BIOL*2400 Evolution

Fall 2019
Section(s): C01

Department of Integrative Biology
Credit Weight: 0.50
Version 3.00 - September 04, 2019

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1 Course Details

1.1 Calendar Description

This course provides a broad overview of evolutionary biology. It examines the concepts and mechanisms that explain evolutionary change and the evolution of biological diversity at different levels of biological organization (gene to ecosystem) and across space and time. It also introduces historical forms of scientific inquiry, unique to biology. The course is designed to be of interest to students with general interests in science and in research in all areas of biology.

Pre-Requisites: BIOL*1070, BIOL*1090

1.2 Timetable

Lectures: Monday/Wednesday/Friday, 9:30-10:20am WMEM (First class is **Friday September 6th**)

Tutorial sessions: Fridays in the Summerlee Science Complex. Check webadvisor for your tutorial time and tutorial room. **Check Courselink to find your assigned group** before our first tutorial on **Friday September 13th.** Teaching assistants will run weekly tutorial help sessions to assist you with group assignments: 1) "Phylogeny assignment", 2) “Population genetics assignment, and 3) “Quantitative genetics assignment”. Attendance is mandatory. In addition, teaching assistants will run review sessions on topics such as: “Study skills and note taking” and “How to answer short answer questions on an exam”, "How to organize your draft essay", "When to cite "in text" references for your term essay.

1.3 Final Exam

Final exam time and location are subject to change. Please see WebAdvisor for the latest information from the registrar's office.

2 Instructional Support

2.1 Instructional Support Team

Instructor:	Professor Elizabeth G. Boulding Ph.D.
Email:	boulding@uoguelph.ca
Telephone:	+1-519-824-4120 x54961
Office:	SC1 1464
Office Hours:	Friday at 13:30 - 15:30 or by appointment
Course Co-ordinator:	Dr. Colin DeMill
Email:	cdemill@uoguelph.ca
Telephone:	519-824-4120 x56557
Office:	SSC 2505
Office Hours:	By appointment.

3 Learning Resources

3.1 Required Resources

Lecture (Readings)

The purposes of lectures are to motivate your interest and curiosity in the topic of evolution while supporting you in your learning of fundamental topics, concepts and methods in evolutionary biology. You will be expected to supplement your learning through readings from the course textbook and the primary literature as indicated by the instructor. You will be advised in advance if you are expected to complete any readings prior to lecture.

Readings (Textbook)

https://carlzimmer.com/books/evolution-making-sense-of-life/

Textbook and primary literature readings are assigned. The textbook for the course is Evolution: Making Sense of Life (3rd edition) by C. Zimmer and D. Emlen (ISBN: 9781319079864) and is on reserve in the main library or available for purchase at the University and Coop bookstores. Major concepts from the required readings from the textbook will be tested on the midterm and final exams. You may choose to use an earlier edition of this textbook.

Courselink (Website)

https://courselink.uoguelph.ca

Most Powerpoint slides from lecture and other course materials will be posted here. (Note that these are only the Powerpoint slides that illustrate the lectures. To be successful on

the exams, you will need to take your own notes as you will be tested on what the lecturer says in class). The Courselink site will be used: for instructions and hints on the Term Assignment, to ask the Professor about course material, to ask the Course Coordinator about logistics, to communicate with the class on class Discussion forums about new discoveries in Evolutionary Biology and to communicate with the other students in your tutorial group in your private group Discussion topic.

Tutorial Assignments, Worksheets, and Discussions (Other)

The purpose of the tutorials is to engage your participation in solving evolutionary problems with your colleagues. Teaching assistants will support your completion of group assignments and your individual critique assignment. They will assist you in developing study skills and help improve your scientific writing. You may find that discussion of course concepts outside of tutorial with your group members enhances your learning and overall experience in BIOL2400. Tutorial Material will be covered on the Midterm and Final examinations.

iClicker Cloud (or other in class electronic assessment tool) (Software)

https://www.iclicker.com/students

To facilitate discussion and to enhance your learning in and out of class, we will be using educational software called iClicker Cloud which allows for students to participate using mobile devices and laptops by default.

The software allows you to answer questions and engage in discussion using your smartphone, tablet or laptop or an iClicker 2 remote. You will either need to purchase the iClicker Cloud app or register an iClicker remote that you already own following the instructions at the URL above for this class "Evolution Fall 2019'. *Please be certain to use your University of Guelph email and your University of Guelph students number so that your iClicker grades can be uploaded to Courselink. We will practice using iClicker Cloud in class on September 9 -13 before the graded questions/participation exercises begin on September 16th.

3.2 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:
https://www.uoguelph.ca/registrar/calendars/undergraduate

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

- make an appointment with a program counsellor in your degree program. http://www.bsc.uoguelph.ca/index.shtml or https://www.uoguelph.ca/uaic/programcounsellors

If you are struggling to succeed academically:

- There are numerous academic resources offered by the Learning Commons including, the Writing Centre, 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/

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.uoguelph.ca/~ksomers/

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

- The Student Accessibility Services (SAS) 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: https://www.uoguelph.ca/sas/

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4 Learning Outcomes

4.1 Learning Outcomes

By the end of the course students will understand the major theories and hypotheses that have been proposed to explain the generation of biodiversity at all levels of biological organization and methods that can be used to test them. This will include:

Learning goals and rationale

(1) Conceptual skills:

(a) Differentiate Darwin's original theory from evolutionary theory after the "Modern Synthesis".
(b) Accurately define and describe terms and concepts such as evolution, adaptation and fitness.
(c) Explain simple methods of phylogenetic tree estimation and interpretation.
(d) Explain basic mechanisms of evolutionary change at the genetic, molecular and phenotypic levels.
(e) Identify, differentiate, analyze and give examples of processes such as sexual selection, life-history evolution, and co-evolution.
(f) Identify species concepts and explain common mechanisms of speciation.
(g) Understand the geological time scale and be able to identify periods of mass extinction and periods of adaptive radiations.

(2) Inquiry skills:

(a) Estimate a phylogenetic tree using the cladistic approach and apply the comparative method to explain character evolution.
(b) Elementary practice with interpretation of simple population genetic and quantitative genetic models in the context of hypothesis testing.

(3) Basic skills:

(a) Comprehend scientific and criticize popular material on Evolution.
(b) Acquisition, filtering, and synthesis of scientific concepts, facts and methods.
(c) Applied numeracy.
(d) Communicate scientific ideas about evolution.

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5 Teaching and Learning Activities

5.1 Lecture

Topics: **Topic 1**

Review of key Evolutionary concepts. Brief history of the Darwin's original Theory of Evolution. The Modern Synthesis of the Theory of Evolution.

Assigned Readings: Ch. 1: The Virus and the Whale: How Scientists Study Evolution (pages 2-15, 22-24)

Ch. 2: Biology: From Natural Philosophy to Darwin pages 39- 48 including Box 2.2.

Ch. 5 Box 5.2 only pages 149-150 (Mendel) Genetics in the Garden

Suggested Readings: pages 16-22, pages 28-38

Topics:

Topic 2

Estimation of Phylogenies: Who gave you AIDs: Your Lover or your Dentist?

Assigned Readings: Ch. 4: The Tree of Life: How Biologists Use Phylogeny to Reconstruct the Deep Past (pages 92-125 EXCEPT for Box 4.1 which contain material that will be covered in upper level Evolution courses).

Suggested Readings: Chapter 9, Molecular Phylogeny Methodology (pages 274-284)

Topics:

Topic 3

Population Genetics: Drift, Migration and Selection.

Assigned Readings: Ch. 5: Raw Material: Heritable Variation among Individuals (Mutation) pages 145-152

Ch. 6: The Ways of Change: Drift and Selection pages 158-177, 184-186, 187- 192 including Boxes 6.2-6.4 but NOT Boxes 6.1, 6.5-6.7.

Topics: **Topic 4**

Quantitative Genetics

Assigned Readings: Ch. 7: Beyond Alleles: Quantitative Genetics and the Evolution of Phenotypes pages 202-216 (but NOT Boxes 7.1-7.2)

Ch. 8: Natural Selection: Empirical Studies in the Wild pages 230-240

Topics: **Topic 5**

Evolution of Sex, Sexual Selection

Assigned Readings: Ch. 11: Sexual selection pages 352-365, Pages 353-381

Topics: **Topic 6**

Geographical Speciation and Sympatric Speciation: Going your Own Way versus Quantum Leaps

Assigned Readings: Ch. 13: The Origin of Species pages 412- 449 EXCEPT Box 13.1

Topics: **Topic 7**

Hopeful Monsters: Development and evolution: Ontogeny recapitulates phylogeny? Heterochrony, and Hox genes

Assigned Readings: Ch. 10: Adaptation from Genes to Traits pages 302-7: Cascades of Genes

Topics: **Topic 8**

Evolution of biodiversity: The Cambrian explosion, the extinction of the dinosaurs and the rise of the mammals

Assigned Readings: Ch. 3: What the Rocks Say: How Geology and Paleontology Reveal the History of Life pages 50-68, 76-91

Topics: **Topic 9**

The Day the Dinosaurs Died: Would humans have evolved without meteorites and Mass Extinctions?

Assigned Readings: Ch. 14: Macroevolution: The Long Run pages 465-469; Adaptive radiations (pages 478-480); K-T boundary in Big Five Mass Extinctions

Topics: **Topic 10**

Human evolutionary divergence from other primates

Assigned Readings: Ch. 17: Human Evolution: A New Kind of Ape including pages 572-575; The emergence of Homo, Parallel Humans and New Discoveries from Ancient Genes pages 588-600.

5.2 Seminar

Thu, Sep 13 - Thu, Nov 22

Topics:	Discussion of course content, completion of group assignments and support with writing the article critique. Note, tutorials will run every Friday beginning on September 13th except for October 11th.
References:	See Web Advisor for your tutorial time and location and Courselink for your group members

5.3 Note

You can be tested on material in assigned readings from the textbook even if the material is not covered in lecture. Usually such material will be straightforward descriptive examples illustrating major course concepts. You will not be tested directly on recommended readings but they will help you understand the lecture material. One copy of the textbook and other supplementary readings as assigned during lectures will be available under our course number at the reserve desk in the library or on Courselink.

5.4 Important Dates

Sept 6th	First Class
Sept 13th	First Tutorial
Sept. 20th	Tutorial group assignment 1 due (phylogeny)
Oct 4th	Midterm #1 in regular classroom (no tutorial)
Oct. 11th	No Tutorial
Oct. 14th	Thanksgiving holiday, no class
Oct. 18th	Tutorial group assignment 2 due (Population genetics)
Nov. 1st	Tutorial group assignment 3 due (Quantitative genetics)
Nov 8th	Midterm #2 in regular classroom (no tutorial)

Nov. 11th Remembrance Day, no class

Nov. 13th Draft of popular article critique due

Nov. 20th Peer review of another student's popular article critique due

Nov. 27th Final popular article critique due

Nov. 29th Last Class - review of topics for final exam (final drop date)

TBA Final Exam - see online schedule

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6 Assessments

6.1 Assessment Details

iClicker Cloud (4%)
Every Lecture beginning with lecture 5

Course Content/Activity: Lecture, readings

Learning Outcome(s) Addressed: Conceptual Skills

Phylogeny Assignment (2%)
Due: Fri, Sep 20
Due online to group's Dropbox

Course Content/Activity: Tutorial Group

Learning Outcome(s) Addressed: Conceptual and quantitative skills

Midterm 1 (25%)
Date: Fri, Oct 4, In-class
Note: Each student's higher grade in the two in-class midterms will be worth 25%, while their lower midterm grade will be worth 15% of their final grade.

Course Content/Activity: Lecture, readings

Population genetics assignment (2%)
Due: Fri, Oct 18
Due online to group's Dropbox

Course Content/Activity: Tutorial Group

Learning Outcome(s) Addressed: Conceptual and quantitative skills

Quantitative genetics assignment (2%)
Due: Fri, Nov 1
Due online to group's Dropbox

Course Content/Activity: Tutorial Group

Learning Outcome(s) Addressed: Conceptual and quantitative skills

Midterm 2 (15%)
Date: Fri, Nov 8
Note: Each student's higher grade in the midterms will be worth 25%, while their lower midterm grade will be worth 15% of their final grade.

Course Content/Activity: Lecture, readings

Popular article critique draft (1%)
Due: Wed, Nov 13
Due online to PEAR website

Course Content/Activity: Lecture, textbook

Learning Outcome(s) Addressed: Critical and communication skills

Peer review of popular article (3%)
Due: Wed, Nov 20
Due online to PEAR website

Course Content/Activity: Lecture, textbook

Learning Outcome(s) Addressed: Critical and communication skills

Group Evaluation (1%)
Date: Fri, Nov 22
Evaluate the contribution and participation of group members on assignments. Due online to PEAR website at 11pm, Nov. 22nd.

Course Content/Activity: Lecture, textbook

Learning Outcome(s) Addressed: Critical and communication skills

Popular article critique final version (15%)
Due: Wed, Nov 27
Due online to PEAR website

Course Content/Activity: Lecture, textbook

Learning Outcome(s) Addressed: Conceptual, inquiry, critical and communication skills

Final Exam (30%)
Exam time and location TBD. Please see WebAdvisor for the latest information.

Course Content/Activity: Lecture, readings, group assignments

Learning Outcome(s) Addressed: Conceptual, inquiry and basic skills

6.2 Note

iClicker Cloud (or other in class electronic assessment tool): 4% of your final grade will be based on your graded responses as well as on your participation based on questions presented using Power Point by the Instructor during our lecture period. Those students achieving 70% or greater on their term will be awarded 100% for this section of the course so that you will not be penalized for illness or occasional absences from class.

Midterm Exams: The two midterm exams will take place in class during the regular lecture period for that day. The midterms exams will include material covered in lecture, in the tutorial assignments, and in the assigned readings. Since the material presented in the class will be integrated, all exams will be comprehensive. Each student's higher midterm grade will be worth 25% of their final grade, while their lower midterm grade will be worth 15%.

Group Assignments: Students will work in groups of 4 or 5 during their registered Friday tutorial period to complete assignments designed to reinforce concepts presented in lecture. Your group will have two tutorial periods to complete each assignment. Each group will submit ONE copy of the assignment to their designated group Dropbox by 11pm on the due date. Late submissions will be subject to a 10% deduction per day. Group members will evaluate each other's participation in group assignments.

Individual Article Critique: The draft, peer review and final critique associated with this assignment are due by 11pm on the due date. Please see the Instructions for this assignment for further details regarding late penalties.

Final Exam: The final exam will cover all material from the course and will take place during the regular examination period. The final exam will cover all lectures and assigned readings, including the ones before the midterm.

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7 Course Statements

7.1 Group Work

Within each tutorial section, you will be randomly assigned to a group of 4 or 5 students. You are expected to maintain a collegial atmosphere during the tutorial sessions while you will work together as a team on tutorial assignments and course material. Your group will have your own discussion board to enable communication outside of tutorial time. Your group will also have a Courselink dropbox folder for submission of group assignments.

7.2 Grading Policies

Midterms

- Midterm exams will be held during normal lecture hours. These exams will consist of multiple choice and short answer questions that focus on concepts and skills related to lecture content. Sample questions will be discussed in tutorial.

Tutorial Group Assignments

- You will complete 3 group assignments that reinforce content presented in lecture
- Tutorial assignments 1-3 (phylogeny, population genetics, quantitative genetics) will be submitted by groups (one copy) to the Dropbox specifically created for each group.
- These assignments are due to the group dropbox by 11pm on the due date.
- Late submissions will be subject to a 10% late penalty per day.
- Turnitin will be used as an originality checker.
- Group members will evaluate each other's participation in group assignments.

Individual Article Critique

- This assignment will be completed and submitted individually by students.
- This assignment has 3 components: Draft, Peer Review, and Final Version each due at 11pm on their corresponding due date.
- Late penalties will apply for late submissions as follows:

  The late penalty associated the draft is 10% per day. If your draft is more than one day late, you will not be able to participate in the peer review

process and thus not earn a mark for this portion of the assignment. The late penalty associated with the Peer Review and Final Draft is 10% per day.

- Turnitin will be used as an originality checker.

Final Exam

- The final exam will be held outside of class during the normal final exam period. This 2 hour exam will consist of multiple choice and short answer questions that cover material presented throughout the course. Sample questions will be discussed in tutorial.

7.3 Discussion Board and Email

The discussion board and associated forums will be monitored by the instructor, course coordinator, and by the TAs. You can expect a response within 48 hours, however, the discussion board forums will not be monitored in the evening or on weekends.

This same policy applies to emails sent to the instructor, course coordinator, or TAs.

Note, your private group discussion board, while not visible to your colleagues outside of your group, is visible to the teaching team.

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

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.

More information can be found on the SAS website
https://www.uoguelph.ca/sas

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