DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of Biology
BIOL 3079 and MARI 3076
Animal Physiology and Marine Animal Physiology, Part II
Winter, 2023

Lecturer: Dr. Margi Cooper, mhcooper@dal.ca; LSC 4130
Lab Instructor: Nina Hamacher, nhamacher@dal.ca; LSC 7026

Lectures: MWF 1:35-2:25, Henry Hicks 217

Laboratories: T, W, or Th 2:35-5:25, LSC 7009

Course Description

This course is a continuation of a discussion of the mechanisms which coordinate the activities of cells within multicellular organisms which began in BIOL 3078.03/MARI 3074.03. This term emphasizes the urinary, cardiovascular, and respiratory systems. The laboratories reflect the approaches taken to study these systems in a variety of organisms.

PREREQUISITES: BIOL 3078.03 or MARI 3074.03
EXCLUSIONS: BIOA 3005.03

Learning Outcomes

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

- Describe the potential fates of energy ingested by animals.
- Define metabolic rate and describe methods used for its measurement.
- Identify factors affecting an animal's metabolic rate and explain in detail the effects of ingesting a meal, body size, and physical activity on metabolic rate.
- Identify aerobic and anaerobic mechanisms of ATP production, detail their functional properties and relate those to when animals employ each mechanism.
- Relate energy costs of locomotion to speed, and body size for various modes of locomotion.
- 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 physiological adaptations underlying the diving abilities of marine mammals.
- 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.
- Collect qualitative and quantitative data and interpret the experimental results
- Practice written communication skills
- Critically analyze/interpret data from lab simulations or scientific journal papers
- Conduct literature and online searches of primary and secondary sources using electronic databases and online search tools

Course Materials

Hill, R., G. Wyse and M. Anderson. *Animal Physiology.* Fifth edition. 2022.

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.

Knisely, K. *A Student Handbook for Writing in Biology.* Sixth edition. 2021.

Alternatively, you can use for free Dalhousie's library information on scientific writing found at Resources for Scientific Writing

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Course Assessment

Lecture portion 60%:
Midterm – 20%
Final Exam – 40%

All exams are planned to be in-person, but online may be necessary. The Midterm will take place during lecture time (see lecture schedule). The Final Exam will be scheduled during the April exam period.

Laboratory portion 40%:
There are 5 labs with assignments (26%) and a final lab exam (14%) that will be scheduled at the same time as the lecture Final Exam, during the April exam period.

Laboratory assignments and evaluation information are found in the laboratory folder on Brightspace.

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

Open communication is essential for a positive learning experience. We 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 us if you have problems with any of these regulations at any time during the term.

Missed or Late Academic Requirements due to Student Absence:

Please inform us in advance if you are unable to attend any of the exams. They will normally only be rescheduled for illness. A Self Declaration of Absence (SDA) form must be submitted in order to write a make-up midterm. An SDA form **cannot** be used for the Final Exam and Lab Exam. If you miss that exam, you must contact Dr. Cooper to discuss options. When make up exams are given, it will be **within one week** of the scheduled exam date at a mutually convenient time. **PLEASE NOTE**: We are **NOT** obligated to provide you with a makeup exam, so excuses other than illness or extreme circumstance are unlikely to be considered. The weight of missed exams will not be redistributed across other exams.

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SDA forms **can** be used if you cannot attend any of the lab sections for a particular lab. However, you are expected to hand in the lab report for the missed lab on the given due date. Without submission of an SDA form, a lab report will still be accepted but there is a penalty of 2% from the total course grade for missed lab attendance.

SDA forms **cannot** be used to gain extensions on lab assignments. Late laboratory assignments will only be marked in unusual circumstances with the permission of the Lab Instructor, and a penalty of **10% per day** will be deducted. Anything more than 5 days late will not be accepted.

Only TWO SDA forms may be used, in any combination of lectures and laboratories, throughout the term.

Plagiarism and Academic Integrity:

You are expected to abide by Dalhousie University's policies on academic integrity.
We 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. 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 and any online exams submitted.

If at any point exams cannot take place in a proctored setting this year, remember that they are independent assessments. 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 promising that the work submitted is solely of your own efforts.

The contents of the assessments in the course are the property of BIOL 3079/MARI 3076 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:

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Lecture schedule - Tentative

Date			Lec #	Topic	Anim. Physiol. 4e	Anim. Physiol. 5e
M	Jan	9		Introduction		
W		11	1	Animal Energetics and Metabolic Rate	pp 165-185, 216-218	pp 171-193, 222-224
F		13	2	Metabolic Rate cont.		
M		16	3	Aerobic and Anaerobic Forms of Metabolism	pp 190-201, 203-206	pp 196-208, 209-213
W		18	4	Energetics of Aerobic Activity	pp 218-227	pp 225-234
F		20	5	Oxygen and Carbon Dioxide Physiology	pp 585-597	pp 601-614
M		23	6	External Respiration	pp 599-603, 605-607	pp 615-620, 621-624
W		25	7	External Respiration cont.		
F		27	8	Breathing by Aquatic Invertebrates and Fish	pp 608-612, 626-629	pp 624-628, 644-646
M		30	9	Breathing by Terrestrial Animals	pp 612-626, 629-633	pp 629-643, 647-651
W	Feb	1	10	Breathing by Terrestrial Animals cont.		
F		3		***No Class - Munro Day***		
M		6		***Exam Review***		
W		8		***Exam I (Lectures 1-10)***		
F		10	11	Circulation: Hearts		
M		13	12	Circulation: Hearts cont.	pp 667-675	pp 687-696
W		15	13	Circulation: Hearts cont.		
F		17	14	Blood Gas Transport	pp 635-665	pp 653-685
Week of Feb 20-24				***Reading Week - No Classes***		
M		27	15	Blood Gas Transport cont.		
W	Mar	1	16	Principles of Pressure, Resistance, and Flow in Vascular Systems	pp 676-678	pp 696-699
F		3	17	Circulation in Mammals and Birds	pp 679-685	pp 700-706
M		6	18	Circulation in Mammals and Birds cont.		
W		8	19	Circulation in Fish, Amphibians, and Non-Avian Reptiles	pp 685-692	pp 707-714
F		10	20	Circulation in Invertebrates	pp 692-699	pp 714-721
M		13	21	Diving Physiology of Marine Mammals	pp 701-719	pp 723-742
W		15	22	Water and Salt Physiology: Intro and Mechanisms	pp 723-727, 731-739	pp 745-749, 753-761
F		17	23	Ionic and Osmotic Adaptation (Freshwater, Estuaries, and Shorelines)	pp 741-762	pp 764-785
M		20	24	Ionic and Osmotic Adaptation (Marine)		
W		22	25	Water Conservation in Terrestrial Animals	pp 728-731, 762-776	pp 751-753, 785-800
F		24	26	Excretory Organs		
M		27	27	Regulating Filtration and Countercurrent Exchange		
W		29	28	Renal Ion and pH Regulation		
F		31	29	Hormonal Control of Kidney Function		
M	Apr	3		TBD		
W		5		TBD		
F		7		***No Class - University Closed***		
M		10		***Exam Review***		
T		11		***Exam Review***		

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LABORATORY SCHEDULE

Date	Lab #	Description
Jan 23 – 27	**1**	**O_2 consumption in aquatic animals**
Jan 30 – Feb 3		**No lab – data analysis and report writing**
Feb 6 – 10		**No lab – data analysis and report writing**
Feb 13 – 17	**2**	**Neurogenic and Myogenic hearts**
Feb 20 – 24		**No lab – reading week**
Feb 27 – Mar 3	**3**	**Blood and heart function**
Mar 6 – 10	**4**	**Diving Physiology**
Mar 13 – 17		**No lab – data analysis and report writing**
Mar 20 – 24	**5**	**Osmotic regulation in crabs**
Mar 27 – 31		**No lab – data analysis and report writing**
Apr 3 – 7		**No lab – data analysis and report writing**
Finals period		**Final Lab Exam**

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Fall/Winter 2022-23

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

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

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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/academic-advising.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/services-support/student-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