

**University of Guelph
College of Biological Science
Department of Integrative Biology**

COURSE OUTLINE

ZOO*3700 INTEGRATIVE BIOLOGY OF INVERTEBRATES

FALL 2016

TEACHING TEAM

PROFESSOR Dr. Andreas Heyland
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LAB INSTRUCTOR Sheri Hincks
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LECTURES 9:30-10:20 Monday MCLN 102
9:30-10:20 Wednesday MCLN 102
9:30-10:20 Friday MCLN 102

LABS 14:30-17:20 Tuesday Room 2314 Science Complex
10:30-13:20 Wednesday Room 2314 Science Complex
14:30-17:20 Wednesday Room 2314 Science Complex

COURSE DESCRIPTION

This course explores variation in physiology, reproduction and life history among invertebrates, and the role of invertebrates in marine, freshwater and terrestrial ecosystems. Through field experiences, lab study and a class experiment, we will examine the diverse solutions that invertebrates have evolved to live in very different environments, including: circulation and gas exchange; feeding and digestion; osmoregulation and excretion, nervous system and sensory structures; locomotion and biomechanics, and invertebrate communities.

Credit: 0.5

Prerequisite: ZOO*2700

LEARNING GOALS AND RATIONALE

In the prerequisite for this course, ZOO*2700, you learned about the unity and diversity of invertebrate taxa in an evolutionary context. In this course, you will explore a variety of functional and ecological concepts that will illuminate the biology of invertebrates in far greater depth. The course is organized around a series of major biotic and abiotic “challenges” that invertebrates face and how they overcome these challenges. This course will help you build a solid foundation of knowledge of invertebrate diversity, ecology, and function that you will build upon in higher-level courses. You will also have the opportunity to develop critical skills such as scientific writing, oral presentations, critical reading of primary literature, and methods of scientific inquiry.

LEARNING OUTCOMES

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

1. Differentiate major patterns in how invertebrates carry out critical functions such as:
 - Gas exchange and circulation
 - Water regulation, ion regulation, and excretion
 - Nutrition and digestion
 - Sensing and responding to the environment
 - Interacting with the physical environment and locomotion
 - Reproduction and development
 - Finding food and avoiding predators and parasites
2. Discuss the mechanisms that led to the diversity of these patterns, including the process of natural selection.
3. Identify the ecological roles played by key groups of invertebrates
4. Identify and classify invertebrates using practical skills.
5. Prepare and communicate scientific ideas, including:
 - Scientific writing
 - Oral communication
6. Formulate research questions by practicing the process of biological inquiry using the scientific method including testing predictions of falsifiable hypotheses.

COURSE RESOURCES

Required Textbook

E. E. Ruppert, R. S. Fox, and R. D. Barnes *Invertebrate Zoology: A Functional Evolutionary Approach*, 7th ed. Thomson.

Useful and on reserve

R.C. Brusca and G.J. Brusca. *Invertebrates*, 2nd ed. Sinauer.

R.S.K. Barnes, P. Calow, P.J.W. Olive, D.W. Golding, and J.I. Spicer. *The Invertebrates: A Synthesis*, 3rd ed. Blackwell Science.

Lab Manual

ZOO*3700 Invertebrate Zoology Laboratory Manual – You must purchase this prior to the beginning of lab 1. Details will be made available week 1.

Dissecting Kit - available from the University Bookstore

Bound lab notebook - available from the University bookstore.

Courselink

This course will make use of the University of Guelph's course website on D2L (via Courselink). Consequently, you are responsible for all information posted on the Courselink page for ZOO*3700. Please check it regularly.

Undergraduate Calendar

This is the source of information about the University of Guelph's procedures, policies and regulations, which apply to undergraduate programs. It can be found at <http://www.uoguelph.ca/registrar/calendars/undergraduat/current/>

COURSE CONTENT

The lab and lecture components of this course are inseparable and it will be very difficult for you to succeed in this course if you neglect either of them. We will post a skeletal outline of lectures the night before they are given. These are by no means a substitute for taking notes, rather they should be used as a way of preparing for the lectures in concert with the appropriate material in the textbook. We will also post a list of "Study Questions" on our course D2L site that will give you examples of the kinds of questions you should be able to answer after that lecture. We also expect you to come prepared to the lab sessions. Please read the lab outline prior to that week's lab and bring your dissection kit each week.

Week	Date (week of)	Lecture Topic	Lab Topic
	Sep 5	Course overview	
1	Sep 12	Review of invertebrate evolution and taxa Marine and planktonic invertebrates	Plankton, marine invertebrates I
2	Sep 19	Terrestrial invertebrates Surface area to volume ratios Energetics and metabolism	Terrestrial invertebrates
3	Sep 26	Gas exchange Circulation	Gas exchange
4	Oct 3	Excretion Osmoregulation Ionoregulation	Class Experiment
5	Oct 10 (Thanksgiving/ Study Break)	Feeding and digestion	NO LABS THIS WEEK
6	Oct 17	Sensing and responding Midterm Lecture Exam Oct 21	Class Experiment
7	Oct 24	Adaptation to the physical environment	Nutrition and Digestion
8	Oct 31	Locomotion	Sensing and responding to the environment
9	Nov 7	Insect Physiology I	Biomaterials, biomechanics, and locomotion
10	Nov 14	Insect Physiology II	LAB FINAL
11	Nov 21	Coevolution Predator-prey interactions	NO LABS THIS WEEK
12	Nov 28	Symbioses Bio-Inspired Design	Oral Presentations

Some labs will take place outside of the Science Complex at both the University of Guelph Arboretum and the Aqualab (or other locations). Students must dress appropriately and must review the field safety protocols outlined in the lab manual before engaging in these activities.

A Note on Evolution and Phylogenies

The most important unifying theme of this course and ZOO*2700 is that the diversity and unity of invertebrates can best be explained by the theory of **Evolution by Natural Selection**. It is therefore critical that you understand this process. There has been great progress made even in the last ten years in elucidating the structure of the tree of life, and we will use the most recent phylogenies available for this course. This phylogeny conflicts in places with trees presented in your textbook, and in these cases, the phylogeny presented in lecture will take precedence. You should be aware that biologists are always collecting more and more phylogenetic data and carrying out more sophisticated analyses, so even this up-to-date tree will likely change in your lifetimes.

Laboratory Notebooks

Each of you should maintain your own Lab Notebook. It will serve as a written record of everything you do in the lab and will include observations, data sheets, drawings, questions, insights, ponderings, and aha moments. It will serve as an invaluable study tool for exams. Your lab notebook will NOT be graded.

METHODS OF ASSESSMENT

Final marks will be calculated from seven assessments. In all cases, students will be expected to write using complete sentences and proper grammar. ***All students are expected to complete and submit work individually unless otherwise stated.***

Assignment 1 Students will work individually to prepare a blog post about an invertebrate from aqualab or from the arboretum. Details will be provided in lab.

The **Lab Report** will consist of a formal write-up of an experiment that we will plan and carry out together as a class. We have reserved two full weeks of lab for the execution of your experiment. The assignment consists of several components including a first draft, final draft and peer review. Students will work in pairs to submit the first draft and final report. Students will complete the peer review individually.

Students will work in groups of 2 or 3 to prepare an **Oral Presentation** on a recent paper in the scientific literature on invertebrates. Presentations can take the form of a video presentation or an oral presentation during lab.

Six **Weekly lab handouts** will be given throughout the semester and will be worth a total of 5%. Students will complete and submit these handouts with their lab group (maximum 4 students per group) during the lab period. There may be some individual components each week. They

will be collected and graded in lab and students **MUST** be present during the marking of these activities in order to receive a grade. **NO** make-up handouts/ quizzes will be given. We will count your top 5 of 6 handouts/ quizzes in your final grade.

The **Midterm** exam will cover lecture content only and will take place in lecture.

The **Lab Final** exam will cover only lab material and will be written in the laboratory.

The **Final Exam** will be written as a formal exam and will cover lecture material. The exam may consist of multiple choice questions, short answer, and longer essay questions.

Assessment standards for this course follow the definitions given in the 2016-2017 Undergraduate Calendar

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-grds-proc.shtml>

ASSESSMENT	% OF FINAL GRADE	DATE	LEARNING OUTCOME ADDRESSED
Assignment 1: BLOG	5	Oct. 3 (by 11:59 pm) ONLINE	3, 5, 6
Lab Report First Draft (50%) Peer Review (20%) Final Copy (30%)	20	Oct 28 Nov 4 Nov 11	5
Midterm Lecture Exam	20	Oct 21 IN LECTURE	1,2,3,5,6
Weekly Lab Handouts (6)	5	Week of Sep 12, 19, Oct 3, 24, Nov 2, 9	1,2,3,4
Lab Final Exam	15	Nov 17/ 18 IN LAB	1,2,3,4
Oral/ Video Presentation	10	Nov. 29, 30 IN LAB	5
Final Exam	25	TBD	1,2,3,5,6

OTHER IMPORTANT DATES

September 8

First Lecture

September 13, 14

First Labs

Monday, October 10

- Holiday--NO CLASSES SCHEDULED -- classes rescheduled to Friday, Dec 4

Tuesday, October 11

- Fall Study Break Day - NO CLASSES SCHEDULED -- classes rescheduled to Thursday, Dec 3

Friday, Nov 4

- Fortieth class day--Last day to drop one-semester courses

COURSE AND UNIVERSITY POLICIES

LATE POLICY

Assignment 1: Work that is handed in late will be penalized 25% for every day that it is late.

Lab Report: Work that is handed in late will be penalized 25% for every day that it is late. If your first draft is submitted late, it will not be reviewed.

Weekly Lab Handout/ Quiz: Students must write these during their scheduled lab period. **NO** make-up handouts/ quizzes will be given. Students will receive a 0 for incomplete weekly assignments.

ABSENCE AND ILLNESS

If you are absent from classes and/or labs during the semester, you will be expected to make up missed lecture and laboratory material on your own.

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:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

When, for legitimate reasons, any assignments are missed, make sure that you have both given the instructor supporting documentation and obtained a written statement of your revised grade evaluation from the instructor.

If you miss an assessed item for medical or other authorized reasons, you will not be given a new assignment, but will have your final mark based on a proportionate adjustment of completed term work.

USE OF ANIMALS

This course uses selected invertebrates for dissection. The University is committed to principles of conducting research and teaching in accord with the highest ethical standards. Given that the use of animals, in research and teaching, is a critical aspect of the work of the University of Guelph, the Department of Integrative Biology is committed to minimizing the use, pain, and suffering of animals used for teaching and to ensuring that animals which are used will receive care and treatment that meets or exceeds the standards outlined by provincial guidelines and statutes, and by the Guidelines of the Canadian Council on Animal Care. For more information

http://www.uoguelph.ca/research/assets/acs/docs/university_animal_care_policy_and_procedures.pdf

EXAM POLICY

For more information about exam scheduling and conflicts, please consult the undergraduate calendar

<http://www.uoguelph.ca/registrar/undergraduate/index.cfm?exams>

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 Centre for Students with Disabilities as soon as possible. For more information, contact CSD at 519-824-4120 ext. 56208 or email

csd@uoguelph.ca or see the website: <http://www.csd.uoguelph.ca/csd/>

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:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

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: <http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

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:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>

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>
<https://www.uoguelph.ca/uaic/programcounsellors>

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.
<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 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: <https://www.uoguelph.ca/csd/>