University of Guelph
College of Biological Science

Department of Integrative Biology

COURSE OUTLINE

Evolutionary Ecology (BIOL*4120)

Winter 2015

Course description

This course is about the process of adaptation. That is, the ways in which organisms have responded to the selective pressures imposed by their environment. We will address both theoretical and empirical issues in evolutionary ecology, but an emphasis will be placed on the process of scientific inquiry. 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.
Credit weighting: 0.5
Prerequisites: BIOL*3110 (Population ecology - discontinued; will accept BIOL*2060 Ecology or other Ecology course), BIOL*2400 (Evolution; replaced BIOL*3400 and ZOO*3300 Evolution - both discontinued).
Students are expected to enter having some background and experience in statistics.

Teaching team

Professor: Dr. Beren Robinson, Office - Scie 2455, berenrob@uoguelph.ca, ext. x58968
Office hours: TBA or by appointment.

Teaching assistant: Christopher Austin, Office Sci 1470, causti03@uoguelph.ca

Course schedule

Lectures: 11:30 AM - 12:30 PM, mondays, wednesdays and fridays,
Location: MacKinnon 117

Labs

- Tutorial Section 1: 12:30 - 1:30 PM, Fridays, Scie 1306
- Tutorial Section 2: 1:30 - 2:30 PM, Fridays, Scie 1306
- Tutorial Section 3: 2:30 - 3:30 PM, Fridays, Scie 1306

Learning Outcomes

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

Conceptual Goals

Students successfully completing this class 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.

Skills Goals

8. Quantify phenotypic variation in a sample in collaboration with others and use basic statistical methods to evaluate the nature of selection acting on the population.

9. Practice effective critical thinking about written and oral communication in tutorial discussions focused on analyzing primary scientific literature and creating a final research poster on applied evolution.

Course Resources

<u>Recommended readings</u>

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:

Bell, G. 2008. *Selection: The mechanism of evolution,* 2nd ed. Oxford University Press, New York.

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

Futuyma, D. J. 1986. *Evolutionary Biology*, 2nd edition. Sinauer Assoc. Inc., MA.

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

CourseLink

Biol*4120 will make use of the UoG course website on D2L (via 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.

Undergraduate Calendar

Undergraduate Calendar is the source of all information about UoG procedures, policies and regulations.

Course Content

This course has both lecture and tutorial components. The lecture period (Mon. & Wed.) 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.

General lecture schedule

Mon	Wed	Fri
Jan 5 Introduction –	**Jan 7** What is an adaptation?	**Jan 9** Asking evolutionary questions. Hypotheses and predictions **Practical Lab 1:** Bythos background, develop hypotheses
Jan 12 Fitness	**Jan 14** Discuss Practical Lab Hypotheses in Class	**Jan 16** Fitness **Practical Lab 2:** Measure Traits; **Submit data**

Mon	Wed	Fri
Jan 19 Fitness	**Jan 21** Natural Selection	**Jan 23** Natural Selection **Practical Lab 3:** Analyze – Measure selection on Bythos
Jan 26 Natural Selection	**Jan 28** Natural Selection	**Jan 30** **No lecture** **Final assignment for practical lab due** **Tutorial:** Losos et al. 2004
Feb 2 Quantitative Genetics	**Feb 4** Quantitative Genetics Breeders Equation	**Feb 6** Levels of Selection **Tutorial:** Freeman & Byers 2006
Feb 9 Phenotypic plasticity	**Feb 11** Genetic Correlations Maternal Effects	**Feb 13** **Applied evolution poster introduction** **Tutorial:** Nussey et al. 2005
Feb 16 – winter break (no classes)	**Feb 18 – winter break (no classes)**	**Feb 20 – winter break (no classes)**
Feb 23 Maternal Effects	**Feb 25** Measuring Evolution	**Feb 27** **No Lecture** **Tutorial:** Schluter 1994
Mar 2 Fst/Qst Rates of Evolution	**Mar 4** Comparative Method	**Mar 6** **Poster draft due** **No Lecture** **Tutorial:** Coltman et al. 2003
Mar 9 Life History Evolution	**Mar 11** Life History Evolution	**Mar 13** **Poster peer-review due** **No Lecture** **Tutorial:** Reznick et al. 1997
Mar 16 Evolutionary Conflict	**Mar 18** Evolutionary Conflict	**Mar 20** **No Lecture** **Tutorial:** Holland & Rice 1999

Mon	Wed	Fri
Mar 23 Coevolution	**Mar 25 Peer review due** Coevolution	**Mar 27** **No Lecture** **Tutorial:** Brodie et al. 2002
Mar 30 Final Lecture	**Apr 1** Q and A **Apr 2 Poster due**	**April 3** **Good Friday**

Methods of Assessment

Form of Assessment	Weight of Assessment	Due Date	Course Content / Activity	Learning Outcomes Addressed
Assignment 1:	15%			1, 2, 3, 5
Practical lab				
Data complete	2%	Jan. 16	Lectures, Readings	8
Write up	13%	Jan. 30		9
Paper Discussion	20%	Friday of wks: 4-6, 8-12	Lectures, Readings	1-7, 9
Paper review	10%	Friday of wks: 4-6, 8-12	Lectures, Readings	1-7, 9
Assignment 2:	25%	April. 2	Lectures, Readings	1-7, 9
Peer review	5%	Mar. 13		
Poster structure	5%			
Poster content	15%			
Final Exam	30%	April. 9	Lectures, Readings	1-7, 9

Assignments:

There are two assignments that will occur over multiple weeks in each half of the term. Details will be presented in class and on the course website. Assignments are to be performed and reported as your individual work.

Assignment 1: Is a practical lab on measuring phenotypic variation in a real population and estimating selection on the phenotypic traits and writing a summary report.

Assignment 2: Is your chance to research and discuss a topic on applied evolution of your choice. You will research, design and present a poster on how humans may impose selection (intentionally or unintentionally) that may drive the evolution of other organisms to our benefit or cost. You will provide and evaluate the evidence for human-induced evolution identifying any key uncertainties in our understanding of your chosen system. Posters should focus on the strengths and weaknesses in our understanding and must derive from a minimum of six peer-reviewed articles from the primary scientific literature on your topic.

The poster assignment will also have a pre-submission peer-review process where you will offer

feedback on two randomly assigned draft versions of posters. The intent of the peer review is to help you give and get feedback that improves your final poster presentation.

Paper Discussion and Reviews:
You will be leading a discussion of one of the eight primary research papers that will be discussed in your tutorial section over the term. Students will form groups of two and sign up for either the summary or critique part of the discussion. All four students will jointly lead the tutorial discussion on their paper.

You will also write one review report of any of the seven remaining primary research papers discussed in the course tutorials (other than the paper you present).

Instructions and materials for paper discussion and reviews will be on the course website.

Final exam:
Will be cumulative for the whole term.

Class Atmosphere:
As with any scholarly communication, the success of this course depends on mutual respect and trust among students and instructors. Any form of academic misconduct or personal harassment will not be tolerated and will be subject to University disciplinary procedures. The point of criticism is to provide useful feedback that helps the person improve their understanding or product. Please focus your critiques on the understandings or products and never on the person.

Important Due Dates

- Jan. 16: Bytho data due (Assignment 1)
- Jan. 19: Deadline to sign up for paper discussion schedule
- Jan. 30: Bytho write-up due (Assignment 1)
- Feb 16-20: Winter break
- March 6: 40th day of classes (course drop deadline)
- Poster draft version due (Assignment 2 for peer review)
- March 13: Poster peer reviews due (Assignment 2)
- April 2: Final poster due (Assignment 2)
- April 9: Final exam

Paper critique: you decide which paper to critique but your critique is due **prior to the start of your tutorial section** in that week.

Course and University Policies

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.

University Policies

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, and be prepared to provide supporting documentation. See the undergraduate calendar for information on regulations and procedures for Academic Consideration: Undergraduate Calendar - Academic Consideration

Consideration may be granted at the instructors 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 generally more likely when the student proactively advises the instructor of issues well in advance of deadlines.

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services - SAS (formerly: Centre for Students with Disabilities - CSD) as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: Centre for Students with Disabilities

Academic Misconduct

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 discourages misconduct. 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.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:
Undergraduate Calendar - Academic Misconduct

E-mail Communication

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

Drop Date

The last date to drop one-semester courses, without academic penalty, is the 40th class day. To confirm the actual date please see the schedule of dates in the Undergraduate Calendar. For regulations and procedures for Dropping Courses, see the Undergraduate Calendar:
Undergraduate Calendar - Dropping Courses

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.

Recording of Materials

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

Campus Resources

The Academic Calendar is the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:
Academic Calendars

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

If you are struggling to succeed academically:

- 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. The Learning Commons

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. Counselling Services
- Student Health Services is located on campus and is available to provide medical attention. Student Health Services
- 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. Stress Management and High Performance Clinic

If you have a documented disability or think you may have a disability:

- The Centre for Students with Disabilities (CSD) can provide services and support for students with a documented learning or physical disability. They can also provide information about how to be tested for a learning disability. For more information, including how to register with the centre please see: Centre for Students with Disabilities