



# BIOL\*4120 Evolutionary Ecology

Winter 2020

Section(s): C01

Department of Integrative Biology

Credit Weight: 0.50

Version 1.00 - November 01, 2019

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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 will not be a broad survey of the field, but will instead focus on a few subject areas that we will discuss in detail.
- 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).
- Students are expected to have some background and experience in statistics.

### 1.3 Timetable

- Lectures: 11:30 AM - 12:20 PM, Monday, Wednesday and Friday,  
Location: MacKinnon - 031
- Labs  
Tutorial Section 1: 12:30 - 1:30 PM, Fridays, SSC 1306 (Jan-Feb), SSC 2306

(Feb-April)

Tutorial Section 2: 1:30 - 2:30 PM, Fridays, SSC 1306 (Jan-Feb), SSC 2306

(Feb-April)

Tutorial Section 3: 2:30 - 3:30 PM, Fridays, SSC 1306 (Jan-Feb), SSC 2306

(Feb-April)

## 1.4 Final Exam

Exam time and location is subject to change. Please see WebAdvisor for the latest information.

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## 2 Instructional Support

### 2.1 Instructional Support Team

<b>Instructor:</b>	Elizabeth Boulding Ph.D.
<b>Email:</b>	boulding@uoguelph.ca
<b>Telephone:</b>	1 519 824 4120 x54961
<b>Office:</b>	SSC1464
<b>Office Hours:</b>	Friday 14:00 to 16:00 or by appointment.

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## 3 Learning Resources

- Lecture material will be drawn from the primary literature and supplied on the course website (via CourseLink).
- However, for background material, chapters in a number of books on evolutionary biology will be useful, such as these recommended below.

### 3.1 Required Resources

#### CourseLink (Website)

<https://courselink.uoguelph.ca>

BIOL\*4120 will make use of the UoG course website on CourseLink for supplying background and reading materials, lab materials, etc. Announcements of course news, deadlines etc, will also be displayed on the Biol\*4120 CourseLink website. Please check it regularly.

### 3.2 Recommended Resources

**Evolution: Making sense of Life - Emlen & Zimmer (any edition) (Textbook)**

**Evolution: Making sense of Life - Douglas Emlen and Carl Zimmer ISBN-13: 978-**

1319079864 current textbook BIOL\*2400 Evolution

**Evolutionary Biology (Textbook)**

Evolution Fourth Edition Douglas J. Futuyma and Mark Kirkpatrick Publication Date - April 2017 ISBN: 9781605356051

**Evolutionary Ecology: Concepts and Case Studies (Readings)**

Fox, C.W., D.A. Roff and D.J. Fairbairn (eds). 2001. Evolutionary Ecology: Concepts and case studies. Oxford University Press, Oxford, UK.

**A Primer in Ecological Genetics (Readings)**

Conner, J.K. and D.L. Hartl. 2004. A Primer in Ecological Genetics. Sinauer Assoc. Inc., MA.

**Eco-Evolutionary Dynamics (Readings)**

Hendry, A.P. 2017. Eco-evolutionary dynamics. Princeton University Press, Princeton, NJ

## 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 (skills goal).
9. Understand how DNA markers are currently being used by Evolutionary Ecologists.
10. Practice effective critical thinking during written and oral communication in tutorial discussions focused on analysing primary scientific literature and creating a final research poster on applied evolution by natural selection (skills goal).

## 5 Teaching and Learning Activities

- This course has both lecture and tutorial components. The lecture period (Mon., Wed. and Fri.) will introduce and discuss theoretical concepts and specific methods in evolutionary ecology. The Friday lecture period will be used flexibly. In some weeks it will be used for additional lectures, while in other weeks it will be used for extended tutorials or project time.
- Tutorials will be used to apply concepts through practical exercises and the discussion, critique and presentations of the primary literature.

### 5.1 General Lecture Schedule

Monday	Wednesday	Friday
Jan 6 - Introduction	Jan 8 - What is an adaptation?	Jan 10 - Asking evolutionary questions.  Hypotheses and predictions  <b>Practical Lab 1:</b> System background; develop hypotheses about anti-predator trait function and fitness.
Jan 13 - Fitness	Jan 15 - Fitness	Jan 17 - Discuss Practical Lab Hypotheses  <b>Practical Lab 2:</b> Predictions of Trait change

Jan 20 - Fitness	Jan 22 - Natural Selection	Jan 24 - Natural Selection <b>Practical Lab 3: Analyze – Measure selection</b>
Jan 27 - Natural Selection	Jan 29 - Natural Selection	Jan 31 - <b>Assignment 1:Tadpole lab due</b> <b>Tutorial: Losos et al. 2004</b>
Feb 3 - Quantitative Genetics	Feb 5 - Quantitative Genetics Breeders Equation	Feb 7 - Levels of Selection <b>Tutorial: Freeman &amp; Byers 2006</b>
Feb 10 - Phenotypic plasticity	Feb 12 - Genetic Correlations Maternal Effects	Feb 14 - <b>Assignment 2: Applied Evolution Poster Intro.</b> <b>Tutorial: Nussey et al. 2005</b>
Feb 17 2020 - Winter Break (No classes)	Feb 19 2020 - Winter Break (No classes)	Feb 21 2020 - Winter Break (No classes)
Feb 24 - Maternal Effects	Feb 26 - Measuring Evolution	Feb 28 - <b>Applied evolution poster design</b> <b>Tutorial: Schluter 1994</b>
Mar 2 - Fst/Qst Rates of Evolution	Mar 4 - Review of Phylogeny	Mar 6 - Comparative Method <b>Tutorial: Coltman et al. 2003</b>
Mar 9 - Life History Evolution	Mar 11 - Life History Evolution	Mar 13 - <b>Tutorial: Reznick et al. 1997</b> <b>Poster draft due</b>
Mar 16 - Evolutionary Conflict	Mar 18 - Evolutionary Conflict	Mar 20 - <b>Tutorial: Holland &amp; Rice 1999</b> <b>Poster peer-review due</b>

Mar 23 - Coevolution	Mar 25 - Peer Review Due  Coevolution	Mar 27 Coevolution
Apr 1 - Final Lecture	April 3 - Review for Final Exam	April 5 - <b>Tutorial:</b> Brodie et al. 2002  <b>Final Poster due</b>

## 5.2 Important Dates

- Jan 17: Deadline to sign up for paper discussion schedule (Assignment 2)
  - Feb 1: Selection write-up due (Assignment 1)
  - Feb 17-21: **Winter break (No Classes)**
  - March 12: Poster draft version due on PEAR (Assignment 3 for peer review)
  - March 19: Poster peer reviews due on PEAR (Assignment 3)
  - April 4: Final poster due (Assignment 3)
  - April TBA: Final exam
- Note: Assignment 2 (paper oral presentation and participatory questions) are always due on Fridays in tutorial throughout February to April depending on article schedule above.

## 6 Assessments

### 6.1 Marking Schemes & Distributions

Name	Scheme A (%)
In-Class Student Response	0
Assignment 1: Practical Lab	20
Assignment 2: Paper Oral Presentation & Discussion	20
3 Questions Per Discussion Paper	2.5

Name	Scheme A (%)
Assignment 3: Submission of complete draft 1 poster for Peer Review	5
Peer Review of Poster Draft 1	5
Assignment 3: Scientific Poster Project	25
Final Exam	22.5
Total	100

## 6.2 Assessment Details

### Assignment 1: Practical Lab (20%)

**Date:** Thu, Jan 30

**Learning Outcome:** 1, 2, 3, 5, 8, 10

Course Content: Lectures & Readings

### Assignment 2: Paper Oral Presentation & Discussion (20%)

**Date:** Friday of weeks: 4-6, 8-12

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 10

Course Content: Lectures & Readings

### 3 Questions Per Discussion Paper (2.5%)

**Date:** Friday of weeks: 4-6, 8-12

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 10

Course Content: Lectures & Readings

### Assignment 3: Submission of complete draft 1 poster for Peer Review (5%)

**Date:** Thu, Mar 12

5% for the Peer Evaluation

### Peer Review of Poster Draft 1 (5%)

**Date:** Thu, Mar 19

**Learning Outcome:** 10

5% for Instructor evaluation of Peer Evaluation

### Assignment 3: Scientific Poster Project (25%)

**Date:** Thu, Apr 2

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 10

Course Content: Lectures & Readings

- Content 15%
- Structure 10%

Instructor Evaluation

### Final Exam (22.5%)

**Date:** TBA

**Learning Outcome:** 1, 2, 3, 4, 5, 6, 7, 10  
 Course Content: Lectures & Readings

### 6.3 In-Class Student Response System

We will be using a student response system that meshes with iClicker remotes, smart phones, tablets and laptops called iClicker Cloud in class in order to poll class knowledge and to generate interactions with students. Of course, this should NOT preclude you from asking questions anytime during any lecture.

### 6.4 Assignments

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

- Assignment 1: Is a **practical lab** on quantifying phenotypic variation in a real population and estimating selection on the phenotypic traits and writing a summary report (Friday labs in January). See instructions on CourseLink.
- Assignment 2: **Paper Oral Presentation and Discussion** in Friday's lab sections:
 

You will sign into a student group to present an oral summary and help lead a discussion of one of the eight primary research papers in your tutorial section over the term. Students will form groups of 2-3 and sign up for either the summary or critique part of the oral presentation. Student groups will then split up and members from each presenting group will lead a discussion of the paper in a discussion group (2 per tutorial). Note that oral presentations are expected to meet a 4<sup>th</sup> year level of presentation! See instructions on CourseLink.

All students are also expected to participate in weekly paper discussions. Provide 3 written questions that you have about each paper read to the instructor in tutorial. Use your questions to help motivate discussion in your group. Submitting questions and participation in discussion gets you an easy 2.5% of your final grade.

Instructions and materials for paper analysis and presentation are on the course website and also available on the Dept. of Integrative Biology website at: <https://www.uoguelph.ca/ib/academic-resources>
- Assignment 3: Perform a review of the primary scientific literature in order to analyse a potential example of human induced evolution in any natural system of your choice. You will then create a **scientific poster presenting** your analysis of the evidence for whether or not human activities may be driving trait evolution in a natural population. Your goal is to find and evaluate data to test the general



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. Focus on addressing the following questions:

What evidence is there that human activities are a source of selection?

What is the likely strength of selection?

What are the phenotypic targets (traits) of selection?

What is the evidence that phenotypic change has occurred in the population?

What is the evidence that any observed phenotypic change is evolutionary?

- Then try to identify and discuss any key uncertainties related to these questions, and how these uncertainties might be assessed in a future study.
- Include a minimum of six peer-reviewed scientific articles relevant to your project.
- Poster design will be discussed in lecture and materials will be provided on CourseLink. Other useful information about poster design can be found here: <https://www.uoguelph.ca/ib/academic-resources>
- This poster assignment has an additional **pre-submission peer-review process** of the first draft where you will be evaluated by three of your peers. 5% of your grade will be based on these peer reviews. You will also evaluate and provide feedback on randomly assigned draft versions of posters from three other students. Your review of these posters will be evaluated for an additional 5% by an instructor (ie., we will evaluate your reviews). There are two benefits to peer review: To give and get feedback that improves your final poster, and to see different ways to craft posters. First and final poster drafts will be submitted through PEAR, and the final poster version will be evaluated by instructors.

## 6.5 Final Exam

This is cumulative for the whole term and usually involves some multiple choice, short and longer answer questions. Note that short answer questions are often drawn from the assigned readings!

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## 7 Course Statements

## 7.1 Class Atmosphere

- The success of this course depends on mutual respect among students and instructors. It also depends on the participation of the instructors and students. Please bring your enthusiasm with you to class!
- The value of criticism during the peer reviews is to provide useful feedback that helps the person improve their understanding or product, so please focus your critiques on the understandings or products and never on the person.
- 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.
- Academic misconduct or personal harassment will not be tolerated and will be subject to University disciplinary procedures.
- If you are a SAS registered student that requires accommodation - PLEASE contact me so that we can discuss how I can help you succeed.

## 7.2 Grading

- **All assignments are due in class by the end of the period unless consideration is agreed to in advance of the deadline by the instructor. Late penalty is 10% per each additional 24 hr period starting at 12:01 AM, including weekends.**
- One exception to this rule is for the submission of draft posters and reviews of posters, where no late draft posters or reviews will be accepted in order to keep to schedule.
- Technology in the classroom: Feel free to bring your laptop to lectures, but only use it in a manner that will not disturb those around you. Please do not use your laptop for anything other than activities related to this biochemistry course. Turn your cell phones off, or put them on silent, and do not text-message during class.

## 7.3 When You Cannot Meet a Course Requirement

Consideration may be granted at the instructor's discretion. Please note that consideration for medical, compassionate or university-related conflicts (e.g., varsity sports) 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.

## 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/>

## 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 book their exams at least 7 days in advance and not later than the 40th Class Day.

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>

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