

Faculty of Science Course Syllabus (Section A)**Department of Biology**

BIOL 3326.03

Vertebrate Design: Evolution and Function

Fall 2022

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor: C. Isabelle Aubé; isabelle.aube@dal.ca; LSC 2123; in-person/Teams office hrs W: 4:30-5:30 pm

Lectures: MWF, 1:35-2:25 pm, LSC 236

Laboratories: None

Tutorials: None

Course Delivery: In-person, synchronous live lectures, with recordings made available afterwards

COVID-19 Masking and Isolation protocols: <https://www.dal.ca/covid-19-information-and-updates.html>

Course Description

Vertebrate Design explores 600 million years of vertebrate evolution and phylogenetic relationships, with particular attention to origins of major groups and the anatomical and functional innovations associated with their rise and diversification. Functional morphology and physiology of swimming, flying and terrestrial locomotion is also covered.

Course Prerequisites

BIOL 2003.03 (Animal Diversity) and BIOL 2040.03 (Evolution)

Course Exclusion

None

Learning Objectives

Before taking this class, you are assumed to already know how to:

1. Identify living vertebrates to taxonomic class (BIOL 2003)
2. Interpret the information available in cladograms (BIOL 2003)
3. Describe the process of adaptation and requirements for evolution by natural selection (variation, heritability, differential reproduction) (BIOL 1000, 2040)
4. Describe basic anatomy and life history characteristics of living vertebrates (BIOL 2003)

At the end of this course, you will be able to:

1. Identify and compare homologous anatomical features between vertebrates
2. Describe in general terms which vertebrates lived at what time

3. Relate vertebrate history to geological history
4. Relate vertebrate history to history of other organisms
5. Describe important fossils close to major divergences in lineages (also part of your **Fossil Species Project**)
6. Synthesize a phylogeny showing relationships of arbitrarily chosen lineages of vertebrates
7. Diagram major anatomical structures (skull, limbs/fins, axial skeleton etc.)
8. Assess new paleontological evidence (fossils) and their implications for interpretations of vertebrate history (also part of **Fossil Species Project**)
9. Evaluate media accounts of vertebrate history and evolution (scientific literacy, also part of **Fossil Species Project**)
10. Use cladistic analysis of morphology to evaluate phylogenetic hypotheses
11. Distinguish between mass extinctions and background extinctions and their implications for adaptation (extinction, evolutionary constraint)
12. Relate morphology to function and selection pressures (form and function, adaptation)
13. Argue for or against interpretations of major events in vertebrate history (e.g., dinosaur endothermy, origin of flight, relationships between legs and fin types etc.)
14. Use principles of allometry to predict differences in structure and function between large and small animals (more in BIOL 3336)
15. Trace the ancestry and evolutionary changes in morphology from modern vertebrates back to early Paleozoic animals
16. Visually represent scientific information to the general public (**Fossil Species Project**)
17. Practice peer-review and evaluation

Course Materials

Note: There is nothing required for you to purchase. All course information will be available on Brightspace, including links to free software you can use for the course assignments. The following recommended—but optional—textbooks are **not** available for purchase via the Dal Bookstore, but you are welcome to locate and/or purchase them through other means. A few copies are available on reserved for this course from the [Dal Library](#). The three most recent editions are also acceptable (including e-copies).

Textbook (optional)

Pough FH, Bemis WE, McGuire B, Janis CM. 2022. Vertebrate Life. 11th Ed. New York (NY): Oxford University Press. 656 p.

Kardong KV. 2019. Vertebrates: Comparative Anatomy, Function, Evolution. 8th Ed. New York (NY): McGraw-Hill Education. 790 p.

Brightspace:

All course materials, including Lecture PowerPoint slides and “Dr. Pinder’s Lecture Notes” (the original creator of the course) 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 submission grades, and any other pertinent resources.

In-class Response System:

<https://kahoot.com> (optional); see the **Course Assessment** and **Course Policies** Sections on Quizzes for more details.

Course Assessment

| Component | Weight (% of final grade) | Date (see schedule) |
|---|--|--|
| Quizzes 1-9 (in class) <i>Review of previous week's material through Kahoot or submit a paper copy of your answers. For participation marks only.</i> | <i>1% each, best 7/9 for a total of 7%</i> | <i>Weekly in class on most Mondays & on last day (Wed Dec 7)</i> |
| Midterm Test 1 (in class) <i>Covers Weeks 1-4</i> | <i>15%</i> | <i>Mon Oct 3, in class</i> |
| Midterm Test 2 (in class) <i>Covers Weeks 5-8</i> | <i>15%</i> | <i>Mon Oct 31, in class</i> |
| Final Exam (in person, location TBD) <i>Cumulative, covers Weeks 1-14</i> | <i>30%</i> | <i>Scheduled by the Registrar</i> |
| Assignments (online, by 11:59 pm) | | |
| 1a: Fossil Species Selection | <i>No marks</i> | <i>Fri Sep 16</i> |
| 1b: Fossil Species Initial Literature Review/Annotation | <i>5%</i> | <i>Fri Sep 23</i> |
| 2: Fossil Species Infographic/Museum Brochure | <i>8%</i> | <i>Fri Oct 14</i> |
| 3: Fossil Species Final Project | <i>15%</i> | <i>Fri Nov 18</i> |
| 4: Fossil Species Peer Evaluation | <i>5%</i> | <i>Fri Dec 2</i> |

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

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

Course Policies on Missed or Late Academic Requirements

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

You **cannot** use a Student Declaration of Absence (SDA) form for missed Quizzes, Midterm Tests, or the Final Exam.

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

Quizzes

- Since these are for participation marks only, **you can miss up to 2 Quizzes without penalty.**
- Contact your Instructor (isabelle.aube@dal.ca) if you have a reasonable excuse for missing 3 or more Quizzes.

Midterm Tests and Final Exam

- Contact your Instructor (isabelle.aube@dal.ca) if you have a reasonable excuse for missing any Midterm Tests or the Final Exam.
- There will be **no makeups** 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 makeup 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.

Assignments

- 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 particular assessment. A **maximum number of 2 SDA forms** will be allowed for this course.
- If you require any additional extensions, or an extension that is longer than 72 hours, you 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 while working on your assignments; however, you must submit your own unique work that is appropriately referenced.
- 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.](#)

Course Schedule and Content

¹ All Quizzes are in-class on most Mondays and based on the previous week's material, except when otherwise indicated. The best 7/9 participation marks are kept.

² All Assignment are submitted online via Brightspace and are due on Fridays by 11:59 pm, unless otherwise indicated.

³ All Midterm Tests are in-class and non-cumulative.

| Date | Lecture Topics | Assessments |
|----------------------------------|---|--|
| Week 1 Sep 7 - 9 | Introduction: mechanics and philosophy of course – including phylogeny, geologic time scale and classification and taxonomy | |
| Week 2 Sep 12 - 16 | Chordate origins, living fossils – Cambrian explosion, Hagfish and Lampreys | ¹ Quiz 1: Mon Sep 12 (1%) ² Assignment 1a: Fossil Species Selection, Fri Sep 16 (no marks) |
| Week 3 Sep 19 - 23 | Vertebrate body plan, material properties of flesh and bone | Quiz 2: Mon Sep 19 (1%) Assignment 1b: Fossil Species Initial Literature Review/Annotation, Fri Sep 23 (5%) |
| Week 4 Sep 26 - 30 | Paleozoic armoured fish: Heterostracans, Osteostracans et al. No class on Sep 30: National Day for Truth & Reconciliation | Quiz 3: Mon Sep 26 (1%) |
| Week 5 Oct 3 - 7 | Origin of gnathostomes: Placoderms, Acanthodians, Chondrichthyes, Teleosts | ³ Midterm Test 1: Mon Oct 3 (15%) |
| Week 6 Oct 10- 14 | No class on Oct 10: Thanksgiving Day Radiation of Teleosts: variations on aquatic feeding and locomotion | Assignment 2: Fossil Species Infographic/Museum Brochure, Fri Oct 14 (8%) |
| Week 7 Oct 17 - 21 | Transition to land: Sarcopterygia, Tiktaalik, Acanthostega, Ichthyostega: transformations in limbs, girdles, axial skeleton, respiration & senses | Quiz 4 (based on post-Midterm material): Mon Oct 17 (1%) |
| Week 8 Oct 24 - 28 | Paleozoic anamniotic Tetrapods and origin of modern Amphibians | Quiz 5: Mon Oct 24 (1%) |
| Week 9 Oct 31 - Nov 4 | Origin of the Amniotes: amniote egg, Sauropsids and Synapsids | Midterm Test 2: Mon Oct 31 (15%) |
| Week 10 Nov 7 - 11 | No classes: Study Break | |
| Week 11 Nov 14 - 18 | Origin of Amniotes continued Non-Dinosaur Archosaurs | Quiz 6 (based on post-Midterm material): Mon Nov 14 (1%) Assignment 3: Fossil Species Final Project, Fri Nov 18 (15%) |
| Week 12 Nov 21 - 25 | Archosaurs: Dinosaurs and Birds; allometry (size matters!), morphology of flight | Quiz 7: Mon Nov 21 (1%) |
| Week 13 Nov 28 - Dec 2 | Birds continued Synapsids and the fabulous furballs (aka Mammals) | Quiz 8: Mon Nov 28 (1%) Assignment 4: Fossil species Peer Evaluation, Fri Dec 2 (5%) |
| Week 14 Dec 5 - 7 | End Mammals (Hopefully!!) | Quiz 9 (Final Review!): Wed Dec 7 (1%) |
| Exams Dec 9 - 20 | | Final Exam (cumulative): scheduled by Registrar (30%) |

Faculty of Science Course Syllabus (Section B)

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of 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.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.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.

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

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

Statement: <http://www.dal.ca/cultureofrespect.html>

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 (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

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

<https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loadusercredits=False>

University Grading Practices

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

Faculty of Science Course Syllabus (Section C)

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

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

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

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

Academic supports

Library: <https://libraries.dal.ca/>

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

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

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

Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

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

Student Advocacy: <https://dsu.ca/dsas>

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

Safety

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

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

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

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

Dalhousie COVID-19 information and updates: <https://www.dal.ca/covid-19-information-and-updates.html>