. We also encourage levity during all discussions! We all gotta laugh sometimes... so, please bring your enthusiasm to class!
- We wish to support all students whether or not registered through Student Accessibility Services (SAS). If you are a SAS registered student that requires accommodation - PLEASE contact me so that we can discuss how I can help you succeed. If not, contact me anyway. I will try to support individuals while also maintaining a fair benchmark for all.
- Academic misconduct or personal harassment will not be tolerated and will be subject to University disciplinary procedures.

7.2 Grading

- **All assignments are due by the end of the indicated day (11:59PM) unless consideration is agreed to in advance of the deadline by the instructor. Late penalty is 20% per each additional 24 hr period starting at 12:01 AM, including weekends.**

7.3 When You Cannot Meet a Course Requirement

Consideration may be granted at the instructor's discretion for medical, compassionate or university-related conflicts may require additional discussion with your program counsellor.

Consideration is more likely when the student proactively advises the instructor of issues well in advance of deadlines.

<u>We wish to support all students whether or not registered through Student Accessibility Services (SAS). Please be aware that the SAS does NOT contact faculty about your presence in any course. Please reach out to your instructors in order for us to help you succeed.</u>

8 Department of Integrative Biology Statements

8.1 Academic Advisors

If you are concerned about any aspect of your academic program:

- Make an appointment with a program counsellor in your degree program. B.Sc. Academic Advising or Program Counsellors

8.2 Academic Support

If you are struggling to succeed academically:

- Learning Commons: There are numerous academic resources offered by the Learning Commons including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills. You can also set up individualized appointments with a learning specialist. http://www.learningcommons.uoguelph.ca/
- Science Commons: Located in the library, the Science Commons provides support for physics, mathematic/statistics, and chemistry. Details on their hours of operations can be found at: http://www.lib.uoguelph.ca/get-assistance/studying/chemistry-physics-help and http://www.lib.uoguelph.ca/get-assistance/studying/math-stats-help

8.3 Wellness

If you are struggling with personal or health issues:

- Counselling services offers individualized appointments to help students work through personal struggles that may be impacting their academic performance. https://www.uoguelph.ca/counselling/
- Student Health Services is located on campus and is available to provide medical attention. https://www.uoguelph.ca/studenthealthservices/clinic
- For support related to stress and anxiety, besides Health Services and Counselling Services, Kathy Somers runs training workshops and one-on-one sessions related to stress management and high performance situations. http://www.selfregulationskills.ca/

8.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) http://www.e-laws.gov.on.ca/index.html. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar. (https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml)

8.5 Course Offering Information Disclaimer

Please note that course delivery format (face-to-face vs online) is subject to change up to the first-class day depending on requirements placed on the University and its employees by public health bodies, and local, provincial and federal governments. Any changes to course format prior to the first class will be posted on WebAdvisor/Student Planning as they become available.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

9.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

9.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
