

Invertebrate Biology

BIOL/MARI 3301 Winter 2025

Faculty of Science Course Syllabus (Section A)

Department of Biology

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor

Name	Email	Office Hours
C. Isabelle Aubé (she/her)	isabelle.aube@dal.ca	Drop-in student support available on Mondays, 12-1 pm, LSC 2123 (or by appointment)

Course Description

A survey of the diversity, ecology, and evolutionary history of the major invertebrate groups. Lectures will emphasize phylogenetics and diversity of body plans. Labs will emphasize identification and anatomy through dissections and observations.

Course Prerequisites: BIOL 2003.03 (Animal Diversity)

Course Exclusions: BIOL 3321X/Y.06

Course Structure

Course Delivery: In-person, synchronous live lectures, with recordings made available afterwards (from previous or current year). Self-directed, in-person open lab format.

Lectures: MWF, 9:35-10:25 am, LSC P5260

Laboratories: B01 (W 11:35 am-2:25 pm), B02 (W 2:35-5:25pm); LSC 2102

Tutorials: None

Instructor EDI, Respect, Accessibility, and Empathy Statement

"I am committed to creating a respectful and inclusive learning environment that is supportive for everyone in this course. This includes an expectation that sharing ideas and learning from each other will be done in a respectful manner. I will also aim to forewarn students about potential triggers of topics, images, and videos that may be traumatizing to some (e.g., common phobias). If you have any questions, concerns, or improvements to suggest, please do not hesitate to reach out." – Isabelle (isabelle.aube@dal.ca)

Course Materials

Textbook

Recommended (purchase eBook or paperback via [Dal Bookstore](#), or three copies available free on reserve via the [Dal Killam Library](#)):

Brusca RC, Giribet G, Moore W. 2023. Invertebrates. 4th Ed. New York (NY): Oxford University Press. 1088 p.

Note: Older editions of this textbook may be used, but the phylogeny trees and other information may be outdated. In the event of conflicting information, use the information provided from the most recent textbook and lectures.

Brightspace:

- All Lecture and Laboratory course materials, including PowerPoint slides, video links, and reading materials will be made available to students via our Brightspace course page.
- Brightspace will also be our communication hub for the course regarding announcements, cancellations, deadlines, assignment submissions, grades, and any other pertinent resources.

Laboratory Equipment:

- A **lab coat** and **closed-toed shoes** are required for each lab.
- Vinyl **gloves** will be provided in lab if needed.
- You do not need to purchase a Lab Manual for this course. E-copies of each lab assignment will be available in the Lab Module in Brightspace, and printed copies will be available for reference (only) in the lab.
- However, you will need to bring a paper **notebook** to keep detailed notes and drawings in the lab. The use of e-notebooks is at your own risk as they may get wet, dirty, and/or damaged.
- You may bring to lab your smart phone/**camera** to take photographs of the specimens and/or other digital devices to support your learning. Again, this is at your own risk as they may get wet, dirty, and/or damaged.

- You will need access to a **digital camera and/or scanner** to insert lab drawings/photos in your online lab assignment submissions. You may borrow a camera (and other equipment) and/or scan images through the [Killam Library](#).

Course Assessment

Component	Weight (% of final grade)	Date (see schedule)
Midterm Test 1 (in class, 50 min) <i>Covers Lectures 1-10</i>	15%	Mon Feb 3, in class
Midterm Test 2 (in class, 50 min) <i>Covers Lectures 11-20</i>	15%	Mon Mar 10, in class
Final Exam (in person, location TBD, 120 min) <i>Cumulative, covers Lectures 1-30</i>	30%	Scheduled by the Registrar during exam period
Lab Assignments		Submitted online by 11:59 pm:
Lab 1: Introduction & Treasure Hunt	3%	Wed Jan 15
Lab 2: Sponges & Cnidarians	3%	Wed Jan 22
Lab 3: All the Small Things	3%	Wed Jan 29
Lab 4: Molluscs	3%	Wed Feb 5
Lab 5: Annelids	3%	Wed Feb 26
Lab 6: Crustaceans	3%	Wed Mar 5
Lab 7: Insects & Spiders	3%	Wed Mar 12
Lab 8: Echinoderms	3%	Wed Mar 19
Term-long Project		Submitted online by 11:59 pm:
Sign up for group invert topic	No marks	Fri Jan 24
Annotated bibliography 1 (self)	3%	Thurs Feb 6
Annotated bibliography 2 (group)	3%	Fri Feb 28
Oral Group Presentations	10%	Mar 26-Apr 7: in-person during Lab and Lecture times

Conversion of numerical grades to final letter grades follows the [Dalhousie Grade Scale](#):

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Learning Objectives

Picking up from BIOL 2003, you will learn many things in BIOL/MARI 3301. By the end of this course, you should be able to:

- Correctly identify all of the Metazoan invertebrate phyla when presented with a specimen and describe the unifying characteristics of that phylum.
- Describe the anatomy of invertebrates using scientific language.
- Safely handle and observe live and preserved invertebrate specimens through microscopy and dissections.
- Understand the process of evolution by natural selection, the phylogeny of invertebrate groups, and the terms used to describe specific concepts in phylogeny such as synapomorphies or crown groups.
- Critically examine scientific literature through prepared annotated bibliographies and a term-long group oral presentation.
- Examine how human culture has historically been influenced and continues to be influenced by invertebrates.
- Acquire a new curiosity and appreciation for the invertebrate life around us!

Course (Tentative) Schedule and Content

¹ All lab assignments are submitted online via Brightspace and are due by 11:59 pm at the end of your lab day.

² All term-long project assignment deadlines (e.g., bibliographies) are due by 11:59 pm on the indicated deadlines.

Each member of the group must submit a copy online via Brightspace.

³ All Midterm Tests are in-class and non-cumulative. Final Exam is scheduled by the Registrar and is cumulative.

Date	Lectures	Labs
Week 1 Jan 6 - 10	L01 Admin & Intro to Inverts I (Ch. 1) L02 Intro to Inverts II: Systematics, Phylogeny, & Classification (Ch. 1 & 2) L03 Invert Animal Architecture (Ch. 3 & 4)	
Week 2 Jan 13 - 17	L04 Poriferans (sponges) (Ch. 5) L05 Ctenophores (Ch. 6) L06 Placozoans & Cnidarians I (Ch. 6 & 7)	Lab 1: Intro and Treasure Hunt¹ (3%)
Week 3 Jan 20 - 24	L07 Cnidarians II: Ecology and Ediacaran Biota (Ch. 7) L08 Cnidarians III: The 7 Classes (Ch. 7) L09 Intro to Bilaterians & Xenacoelomorphs (Ch. 8 & 9)	Lab 2: Sponges & Cnidarians (3%) Sign up for term-long group project: Fri Jan 24²
Week 4 Jan 27 - 31	L10 Intro to Protostomes, Gnathiferans (Rotifera & Chaetognatha), & Entoprocta (Ch. 10, 11, 12) L11 Intro to Lophotrochozoa, Molluscs I (Ch. 13) L12 Molluscs II: Fossils, Aplacophores, Chitons, & Monoplacophores (Ch. 13)	Lab 3: All the Small Things (3%)
Week 5 Feb 3 - 7	Mon Feb 3: Midterm Test 1 (L01-10)³ (15%) L13 Molluscs III: Gastropods (Ch. 13) Fri Feb 7: Munro Day—no classes	Lab 4: Molluscs (3%) Annotated Bibliography 1 (self): Thurs Feb 6 (3%)
Week 6 Feb 10 - 14	L14 Molluscs IV: Bivalves & Tusk Shells (Ch. 13) L15 Molluscs V: Cephalopods (Ch. 13) L16 Nemertea and Annelids I (Ch. 14 & 15)	Backup Lab Week
Week 7 Feb 17 - 21	Study Break—no classes or labs	
Week 8 Feb 24 - 28	L17 Annelids II: Polychaetes, Earthworms (Ch. 15) L18 Annelids III: Leeches & Others, Intro to Lophophorates (Ch. 15 & 16) L19 Lophophorates II: Phoronids, Bryozoans & Brachiopods (Ch. 16)	Lab 5: Annelids (3%) Annotated Bibliography 2 (group): Fri Feb 28 (3%)
Week 9 Mar 3 - 7	L20 Rousphozoa: Platyhelminthes & Gastrotrichs (Ch. 17) L21 Intro to Ecdysozoans, Nematoids (Ch. 18 & 19) L22 Parnarthropods, Tardigrades (Ch. 20)	Lab 6: Crustaceans (3%)
Week 10 Mar 10-14	Mon Mar 10: Midterm Test 2 (L11-20) (15%) L23 Onychophores, Intro to Arthropods, Trilobites (Ch. 20) L24 Arthropods II: Chelicerates (spiders), Myriapods (Ch 23 & 24)	Lab 7: Insects and Spiders (3%)
Week 11 Mar 17 - 21	L25 Arthropods III: Crustaceans (Ch. 21) L26 Arthropods IV: Hexapods, Insects I (Ch. 22) L27 Arthropods V: Insects II, Intro to Deuterostomes, Hemichordates (Ch. 22, 25)	Lab 8: Echinoderms (3%)
Week 12 Mar 24 - 28	L28 Echinoderms I (Ch. 26) L29 Echinoderms II: The 5 Classes (Ch. 26) L30 Invert Chordates: Cephalochordates and Tunicates (Ch. 27)	Oral Group Presentations (10%)
Week 13 Mar 31 - Apr 4	Mon Mar 31: Backup Lecture Wed Apr 2: Review/Backup Day/Oral Group Presentations (10%) Fri Apr 4: Review/Backup Day/Oral Group Presentations (10%)	Oral Group Presentations (10%)
Week 14 Apr 7	Mon Apr 7: Review/Backup Day/Oral Group Presentations (10%)	
Exams Apr 9 - 26	Final Exam (L01-30 cumulative): scheduled by Registrar (30%)	

Course Policies on Missed or Late Academic Requirements

Students are expected to **read the course syllabus** in full and **keep track of all the deadlines**.

Students with a **Special Accommodations plan must follow their plan's guidelines** to request extensions and/or alternative testing arrangements.

Students who require an alternate deadline and/or testing date due to **cultural and/or religious holidays**, please contact the Instructor (isabelle.aube@dal.ca) beforehand.

Midterm Tests and Final Exam

- You **cannot** use an SDA form for missed Midterm Tests or Final Exam.
- Contact your Instructor (isabelle.aube@dal.ca) if you have a reasonable excuse for missing any Midterm Tests or the Final Exam, or else you will automatically receive a grade of **zero**.
- There will be **no make-ups** for missed Midterm Tests. If the reason for missing the Test is deemed reasonable by the Instructor, the value of that Test will be added to your cumulative Final Exam.
- A make-up Final Exam **may** be scheduled at the end of the term or at the start of the next term, on a case-by-case basis.

Labs

- Lab attendance is **mandatory**, but since these are **self-directed open-labs**, you are not required to stay for the full period.
- If you have a reasonable excuse for missing a lab, contact your instructor (isabelle.aube@dal.ca), or else you will automatically receive a grade of **zero**.
- There will be **no make-up labs**, but you **may** have the option to attend another lab section, or have up to a **maximum of 2 missed labs** pro-rated upon the Instructor's discretion.

Assignments

- The deadline to **submit your lab assignment online is by 11:59 pm at the end of your lab day**. You will have plenty of time to complete your lab assignment within your designated 3-hr lab period. Therefore, a wise time-management strategy would be to submit it then rather than risk missing the deadline later.
- The deadline to **submit all other assignments and requirements online is by 11:59 pm (see schedule)**.
- If you are unable to complete an assignment by its deadline, you can submit a **Student Declaration of Absence (SDA)** form to allow an **automatic extension of no more than 72 hours (3 days)** without the need for a reasonable excuse. Your SDA must be submitted no more than 72 hours past the deadline for that specific assessment. A **maximum number of 2 SDA forms** will be allowed for this course.

- For group assignments, **each member of the group is required to submit a copy online** so we can auto-create a link to your Brightspace gradebook.
- If you require any additional extensions, or an extension that is longer than 72 hours, you (or someone else on your behalf) must contact your Instructor (isabelle.aube@dal.ca) as soon as reasonably possible.
- Assessments submitted past the deadlines without an SDA or special permission from the Instructor will receive a **10% deduction per day late** (including weekends).

Course Policies related to Academic Integrity

You may collaborate with others in this course while working on your assignments; however, **you must submit your own unique work that is appropriately referenced.**

If you collaborate with others to obtain photographs in the lab, **you must credit the person who took the photo.**

The use of generative **Artificial Intelligence (AI)** and large language models (e.g., **ChatGPT**) is not a replacement for a student's own voice and creativity. However, students may use these programs to help reduce writing workload (e.g., generate a summary of notes, create practice questions). Please note that these programs are not foolproof, and it is the student's responsibility to **verify ALL the information generated against accuracy, plagiarism, and that the work is appropriately referenced.** If you copy and paste an AI generated sequence without the appropriate editing, **it may be considered cheating.** For any concerns with your use of these programs, you are encouraged to **contact the Instructor (isabelle.aube@dal.ca) in advance** of using them.

The use of online assignment help tools (e.g., **Chegg®**) is considered cheating and is **prohibited to use for the assignments in this course.**

If an **Academic Integrity offence** is suspected (e.g., plagiarism or cheating) the case will be [forwarded directly to an 3rd party Academic Officer as per Dalhousie University guidelines.](#)

General Tips to Ace Inverts!

First off... hopefully, you WILL ace inverts! That being said, I have a couple of tips on how you can make this class go smoothly:

- **Attend in-person Lectures**, even if you're late. This is the BEST use of your time (and mine!) to focus on the material with me. Lecture recordings are meant to aid in your learning if needed, but keep in mind that being overly reliant on Lecture recordings is time wasted.

- **Ask questions and ask often**, and not just right before the exams! This means in class, during labs, on the discussion boards, and during my office hours. There are no questions too insignificant or silly. Especially questions about deadlines or expectations! If I don't know the answer, I WILL follow up.
- Pay attention and **think proactively** to what is emphasized in the lectures and labs: clades, anatomy, form/function, life cycles, etc... These are concepts that will appear throughout the course. Ask yourselves: "what would be a good question for an exam on this particular topic?".
- Simply reading and recopying notes over and over is NOT an effective use of your time when it comes to studying. You need to **have a strategy to actively retain** the huge amounts of material that we will be covering in class. [The Learning Scientists have 6 Strategies for Effective Learning](#), pick one or two that you like best. My favourites are Dual Coding and Retrieval Practice.
- Regularly **work through ALL the end-of-Lecture Practice Questions**. I've created these to help you focus on the important take-aways from each Lecture and are a **great study tool!** Hint: much of your tests and exams are based on these, or parallel versions of these questions.
- **Create a weekly schedule** of all your tasks (school, work, leisure, deadlines) with backup slots in case you need them. Ideally, block out 1-2 hours on or near each of your Lecture days to go over your notes/clarify questions you have/make up practice questions. Schedule a weekly timeslot to **actively study** the material covered that week. **Pro-tip:** Fridays 5-9 pm are an often-forgotten time to study, but you'll be glad you did, and you still have the night to have fun with friends!
- **Form a study group** with other students for review sessions. I've made life-long friendships through my undergrad study groups at Dal!
- **Try not to cram!** This course requires you to think critically, which is harder to do when you're under pressure from multiple deadlines. **Think about your project presentation topic early and start saving references.**
- **Explore online!** There is a huge community of scientists on twitter and many scientific organizations have some form of social media, and we ALL love to nerd out about Inverts too! I encourage you to share anything interesting or useful with the class on our Discussion Board.
- Finally, **rest, eat well, exercise, and do something fun** once in a while to "recharge your batteries"! I'm still my own worst critic when it comes to this, but I never give up!

Faculty of Science Course Syllabus (Section B)

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at:

https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: <https://www.dal.ca/about/leadership-governance/academic-integrity/faculty-resources/ouriginal-plagiarism-detection.html>

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.

Faculty of Science Course Syllabus (Section C)

Student Resources and Support

University Policies and Programs

Important Dates in the Academic Year (including add/drop dates):

http://www.dal.ca/academics/important_dates.html

Classroom Recording Protocol:

https://www.dal.ca/dept/university_secretariat/policies/academic/classroom-recording-protocol.html

Dalhousie Grading Practices Policies:

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Grade Appeal Process: https://www.dal.ca/campus_life/academic-support/grades-and-student-records/appealing-a-grade.html

Sexualized Violence Policy: https://www.dal.ca/dept/university_secretariat/policies/health-and-safety/sexualized-violence-policy.html

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Learning and Support Resources

General Academic Support – Advising (Halifax): https://www.dal.ca/campus_life/academic-support/advising.html

General Academic Support – Advising (Truro): <https://www.dal.ca/about-dal/agricultural-campus/ssc/academic-support/advising.html>

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

On Track (helps you transition into university, and supports you through your first year at Dalhousie and beyond): https://www.dal.ca/campus_life/academic-support/On-track.html

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Indigenous Connection: <https://www.dal.ca/about-dal/indigenous-connection.html>

Elders-in-Residence (The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit the office in the Indigenous Student Centre or contact the program at elders@dal.ca or 902-494-6803:

<https://cdn.dal.ca/content/dam/dalhousie/pdf/academics/UG/indigenous-studies/Elder-Protocol-July2018.pdf>

Black Student Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre.html

LGBTQ2SIA+ Collaborative: <https://www.dal.ca/dept/vpei/edia/education/community-specific-spaces/LGBTQ2SIA-collaborative.html>

Dalhousie Libraries: <http://libraries.dal.ca/>

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Dalhousie Student Advocacy Services: <https://www.dsu.ca/dsas?rq=student%20advocacy>

Dalhousie Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Human Rights and Equity Services: <https://www.dal.ca/dept/hres.html>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Study Skills/Tutoring: http://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Faculty of Science Advising Support: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Safety

Biosafety: <http://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <http://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Laser Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety/laser-safety.html>