

Laboratory in Comparative Animal Physiology Syllabus

Department of Biology
BIOL/MARI 3371 Winter 2024

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(s)

Name	Email	Office Hours
Dr. Margaret Cooper	Margaret.Cooper@dal.ca	LSC 4130; by appointment

Course Description

This laboratory intensive course will provide opportunities for students to experience firsthand the role that experimentation, and data collection, interpretation, and communication plays in our understanding of how animals function. Vertebrate and invertebrate examples are used, in a comparative approach, to study a variety of physiological processes.

NOTES: Laboratory experiments involve live invertebrates and/or vertebrate tissues. Students are required to handle live invertebrates during the lab.

PREREQUISITES: BIOL 3078 or MARI 3074 or BIOL 3370 or MARI 3370; CHEM 1011 and CHEM 1012; STAT 1060 or STAT 2060

EXCLUSIONS: BIOL 3079, MARI 3076

Course Structure

Course delivery and all examinations will be in-person.

Lectures and Tutorials: Combined total of three hours per week

Laboratories: Three hours most but not all weeks

Statement of Respect: You are encouraged to speak up and participate during class meetings and on our Brightspace discussion board. Students in the class will have a diversity of backgrounds, experiences, and knowledge. Every member of the class must show respect for every other member of the class.

Communication: Good communication between the instructor and students is key to the success of students in a course. I will do my best to respond to your emails within 24 hours except over the weekend when it will be 48 hours.

Course Materials

Hill, R., G. Wyse and M. Anderson. *Animal Physiology*. Fifth edition. 2021.

You will be able to access the e- textbook inside of Brightspace. All you need to do is click on the link to the e-textbook. You can access your course material for free any time before the add-drop deadline. If you have any questions, please feel free to reach out to support@willolabs.com.

I also recommend that you consider purchasing the text ***A Student Handbook for Writing in Biology; 6th ed., 2021 by Karin Knisely***. This text is a very good reference to consult when writing your formal reports.

Alternatively, you can use for free Dalhousie's library information on scientific writing found at [Resources for Scientific Writing](#).

Most of the labs will use sensors and data recording equipment from iWorx. The software used by this equipment is called LabScribe and is free from iWorx and will be available during our first lab session. Students will need a computer onto which they can download the LabScribe software. It will be best if that computer is a laptop that can be brought to lab and tutorial. If that is not possible, please contact me as soon as possible.

Assessment

Assessment	Value	Due
Statistics and Data Presentation	3%	Jan. 19 th
Lab Prep. Activities	9% (1.5% each)	Six throughout term
Data Reports	18% (6% each)	Three throughout term
Formal Report 1	15%	Week of Feb. 26th
Formal Report 2	20%	Week of Apr. 1st
Midterm Test	10%	March 1 st
Final Exam	25%	Exam Period

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 Policies on Missed or Late Academic Requirements

Open communication is essential for a positive learning experience. I will be communicating with you regularly, and hope that you will feel comfortable asking for help when you need it.

To avoid any misunderstanding or confusion during the term, please note the following policies. These regulations have been put in place to try to ensure fair and equal treatment for all. Extenuating circumstances can arise, however, so please feel free to talk to me if you have problems with any of these regulations at any time during the term.

Exams

Please inform me in advance, or as soon as possible after, if you are unable to attend an exam. Make-up exams will be given **within one week** of the scheduled exam date, at a mutually convenient time if possible. *The weight of missed exams will not be redistributed to another exam.* A Self-Declaration of Absence (SDA) will be required if you need to write a make-up midterm exam, but as per University policy, SDA forms cannot be used in relation to the final exam. Make-up final exams will only be provided in the case of illness or extreme circumstances.

Assignments

Participation in the laboratory is integral to your learning in this course. If you cannot attend your regular lab section during a particular week, please contact me in advance to arrange attending one of the others, where possible.

The purpose of the Lab Prep Activities is to ensure that you come to lab well prepared. **An SDA form cannot be used for Lab Prep Assignments.** An SDA form can be used to gain a maximum three-day extension on a Data Report or a Formal Report.

Only TWO SDA forms may be used throughout the term.

SDA forms are meant to deal with short term illnesses. If a circumstance arises that affects your ability to participate in the course over a longer term, contact me as soon as possible to discuss options for rescheduling assessments.

Assignments submitted late, without an arranged extension, will receive a late penalty of **10% per day** up to 5 days late. Assignments more than 5 days late will not be accepted.

Course Policies related to Academic Integrity

You are expected to abide by Dalhousie University's policies on academic integrity.

I encourage you to work with classmates to help each other learn the content of the class. The discussion boards will be particularly important for asking questions and receiving help.

However, all assignments that you submit must be independent and entirely your own wording. You can work together to understand content, but assignments must be your own work. Paraphrasing appropriately from source material is an important skill that you should be learning. If this is something that you struggle with, I encourage you to work with the Writing Centre to develop this skill. This class subscribes to a Brightspace Learning web-based service that checks for originality in submitted work. This service will be used for all assignments.

Generative AI and large language model (LLM) based websites (e.g. ChatGPT) deserve special mention. **I do not consider content generated by ChatGPT, or something similar, to be your own work.** It is also not possible to properly cite content generated by these sites. As such, using LLM generated content in your assignments is not appropriate in this course. The data report and formal report assignments are designed to teach you important data analysis, interpretation, and communication skills. Taking short cuts in the production of these assignments undermines your learning.

If, for any reason, an exam cannot take place in a proctored setting, please remember that it is an independent assessment. You may consult your notes, textbook, or other course content, but you cannot collaborate with classmates or post questions to external websites. By accessing an exam, you are acknowledging that the work submitted is solely of your own efforts.

The contents of the assessments in the course are the property of BIOL/MARI 3371 and are confidential. You may not share the contents of these assessments on 'homework sharing' websites, (e.g. Chegg, Course Hero, Studocu, etc.)

Copyright Notice:

All course materials are designed for use as part of BIOL/MARI 3371 at Dalhousie University and are the property of the course instructor. This includes all images, videos, documents,

assignments and exams. These documents are solely for your learning and evaluation in BIOL/MARI 3371. It is an academic offence to share these materials outside of this course space in such a way that others might gain an unfair advantage, and students who do so may be subject to University discipline. Copying this material for distribution may also lead to a violation of Copyright law.

Assumed Learning Outcomes

Students are expected to possess the following knowledge and skills from prerequisite courses:

- Describe mechanisms used by animals to exchange gases with their external environment, highlighting form and function in respiratory systems of a variety of animals. (BIOL 1011)
- Describe the long-distance transport of materials within animal bodies, highlighting form and function in circulatory systems of a variety of animals. (BIOL 1011)
- Describe mechanisms of osmoregulation and thermoregulation in a variety of animals (BIOL 1011)
- Describe how physiological processes underlie life history variation in wild animals (BIOL/MARI 3370)
- Describe the role that environment and climate play in physiological processes (BIOL/MARI 3370)
- Explain the integration of the sciences at the physiological level from molecules to populations. (BIOL/MARI 3370)
- Provide examples of adaptations and diversity of physiology across terrestrial and marine phyla (BIOL/MARI 3370)
- Define and give examples of homeostasis (BIOL/MARI 3370)
- Describe the structure of striated and smooth muscle tissue and explain how it functions (BIOL/MARI 3370)
- Describe the structures and pathways involved in sensory reception (BIOL/MARI 3370)
- Explain neuronal function and signal transmission (BIOL/MARI 3370)
- Relate how nerves and muscles coordinate to allow for movement (BIOL/MARI 3370)
- Outline basic endocrine functioning (BIOL/MARI 3370)
- Demonstrate understanding of laboratory safety and laboratory techniques including pipetting, titrating, and centrifuging (CHEM 1011)
- Practice proper laboratory techniques including pipetting, spectroscopy, and separations (centrifuging and column chromatography), while maintaining safety standards in the context of a chemical laboratory (CHEM 1012)

Learning Outcomes

By the end of this course, students should be able to:

- Define and differentiate between muscle twitch, summation, and tetanus. Explain how nervous stimulus leads to each.
- Define metabolic rate, identify factors affecting an animal's metabolic rate, and describe methods used for its measurement.
- Relate an animal's maximum rate of oxygen consumption to parameters affecting fitness as well as strenuousness of exercise.
- Relate the diffusion of oxygen and carbon dioxide in air and aqueous solutions to the respiratory physiology of air breathing and water breathing animals.
- Describe the importance of the relationship between the flow of blood and the flow of respiratory fluid in breathing organs, comparing the effectiveness of various arrangements.
- Calculate and compare the ventilatory requirements of air breathers and water breathers.
- Describe the anatomy and physiology of breathing in a variety of animal groups.
- Describe the role of respiratory pigments and how their structure affects the shape of oxygen equilibrium curves.
- Interpret oxygen equilibrium curves in terms of oxygen affinity and oxygen carrying capacity; describe factors that affect both these characteristics.
- Describe the various ways in which carbon dioxide is transported in the blood of animals.
- Describe the structure of cardiac muscle and relate the electrical and molecular events of cardiac action potentials.
- Describe the mechanical and electrical events of the cardiac cycle.
- Relate pressure, resistance, and flow within vascular systems.
- Describe the anatomy and physiology of circulation in a variety of animal groups.
- Describe the compartmentalization and composition of body fluid in animals.
- Explain how osmotic, ionic, and volume regulation are achieved in freshwater, marine, and terrestrial animals.
- Collaborate with other students to collect qualitative and quantitative data in laboratory experiments.
- Use R to statistically analyze and present physiological data.
- Interpret physiological data and practice written communication skills to produce data reports and formal reports.
- Conduct literature and online searches of primary and secondary sources using electronic databases and online search tools.

Course Content

Date	Lecture or Tutorial (M, W, F)	Lab (M, T)
Jan	8 Course Introduction	No Lab
	10 R for Statistics and Data Presentation - Assignment Due Jan. 19 (3%)	
	12 Properties of Whole Muscle Contraction	
	15 Properties of Whole Muscle Contraction	Lab 1: Introduction to LabScribe and Animal Physiology Lab
	17 Measuring Metabolic Rate	
	19 Metabolic Scaling Relationships	
	22 External Respiration	Lab 2: Mytilus Anterior Byssal Retractor Muscle - Lab Prep (1.5%) and Data Report (6%)
	24 Tutorial (T01, T02)	
	26 Ventilatory Requirements of Air and Water Breathers	
	29 Comparative Physiology of Breathing	Lab 3a: Oxygen Consumption vs. Size - Lab Prep (1.5%)
	31 Tutorial (T01, T02)	
Feb	2 Munro Day	
	5 Comparative Physiology of Breathing cont.	Lab 3b: Oxygen Consumption in Mammals - Lab Prep (1.5%) and Formal Report (15%)
	7 Tutorial (T01, T02)	
	9 Respiratory Pigments and Oxygen Equilibrium Curves	
	12 Carbon Dioxide Transport	No Lab - Report Writing
	14 Hearts	
	16 Hearts cont.	
	19-23 READING WEEK	
	26 Hearts cont.	No Lab - Report Due
	28 Exam Review	
Mar	1 Midterm Exam (Up to Carbon Dioxide Transport 10%)	
	4 Principles of Pressure, Resistance, and Flow	Lab 4: Blood Gas Transport, Mammalian ECG and Cardiac Output - Lab Prep (1.5%) and Data Report (6%)
	6 Tutorial (T01, T02)	
	8 Circulation in Birds and Mammals	Lab 5: Hormone Effects on Heart - Lab Prep (1.5%) and Data Report (6%)
	11 Circulation in Fish, Amphibians, and Non-Avian Reptiles	
	13 Tutorial (T01, T02)	
	15 Circulation in Invertebrates	Lab 6: Osmoregulation in Worms and Crabs - Lab Prep (1.5%) and Formal Report (20%)
	18 Water and Salt Physiology: Intro and Mechanisms	
	20 Tutorial (T01, T02)	
	22 Ionic and Osmotic Adaptations in Aquatic Animals	No Lab - Report Writing
	25 Ionic and Osmotic Adaptations in Aquatic Animals cont.	
	27 Water Conservation in Terrestrial Animals	
	29 Good Friday - University Closed	
Apr	1 No Class	No Lab - Report Due
	3 Exam Review	
	5 Exam Review	
	8 TBD	
	9 TBD	
	Exam Period - Final Exam (25%)	

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/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.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.