Marine Invertebrate Zoology
BIOL 3843/3840L

Instructor: Garett Allen (he/him/his)
Hear my name
Office: Biology Building 100
Office hours: M/W 12:30-3:00PM, Tues 10:00-2:30, by appointment/open-door
E-mail: garett.allen@acadiau.ca

Lecture: M/W/F, Huggins Science Hall 143, 10:30–11:20AM
Lab: Biology Building 240
FA01 – Friday, 1:00 - 3:50 PM

Evaluation	Percentage	Date
Midterm	20%	October 21st, 2024
Final Exam	20%	TBD
Final term project	30%	December 4th, 2024
Lab assignments	30%	Varies, see table below

Part 1: Course Information

Course Description

The objectives of this course are to familiarize students with the major invertebrate phyla found in marine environments. Topics that will be discussed include morphological and structure-function relationships, taxonomy, ecosystem services, and evolutionary relationships. Laboratory exercises and field trips will provide students with the opportunity to study living, preserved, and digitally accessible materials – most of which represent local fauna.

Prerequisite(s): BIOL 2073/2070L, minimum grade of C-.

Course Materials & Requirements

Textbook: Invertebrates, 4th edition, by Brusca, Giribet, and Moore, Oxford University Press, 2022.

Please note that renting the e-book equivalent of this text is substantially cheaper than buying the paperback copy. The online and physical versions should both be available at the Acadia University bookstore.

You will also need access to the course Moodle page, Microsoft Teams, a lab coat (eye-protection is optional), and clothing/footwear suitable for field trips when the weather and tides co-operate (*e.g.*, rubber boots, jacket).

Course Structure

Lectures (50 minutes) will be delivered in person on **Monday, Wednesday, and Friday** in **Huggins Science Hall 143, 10:30-11:20 AM.** Students are expected to attend all lectures.

Labs (3h) will take place in person in **Biology Building 240** on **Fridays** from **1:00 – 3:50 PM.** Students are expected to attend and participate in all labs.

****LABS WILL BEGIN THE 2nd WEEK OF CLASS (SEPTEMBER 13th).****

There will be no classes on September 30th (National Truth and Reconciliation Day), October 14-18th (Thanksgiving Day and Fall Study Break), or November 11th (Remembrance Day).

Student Learning Outcomes

1. Understand and be able to distinguish key characteristics separating major marine invertebrate phyla.
2. Become knowledgeable about the evolutionary relationship between these major invertebrate phyla.
3. Describe the general physiological traits of marine invertebrates based on their lifestyles and habitats.
4. Understand the types of ecosystem services that invertebrates provide and their relationship to humanity.
5. Independently develop documentation related to marine invertebrates or related topics.

How to Meet the Learning Outcomes

1. Attend lectures and participate in class discussions.
2. Ask questions! There is an enormous amount of diversity surrounding marine invertebrates (and many very good questions that are still difficult/not possible to answer), don't be afraid to share your thoughts.
3. Review the course material posted on Moodle, including suggested readings in the textbook.
4. Start your projects/reports earlier than you feel is needed and seek help during office hours if needed. The term report and written lab reports will take time to complete.
5. Schedule an appointment or drop by my office (Biology Building 100) to discuss challenging material.

Part 2: Course Plan

The instructor reserves the right to amend the course plan with reasonable notice and consultation with the class.

Lecture:

The following lecture topics are listed alongside recommended readings from the Brusca *et al*. Invertebrates 4th edition textbook. The precise timing of the lectures may change based on the pace of instruction and the occurrence of any relevant and timely world events.

Date	Lecture	Planned Topic	Readings / Events
September 4th	1	Course Overview & Introduction	N/a
September 6th	2	Origins of (Animal) Life & Diversification	Ch. 1 some of 4, 2, 28
September 9th	3	Porifera	Ch. 5
September 11th	4	Ctenophora and Placozoa	Ch. 6
September 13th	5	Cnidaria #1	Ch. 7
September 16th	6	Cnidaria #2	Ch. 7
September 18th	7	Cnidaria #3	Ch. 7
September 20th	8	The Great Debate – Who's First?	Ch. 2, 28
September 23rd	9	Bilateria & Xenacoelomorpha	Ch. 8, 9
September 25th	10	Gnathifera #1	Ch. 11
September 27th	11	Gnathifera #2	Ch. 11
September 30th	NO LECTURE	Truth and Reconciliation Day	NO LECTURE
October 2nd	12	Entoprocta, Cycliophora and Dicyemida	Ch. 10, 12
October 4th	13	Ethical Considerations: Inverts in Education and Research	N/a
October 7th	14	Mollusca #1	Ch. 13

October 9th	15	Mollusca #2	Ch. 13
October 11th	16	Mollusca #3	Ch. 13
October 14th	NO LECTURE	Thanksgiving Day	NO LECTURE
October 16th	NO LECTURE	Fall Study Break	NO LECTURE
October 18th	NO LECTURE	Fall Study Break	NO LECTURE
October 21st	N/a	MIDTERM #1	MIDTERM #1
October 23rd	17	Nemertea	Ch. 14
October 25th	18	Annelida	Ch. 15
October 28th	19	Rouphozoa	Ch. 17
October 30th	20	Lophophorates	Ch. 16
November 1st	21	Scalidophora	Ch. 18
November 4th	22	Nematoda and Nematomorpha	Ch. 19
November 6th	23	Tardigrades and Arthropoda #1	Ch. 20, 21
November 8th	24	Arthropoda: Crustacea #2	Ch. 20, 21
November 11th	NO LECTURE	Remembrance Day	NO LECTURE
November 13th	25	Guest - Dr. Katie Marshall Freeze tolerance of intertidal invertebrates	N/a
November 15th	26	Arthropoda: Crustacea #3	Ch. 20, 21
November 18th	27	Arthropoda: Chelicerata	Ch. 24
November 20th	28	Hemichordata	Ch. 25
November 22nd	29	Chordata: Lancelets and Tunicates	Ch. 27
November 25th	30	Echinodermata #1	Ch. 26
November 27th	31	Echinodermata #2	Ch. 26
November 29th	32	Humankind and Marine Inverts	N/a
December 2nd	33	Looking Forward	N/a
December 4th	34	Review (Q&A)	TERM PROJECT

Lab:

Please note that some lab dates may be exchanged depending on weather and animal availability. The professor will inform the class as soon as possible, should such changes become necessary. Their presented order is considered the optimal format for the course, as the lab topics align with material discussed during the lectures of that week.

Date	Lab Assignment/Module	Planned Topic
September 13th	1a	Microscopy-Based Comparisons #1
September 20th	1b	Microscopy-Based Comparisons #2 **Assignment #1 due by September 27th!**
September 27th	2a	Field Trip: Kingsport – Diversity Screening
October 4th	2b	Kingsport Collections Identifications **Assignment #2 due by October 11th!**
October 11th	3	Comparative Molluscs **Assignment #3 due by Oct. 25th!**
October 25th	4	Digital Lab – Cuttlebase **Assignment #4 due by Nov. 1st!**
November 1st	5	Comparative Crustaceans #1 **Assignment #5 due by Nov. 8th!**
November 8th	6	Comparative Crustaceans #2

		Assignment #6 due by Nov. 15th!
November 15th	N/a	In-Lab Term Project Workshop **No Assignment this week.**
November 22nd	7	Comparative Echinoderms **Assignment #7 due by Nov. 29th!**
November 29th	8	Crustacean Gill Perfusions **Assignment #8 due by Dec. 4th!**

Note:

- Lab coats are required during non-field-based or digital laboratory exercises.
- Protective eyewear is recommended but not required during dissections.
- Dissection tools will be provided as needed, but you may bring your own.
- This course does make use of live, terminally anaesthetized/euthanized, and preserved invertebrate animals. **If you have allergies – especially to shellfish – or concerns relating to dissections and animal welfare**, please let me know before laboratory exercises begin to allow for accommodation.
- Field trips are a great way to see local marine invertebrates and their habitats. The success of a field trip depends on the weather, the tides, and your ability to safely navigate amongst tidal pools, slippery ground, and mud. Please be careful and dress appropriately if/when field trips occur. This also can make field trips difficult to schedule, so be aware that changes in planned laboratories may occur.

Part 3: Assessment and Grading

Lecture and course material component (70% of the final grade):

Lecture and course material will be assessed by a midterm examination (20% of the final grade), a final exam (20% of the final grade) and an independent term project (30% of the final grade).

The mid-term examination (20% of final grade) is non-cumulative and will consist of multiple choice/labeling styled questions, short answer questions, and long-form questions. The final exam (20% of final grade) will be non-cumulative, covering all lecture materials after October 21st. Although the exam material is non-cumulative, major concepts may be relevant to both exams when applied to different phyla.

The independent term project can be formatted as either a literature review or the completion of an equally detailed Wiki page covering a topic of your choosing that is related to marine invertebrates. Your topic must **be approved through consultation with the professor before October 1st, 2024.** If you choose to change the project topic, you must also have this approved by the professor. The Wiki app within Moodle will be used to develop your Wiki page and, while it is encouraged, it is entirely your choice to publish your work on Wikipedia **after the course closes**. **The final term project must be submitted by December 4th, 2024 (last day of classes) but can be submitted earlier during the semester. Once the final project is submitted, you will not be able to make amendments.**

You are also welcome to submit an optional draft of your independent term project, in any shape or form, to me on October 21st, 2024. This draft will not be graded, but I will provide general feedback about your progress.

Students that attend or participate in the Bio Society's honour program panel event will receive 1% towards their final grade. Attendance or participation will be verified when you scan a QR code at the event that is prepared by the Bio Society. The event is scheduled to occur in the late afternoon on October 8th in the KCIC, but please keep in contact with the Bio Society to confirm these details ahead of the event.

Laboratory component (30% of the final grade):

The laboratory component will be assessed by 8 assignments submitted through the course Moodle page. These assignments will feature questions related to the observations and measurements made during the laboratory exercise as well as short essay questions that may require additional literature sourcing by the student. When completing short essay questions, please follow the departmental Scientific Writing guidelines which can be found at: https://biology.acadiau.ca/biology-scientific-writing-guide.html. The lowest scoring assignment will not count towards your final grade whereas the highest scoring assignment will count for 7.5% of your final grade. The remaining 6 assignments will each count for 3.75% of your final grade. There is no final lab examination in this course.

You are required to pass the lab to pass the course. This rule is in place for all biology courses with labs.

Part 4: Course Policies

Course material will be made available on Moodle before class.

- This allows you to follow the slides on a personal device and review the material on your own time.
- While the slides contain ***most*** of the information you need to succeed in the course, taking supplementary notes – especially during discussions – will likely improve your overall experience.
- The guest lecture material will be provided if the guest is willing to make the slides accessible. If the materials are not made available on Moodle the content will not be included in examinations.

Course material that is provided verbally *is* testable.

- It is your responsibility to attend class to receive this content and to record the content.

Please be respectful of those learning around you.

- Learning is a complicated and often individualized process. What may not seem distracting or disruptive to you could be highly distracting and disruptive to your peers.
- If there are specific learning methods that you feel are not present throughout the course, please inform me. While I cannot guarantee that I will be immediately able to correct this, I will do my best to improve the situation within reason.

Use of artificial intelligence tools to assist in learning is only permitted when:

1. The professor has given you explicit permission, and
2. The use of artificial intelligence is made clear (cited properly and explicitly indicated).

The use of artificial intelligence tools may not be used in ways that violate Acadia University's Integrity Policy and must only be used as a positive learning tool. Plagiarism and other forms of cheating are considered an act of academic dishonesty.

Accessible Learning Services Statement:

Acadia University is dedicated to improving access to campus life for all students with disabilities. While we attempt to ensure that all courses are accessible, we recognize that there are barriers that need to be addressed on an individual basis. Students who require accommodations to complete coursework or otherwise fully participate in class should contact Accessible Learning Services directly as soon as possible.

For more information, please email accessible.learning@acadiau.ca

Part 5: University Policies

University policies are available in the Acadia University Academic Calendar or through the Registrar's website: https://registrar.acadiau.ca/welcometotheregistrarsoffice.html

Equity, Diversity and Inclusion

Acadia University is committed to becoming a culturally safe and anti-oppressive community. This can only be achieved where there are simultaneous efforts to eliminate all forms of discrimination and harassment from our campus community, including the elimination of all discrimination, harassment and violence based on one's identity, including but not limited to, gender, race, class, ethnicity, sexual orientation, disability, gender identity, gender expression, and Indigeneity. The policy against harassment and discrimination, and resources for students who believe they may have experienced, or witnessed, discrimination or harassment, are available here: https://www2.acadiau.ca/student-life/equity-judicial/equity.html

Last Drop Day

Last day to drop a course and receive a "W". Please check the Acadia University calendar dates, which are available here: https://registrar.acadiau.ca/AcademicCalendars.html

Inform Your Instructor of Accommodations

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The Use of Animals in Teaching and Research

The use of animals in teaching and research at Acadia University is done in accordance with guidelines on the care and use of animals published by the Canadian Council on Animal Care (CCAC). For more information on the CCAC, please visit their website at http://www.ccac.ca

Commitment to Integrity

It is standard practice in Biology to check exams and assignments for cheating and plagiarism. Cheating in the class and/or lab, including plagiarism, will not be tolerated. Please read the appropriate sections of the current Acadia University Academic Calendar: https://registrar.acadiau.ca/AcademicCalendars.html

Information on copy-write and course content from Acadia University is available through the Vaughan Memorial Library: http://libguides.acadiau.ca/c.php?g=433650&p=5027078

The spoken and written course content (including the syllabus, handouts, lectures, presentations, labs, assignments, quizzes, tests, and exams) are the intellectual property of the instructor and may only be copied for personal use. Sharing these materials or uploading them where they may be accessed by others is a violation of copyright. If you wish to make audio, video, or photographic recordings in class, you must first obtain the consent of the instructor and of any other persons (e.g., guest speakers, other students) who may be captured in such recordings. In the case of personal use by students with disabilities, the instructor's consent shall not be unreasonably withheld.

Part 6: Program Learning Outcomes

Foundations of knowledge	**Course specific examples**	**Proficiency** 1-Introduction 2-Reinforcement 3-Proficient

Scientific method, inquiry and hypothesis testing	Find, understand and apply information from the literature; understand how to use the scientific method to examine problems from different perspectives	Comparative assessment of observations and measurements made by students to literature in labs and their term project. Perspectives across phyla and species are critical to the course.	2
Historical concepts and contributions by important figures	Explain foundational concepts in biology, Two-eyed Seeing, and ethical implications of scientific discoveries	Foundational concepts of invertebrate discoveries and the discovery of unexpected invertebrate niches, essential content relating to life as marine invertebrates and theories of life origins, ethical use of invertebrates discussed with concepts of historical value	2
Biodiversity and ecology	Understand the genetic, taxonomic and ecosystem levels of biodiversity; focus on SW Nova including the Acadian Forest and Bay of Fundy ecosystems	Evolutionary relationships of invertebrate phyla, highlights of regionally relevant fauna, especially during lab exercises, and their comparison to major global species	3
Genetics and evolution	Understand the chemical basis of heredity, genetics and genomics; integrate concepts across disciplines to understand evolution	Discussions of the evolving understanding of invertebrate phylogeny, discuss the value of genetic advancements	2
Human and environmental health	Understand form and function in health and disease within a One Health framework, integrating human and environmental health	Course material links invertebrates to their environment as well as their relationship to one another. Human interactions are also discussed.	2
Lab and field skills			
Experimental design	Gain experience in applying the scientific method	Use of the scientific method when completing assignments	1
Safety	Work safely and productively in lab and field settings	Animal handling/dissection safety, field safety, and general lab considerations.	2
Lab skills	Gain experience with basic and advanced lab techniques and understand their application in research, health science and industry	Observational and experimental skills related to comparative physiology and zoology. Some linkage to more advanced techniques including isolated organ perfusion.	2
Field skills	Gain experience in basic and advanced field skills and understand their application in ecology, conservation biology and environmental change	Field trips include a basic overview on observing invertebrates and their surroundings	1
Data acquisition, analysis and interpretations	Collect data, present results both qualitatively and quantitatively, and interpret outcomes in light of the literature	Collection of observational data, summarization in tables/figures, preparing graphic support for projects, literature comparisons	2
Statistical analysis	Use R and or other programs to analyze biological data	Assignments do not typically require students to use statistical analyses.	N/a
Professional skills			
Ethical practices	Demonstrate ethical conduct, apply principles of academic integrity, and understand the principles of EDI in science	Review of invertebrate ethics in education and research, overview of EDI in considering invertebrate documentation and biases	1
Collaboration and group work	Work effectively in groups within and across disciplines	Collaborative efforts during laboratory exercise and class discussions	2
Critical thinking	Analyze and evaluate information to make science-based decisions	Independent term project and completing assignments.	3
Computer proficiency	Use common and discipline- specific software	Use of online tools like Cuttlebase to assess neural complexity.	1

Scientific communication	Communicate science effectively to both scientific and general audiences	Independent term project (report/public database)	3