



# ZOO\*3700 Integrative Biology of Invertebrates

Fall 2020

Section(s): 01

Department of Integrative Biology

Credit Weight: 0.50

Version 2.00 - September 09, 2020

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## 1 Course Details

### 1.1 Calendar 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.

**Pre-Requisites:** ZOO\*2700

### 1.2 Course Description

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 using physiological and developmental mechanisms. This course will help you build a solid foundation of knowledge of invertebrate diversity, ecology, and function (physiology, development, and life history) 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.

### 1.3 Timetable

Timetable is subject to change. Please see WebAdvisor for the latest information. Note that the entire course will be taught remotely with synchronous lab and lecture sessions and asynchronous lectures provided to the students.

### 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>	Andreas Heyland
<b>Email:</b>	aheyland@uoguelph.ca
<b>Telephone:</b>	+1-519-824-4120 x56459
<b>Office:</b>	SC1 1468
<b>Office Hours:</b>	By Appointment
<b>Lab Co-ordinator:</b>	Dori McCombe
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<b>Telephone:</b>	+1-519-824-4120 x58379
<b>Office:</b>	SSC 1444
<b>Office Hours:</b>	Virtual office hours during scheduled lab time or by appointment.

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## 3 Learning Resources

### 3.1 Required Resources

#### **Invertebrates (Textbook)**

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

#### **Courselink (Website)**

<https://courselink.uoguelph.ca>

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.

#### **TopHat (Website)**

<https://tophat.com/>

Weekly quizzes and self assessment

#### **PEAR Review System (Website)**

<https://peartool.opened.uoguelph.ca/>

Automatic access from courselink

### 3.2 Recommended Resources

#### **Invertebrate Zoology: A Functional Evolutionary Approach (Textbook)**

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

On reserve.

**The Invertebrates: A Synthesis (Textbook)**

Barnes RSK, Calow P, Olive PJW, Golding DW, Spicer JI. The Invertebrates: A Synthesis, 3rd ed. Blackwell Science.

On reserve.

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## 4 Learning Outcomes

### 4.1 Course Learning Outcomes

By the end of this course, you 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
  - Have advanced knowledge of major life-history patterns and their evolution
  - 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.

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## 5 Teaching and Learning Activities

## 5.1 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. Two recorded lectures will be posted at the beginning of each week along with specific learning activities that you can complete on your own time. Every week we will meet for one hour virtually to discuss lecture content, assignments, and other learning activities. Note that each meeting will be mandatory for you to attend and take place during one of the scheduled lecture times (the exact time of meetings will be posted on the first day of classes). Each virtual meeting will consist of several online assessments (quizzes, participation, problem-solving etc.). If you are unable to attend these sessions you will have to contact the instructor in order to take these assessments at a later time.

One recorded pre-lab lecture will be posted at the beginning of each week. Scheduled weekly lab times will be synchronous, virtual meetings used for lab demonstrations, discussions, and office hours/help sessions on the weekly assignment. Lab activities and assignments will include a combination of short answer questions, field work (and field notebooks), discussion, self-directed research, at-home experimentation, data collection and analysis, report writing, and limited scientific media creation.

## 5.2 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.

## 5.3 Schedule

Please note that the below schedule and list of important dates are tentative and may be subject to change.

<b>Week</b>	<b>Date</b>  (week of)	<b>Lecture Topic</b>	<b>Lab Topic</b>
<b>1</b>	Sep 7	Course overview	0. Introduction to Labs
<b>2</b>	Sep 14	Review of invertebrate evolution and taxa Marine and planktonic	1. Plankton, marine invertebrates

<b>Week</b>	<b>Date</b> <b>(week of)</b>	<b>Lecture Topic</b>	<b>Lab Topic</b>
		invertebrates.	
<b>3</b>	Sep 21	Invertebrate Life History Patterns Part 1	2. Terrestrial Invertebrates
<b>4</b>	Sep 28	Invertebrate Life History Patterns Part 2	3. Class Experiment Part 1 - Hypothesis and prediction, Experimental Design
<b>5</b>	Oct 5	Comparative Invertebrate Development Part 1	4. Class Experiment Part 2 - Data collection, Results and Analysis
<b>6</b>	Oct 12	Fall Break - No classes scheduled	No labs scheduled
<b>7</b>	Oct 19	Comparative Invertebrate Development Part 2  Midterm Review and Midterm Lecture Exam	5. EvoDevo Exercise
<b>8</b>	Oct 26	Terrestrial invertebrates - energetics and metabolism	6. Class Experiment Part 3 - Help session
<b>9</b>	Nov 2	Gas Exchange, circulation and excretion	7. Nutrition and Digestion
<b>10</b>	Nov 9	Sensing and responding Locomotion	8. Gas Exchange / Respiration
<b>11</b>	Nov 16	Coevolution Predator-prey interactions	9. Sensing and Responding
<b>12</b>	Nov 23	Parasitism	10. Science Communication
<b>13</b>	Nov 30	Insect Physiology Part 1	

<b>Week</b>	<b>Date</b> <b>(week of)</b>	<b>Lecture Topic</b>	<b>Lab Topic</b>
		Insects Physiology Part 2	
	Dec 7	Final Exam Review	

## 5.4 Important Dates

<b>Date</b>	<b>Event</b>	<b>Time / Location</b>
Sep 9	First class	MCKN 117
Sep 15/16	First labs	Online
Oct 12	<b>Fall study break</b>	
Oct 21	Midterm Exam	Online
Oct 30	Lab report – first draft due	Online by 11:00 PM
Nov 6	Lab report – peer review due	Online by 11:00 PM
Nov 13	Lab report – final version due	Online by 11:00 PM

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## 6 Assessments

### 6.1 Assessment Details

#### Lab Assignments (30%)

**Date:** Weekly, Online

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

#### TopHat Quizzes (10%)

**Date:** During Synchronous Online Sessions with all Students

You will have to get a Tophat account before the first day of class. Different options are available here: <https://tophat.com/pricing/>. A quiz will be conducted during each online

discussion session. There will be several other assignments through TopHat, which will contribute to this grade.

#### **Participation during class discussions (10%)**

**Date:** Online

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

#### **Midterm (15%)**

**Date:** Wed, Oct 23, Online

**Learning Outcome:** 1, 2, 3, 5, 6

The midterm 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 30%.

#### **Lab Report (20%)**

**Learning Outcome:** 5, 6

First Draft (10%) - due October 30, 2020

Peer Review (4%) - due November 6, 2020

Final Copy (6%) - due November 13, 2020

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 of the report submitted after the deadline will not be peer-reviewed. Students who submit the first draft late will not be able to review the paper of another student, and will thus forfeit the marks for the peer-review portion of the assignment.

#### **Final Exam (15%)**

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

The final 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.

## **6.2 Note**

Assessment standards for this course follow the definitions given in the University of Guelph 2020-2021 Undergraduate Calendar.

### 6.3 24-Hour Extension Passes on Lab Assignments

Every student will be given two **24-hour Extension Passes** which can be used for any lab assignment (does not include the lab report assignments). These passes remain separate from regular Academic Consideration on medical, psychological, compassionate grounds based on 2020-2021 Undergraduate Calendar. To use an extension pass, you must email the lab instructor **BEFORE** your assignment deadline with the subject line "24-hour Extension Pass" otherwise you will be

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## 7 Course Statements

### 7.1 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](#).

### 7.2 Missed Lectures & 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.

### 7.3 Late Policy

**Lab Report and Peer Review:** Late submissions will be penalized 20% each day that they are late. First drafts of the report submitted after the deadline will not be peer-reviewed. Students who submit the first draft late will not be able to review the paper of another student, and will thus forfeit the marks for the peer-review portion of the assignment.

Requests to the Instructor for short extensions may be considered, but only if they are made **at least 36 hours before the submission deadline**.

**Lab Assignments:** Late submissions will be penalized 10% each day that they are late.

### 7.4 24-Hour Extension Passes on Lab Assignments

Every student will be given **TWO 24-hour Extension Passes** which can be used for any lab assignment (does not include the lab report assignments). These passes remain separate from regular Academic Consideration on medical, psychological, compassionate grounds based on 2020-2021 Undergraduate Calendar. To use an extension pass, you must email the lab instructor **BEFORE** your assignment deadline with the subject line "24-hour Extension



Pass".

## 7.5 Missed Lab & Midterm Exams

**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 40%.

**Final Exam:** 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.

# 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/>

## 8.4 Personal information

Personal information is collected under the authority of the University of Guelph Act (1964), and in accordance with Ontario's Freedom of Information and Protection of Privacy Act (FIPPA) <http://www.e-laws.gov.on.ca/index.html>. This information is used by University officials in order to carry out their authorized academic and administrative responsibilities and also to establish a relationship for alumni and development purposes.

For more information regarding the Collection, Use and Disclosure of Personal Information policies please see the Undergraduate Calendar.  
(<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/intro/index.shtml>)

## 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>

## 9.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings and academic schedules. Any such changes will be announced via CourseLink and/or class email. All University-wide decisions will be posted on the COVID-19 website (<https://news.uoguelph.ca/2019-novel-coronavirus-information/>) and circulated by email.

## 9.10 Illness

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.

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