University of Guelph
College of Biological Science
Department of Integrative Biology

COURSE OUTLINE
Integrative Biology of Invertebrates, ZOO*3700
Fall 2017

This outline is preliminary and is subject to change up to the first day of classes.

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

Teaching team

PROFESSOR: Dr. Teresa Crease,
SSC 1455, x52723
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office hours by appointment.

LAB INSTRUCTOR: Sheri Hincks
SSC 3509, x56010
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TEACHING ASSISTANTS: TBA

Course schedule

Lectures: 9.30 to 10.20 AM Monday, Wednesday, Friday, ALEX 100

Labs: 2.30 to 5.20 PM, Tuesday, SSC 2314

10.30 AM to 1.20 PM, Wednesday, SSC 2314

2.30 to 5.20 PM, Wednesday, SSC 2314

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 by which 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

Brusca RC, Moore W, Shuster SM. Invertebrates, 3rd ed. Sinauer. (new for 2017)

Useful and on reserve

Ruppert EE, Fox RS, Barnes RD. Invertebrate Zoology: A Functional Evolutionary Approach, 7th ed. Thomson.

Barnes RSK, Calow P, Olive PJW, Golding DW, Spicer JI. 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

The Undergraduate Calendar is is the source of information about the University of Guelph's procedures, policies and regulations, which can be found at:

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 Courselink 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.

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.

Week	**Date** (week of)	**Lecture Topic**	**Lab Topic**
	Sep 4	Course overview	
1	Sep 11	Review of invertebrate evolution and taxa. Marine and planktonic invertebrates.	1. Plankton, marine invertebrates 1
2	Sep 18	Terrestrial invertebrates Surface area to volume ratios Energetics and metabolism	2. Terrestrial invertebrates
3	Sep 25	Gas exchange Circulation	3. Gas Exchange **Lab Exam 1**
4	Oct 2	Excretion Osmoregulation Ionoregulation	Class Experiment
5	Oct 9 Thanksgiving study break	Feeding and digestion	NO LABS THIS WEEK
6	Oct 16	Sensing and responding **Midterm Lecture Exam Oct 20**	Class Experiment
7	Oct 23	Adaptation to the physical environment	4. Nutrition and digestion
8	Oct 30	Locomotion	5. Sensing and responding to the environment
9	Nov 6	Insect Physiology I	6. Biomaterials, biomechanics, and locomotion
10	Nov 13	Insect Physiology II	**LAB Exam 2**
11	Nov 20	Coevolution Predator-prey interactions	NO LABS THIS WEEK
12	Nov 27	Symbioses Bio-Inspired Design	Oral presentations

Methods of assessment

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.**

Form of Assessment	Value (%)	Date	Learning outcome addressed
Lab Report first draft (50%) peer review (20%) final copy (30%)	20	ONLINE by 11:00 PM Oct 27 Nov 3 Nov 10	5
Midterm lecture exam	20	Oct 20 IN LECTURE	1, 2, 3, 5, 6
Lab Exam 1	10	Sept. 26, 27 IN LAB	1, 2, 3, 4
Lab Exam 2	15	Nov 14, 15 IN LAB	1, 2, 3, 4
Oral/video presentation	10	Nov. 28, 29 IN LAB	5
Final exam	25	TBA	1, 2, 3, 5, 6

Lab Report: The 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. Late submissions will be penalized 20% each day that they are late. First drafts submitted after the deadline will not be reviewed. Students who fail to submit a first draft will not be able to review the paper of another student.

Lab Exams Two lab exams will be given during the lab period in weeks 3 and 10 and together will be worth 25% of the final mark. The first exam will cover lab material from the Lab 1 and Lab 2, as well as material that was required reading for Lab 3. Lab exam 2 will cover material from all 6 labs. Students must write the exams during their scheduled lab period. **No make-up exams will be given**. If a student fails to write the first lab exam, the second exam will be weighted at 25% of the final mark. If the student fails to write the second lab exam, a request for academic consideration with supporting documentation must be submitted to the instructor within 5 working days of the missed exam. If approved, the first lab exam will be weighted at 15% and the final exam will be weighted at 35%.

Midterm Exam: This exam will cover lecture content only and will take place during the lecture period. The exam may consist of multiple choice and short answer questions. **No make-up midterm exam will be given**. If a student fails to write the midterm exam, a request for academic consideration with supporting documentation must be submitted to the

instructor within 5 working days of the missed exam. If approved, the final exam will be weighted at 45%.

Oral/video presentation: Students will work in groups of 2 or 3 to prepare a 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. Further details will be provided in lab.

Final Exam: This exam will be written during the final exam period and will cover lecture material. The exam may consist of multiple choice questions, short answer, and longer essay questions. If a student misses the final exam, a request for academic consideration including documentation must be submitted to the Program Counsellor within 5 working days of the missed exam.

Assessment standards for this course follow the definitions given in the 2017-2018 Undergraduate Calendar

Important dates

Date	Event	Time / Location
Sep 8	First class	ALEX 100
Sep 12/13	First labs	SSC 2314
Sep 26/27	**Lab exam 1 (in lab)**	SSC 2314 in lab period
Oct 9	**Thanksgiving**	NO CLASSES
Oct 10	Fall study break	NO LABS THIS WEEK
Oct 20	**Midterm exam**	ALEX 100 in class period
Oct 27	Lab report – first draft due	ONLINE by 11:00 PM
Nov 3	Lab report – peer review due	ONLINE by 11:00 PM
Nov 3	40th class day	last day to drop 1-semester courses
Nov 10	Lab report – final version due	ONLINE by 11:00 PM
Nov 14/15	**Lab exam 2 (in lab)**	SSC 2314 in lab period
Nov 28/29	Oral presentations	SSC 2314 in lab period
TBA	**Final exam**	TBA

Course and University policies

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. 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 ensuring that the animals used 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, consult the University Animal Care Policy.

Missed lectures and labs

If you are absent from lectures or labs during the semester, you will be expected to make up the missed material on your own.

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 in writing or by email and include your name, ID#, email contact and supporting documentation. See the undergraduate calendar for information on regulations and procedures for Academic Consideration.

A make-up midterm exam will not be given. If a student fails to write the midterm exam, a request for academic consideration with supporting documentation must be submitted to the instructor within 5 working days of the missed exam. If approved, the final exam will be weighted at 45%.

Make-up lab exams will not be given. If a student fails to write the first lab exam, the second exam will be weighted at 25% of the final mark. If the student fails to write the second lab exam, a request for academic consideration with supporting documentation must be submitted to the instructor within 5 working days of the missed exam. If approved, the first lab exam will be weighted at 15% and the final exam will be weighted at 35%.

If a student misses the final exam, a request for academic consideration including documentation must be submitted to the Program Counsellor within 5 working days of the missed exam.

Late policy

Lab Report: Late submissions will be penalized 20% each day that they are late. First drafts that are submitted after the deadline will not be reviewed. Students who fail to submit a first draft will not be able to review the paper of another student.

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 Student Accessibility Services (formerly the Centre for Students with Disabilities) as soon as possible.

For more information, contact Student Accessibility Services at 519-824-4120 ext. 56208 or email csd@uoguelph.ca.

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.

Note**:** the software tool **Turnitin**, which is incorporated into the Courselink Dropbox, may be used to evaluate written submissions to detect plagiarism and copying of other students' work. Students are encouraged to use this tool to check their own assignments to ensure that they are free of plagiarised material before they submit the assignment for marking.

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.

Email communication

As per university regulations, all students are required to check their <uoguelph.ca> email account regularly: email 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.

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

Recording of presentations made in relation to course work—including lectures—is strictly prohibited without the permission of the presenter, whether the instructor, a classmate or a guest lecturer. Material recorded with permission is restricted to use for that course by the person who was authorized to make the recording unless further permission is granted.

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

Make an appointment with a Program Counsellor in your degree program.

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.

Student Health Services is located on campus and is available to provide medical attention.

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.

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

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.